

9-1-2004

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Recommended Citation

Gibson, Brian J. & Whitaker, Jonathan D. (2004). Technology based supply chain training: its use and effectiveness. *Journal of Transportation Management*, 15(2), 1-9. doi: 10.22237/jotm/1093996920

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TECHNOLOGY BASED SUPPLY CHAIN TRAINING: ITS USE AND EFFECTIVENESS

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ABSTRACT

Employee training is a huge business in the United States with spending in the neighborhood of \$51 billion dollars. Over the last five years a growing proportion of training dollars have been committed to technology based training involving distance learning and e-learning. This article reports on the use of these innovative training methods in supply chain management and their impact on organizations in terms of cost effectiveness, time efficiency, skill development, and return on investment.

INTRODUCTION

Training presents a vexing challenge for businesses. On one hand, it's viewed as a necessary tool for building employee competency, improving productivity, and establishing competitive advantage (Buhler, 2001). Tom Peters, best selling author and quality guru, goes so far as to recommend that companies "train everyone lavishly, you can't overspend on training" (2004). However, training consumes critical resources (time and money) and organizations find it difficult to measure the return on investment (ROI) of training. Despite its intrinsic value, these realities make training a cost cutting target in times of economic instability.

Recent history attests to the fluctuating commitment to training. Spending on corporate training over the last two years has declined. U.S. companies spent \$51.3 billion on training in 2003 versus \$54.2 billion in 2002 and \$56.8 billion in 2001. Decreased expenditures for training staff salaries, seminars and conferences, and off-the-shelf training materials accounted for the majority of the decline. Technology-based training (TBT) has been the lone exception to the decline over the past two years (Galvin, 2003).

TBT¹ is growing at a very rapid rate. Independent computer-delivered training and instructor-led remote location training are expanding at the

expense of traditional instructor-led classroom training (Galvin, 2003). Research firm IDC estimates that worldwide, Internet-based corporate learning is growing by nearly 70 percent per year (Byrne, 2004). Overall, it is predicted that spending on TBT will top \$18 billion in 2005 (Major, 2002).

TBT is flourishing for a variety of reasons. Cost efficiency is a key driver of its growth. TBT reduces the direct costs of training, including employee travel costs and recurring instructor fees. Indirect costs, such as lost productivity while employees are away at training, are also diminished (Adams, 2002). Flexibility is another benefit of TBT. Training can be scheduled at the convenience of the individual and learners in remote locations can gain access to content, providing "anytime, anyplace" educational opportunities for employees. Overall, TBT is capable of providing 30 percent more training content in 40 percent less time and at 33 percent of the cost of traditional training methods, according to Meta Group (Beckett, 2004).

Anecdotal evidence suggests that supply chain organizations are reaping the benefits of TBT. Early adopters included Burlington Northern Railroad and the Defense Logistics Agency, who both began to use computer-based training programs in the mid-1980s (Anonymous, 1984 and Roman, 1985). United Parcel Service uses TBT to promote company-wide job consistency among drivers and package handlers, Smithway Motor Xpress has cut the cost of training drivers from \$1,000 to \$150, and J.B. Hunt uses TBT simulations to teach technicians how to troubleshoot equipment malfunctions (Kahaner, 2001). Bison Transport, a Canadian truckload carrier, has followed the lead of airlines in TBT, using a full-motion simulator to build operator skills, test knowledge of legal requirements, and train drivers to handle dangerous driving situations (Menziez, 2003).

While these individual success stories are noteworthy and support the justification for TBT in supply chain management (SCM), little research has been conducted in this area to date. Most of the existing research regarding TBT and

SCM has focused on university education rather than employee training and professional development (e.g., Ellram and Easton, 1997; Wan and Wilson, 1999). While the proliferation of distance learning based curriculum from traditional academic institutions and the growth of non-traditional online universities attest to the acceptance of TBT for education, the impact of TBT on corporate supply chain training is not well understood.

The purpose of the study is to investigate the use of TBT for supply chain training. An exploratory study was undertaken to provide insight into the use of TBT for supply chain training, the effectiveness of TBT, and the ROI of supply chain training. The overall objective was to assess the impact of TBT on supply chain training initiatives in corporate America.

RESEARCH QUESTIONS AND METHODOLOGY

Given the limited knowledge regarding the use and acceptance of TBT for supply chain training, the overall goal of the research was to address three key questions:

1. To what extent have organizations adopted TBT for supply chain training?
2. How well does TBT work for supply chain training?
3. What benefits, including ROI, does supply chain training provide?

An iterative design-critique-revise survey development process produced a 60-item questionnaire regarding supply chain training issues. An HTML version of the questionnaire was developed, posted on the Internet, and tested for data capture accuracy. Shortly thereafter, a wide variety of supply chain, logistics, and transportation professionals received an e-mail requesting their participation in the study. The e-mail also provided a hyperlink to the online survey. The original request and a follow-up reminder e-mail generated 70 usable responses.

The completed surveys were coded, entered into a personal computer and analyzed using Microsoft Access 2003 and SPSS Release 11.5 for Windows. Key statistical tests included independent samples t-tests and paired samples t-tests. All statistical tests were conducted at the .05 significance level.

RESULTS AND DISCUSSION

The survey respondents represent a variety of businesses and industries. Manufacturers, logistics service providers, and merchandisers accounted for over three quarters of the responses. Table 1 provides details regarding the participation levels by business type.

TBT Adoption

The initial questions of the survey focused on the training methods used by each organization for supply chain training. Overall, 62.9 percent of the respondents use some form of TBT. The use of TBT methods across the five business groups ranged from 55 percent to 67 percent, with manufacturers and logistics service providers leading the way (See Table 1).

Among the respondents, it is fairly common to use multiple delivery methods for supply chain training. Nearly half of the respondents (44 percent) combine traditional classroom training (TCT) methods with TBT methods to educate their supply chain personnel. A small group (18.6 percent) has eschewed TCT altogether, choosing to rely exclusively upon TBT methods. The re-

maining respondents (37.1 percent) rely upon TCT methods, mentoring, on the job training, and related approaches for supply chain training.

Of the TBT methods employed for supply chain training, Web-based self study courses (Internet, intranet, and extranet) have been adopted at a slightly higher rate than computer-based self study courses (CD-ROM, DVD, and diskette) and instructor led distance learning courses. Figure 1 highlights these differences as well as the respondents' use of multiple TBT methods.

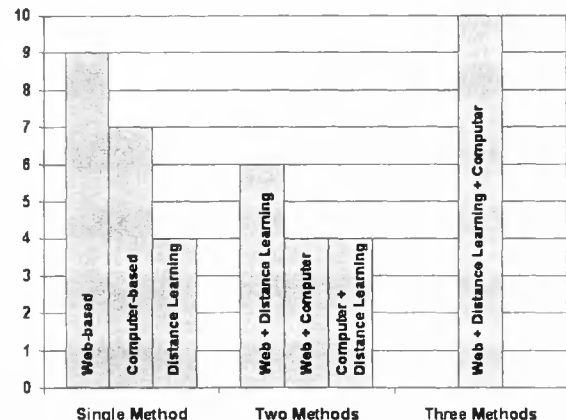
TBT Effectiveness

TBT proponents identify a wide variety of benefits that can be gleaned from its implementation. Reduced course delivery costs, consistent instructional quality, user flexibility, and better learning retention are often cited reasons for moving toward TBT (Adams, 2002; Kaupins, 2002; Oakes, 2003). However, the enthusiasm is not universal. Concerns regarding the integration of training into real-world skills, the expense of developing courses, and the ability of TBT to improve employee productivity

**TABLE 1
DEMOGRAPHIC DATA**

Type of Business	Percent of Responses	Percent Using Technology Based Training Methods
Manufacturing Firm	30.0	66.7
Logistics Service Provider	25.7	66.7
Merchandising Firm	21.4	60.0
Consulting Firm	15.7	54.5
Technology Firm	7.1	60.0

**FIGURE 1
RESPONDENTS' USE
OF TECHNOLOGY-BASED
TRAINING METHODS**



are cited as reasons why TBT has not been implemented on a wider scale (Bowen, 2000; Oakes, 2003).

Given these conflicting opinions, it is important to determine how TBT is perceived by the SCM community. Three relevant issues were studied: cost effectiveness, time efficiency, and skill enhancement. The survey participants were asked to rate various training methods on each of these three issues using a seven-point Likert scale (from 7 = very effective to 1 = not at all effective). To gain greater insight into the responses and actual experiences of the respondents, their responses were split into two groups—TBT users and TBT non-users—for statistical analysis.

The results indicate that neither group has fully bought into the argument that TBT is more cost effective than TCT. Independent samples t-tests revealed that TBT users and nonusers agreed on the cost effectiveness of TCT, assigning it statistically similar high ratings (See Table 2). In contrast, TBT users rated TBT computer methods and TBT distance learning methods significantly higher than nonusers in terms of cost effectiveness. Clearly, those who have no experience with TBT methods are skeptical of their financial benefits, assigning relatively neutral cost effectiveness ratings to both TBT methods.

Further analysis using paired samples t-tests within the two groups also highlights the TBT nonusers' bias against TBT methods. This group rated TCT significantly more cost effective than either TBT computer methods (p -value = .026) or TBT distance learning methods (p -value = .004). In contrast, there were no significant differences in the TBT users' cost effectiveness ratings pairs. The TBT users place all three methods on statistically equal footing in terms of cost effectiveness.

The second issue studied—time efficiency—revealed little divergence of perceptions between the two groups regarding the time required to complete a training program. Although TBT users rated TBT computer methods and TBT

distance learning methods higher than TBT non-users on this factor, independent samples t-tests revealed that the differences were not statistically significant (See Table 3).

Within group analysis produced noteworthy results. Paired samples t-tests indicate that TBT nonusers did not perceive that any particular method holds a time efficiency advantage over the other methods. However, TBT users indicated that TBT computer methods are clearly superior to both TCT methods (p -value = .037) and TBT distance learning methods (p -value = .001) in terms of time efficiency.

While training cost and speed are certainly important factors in selecting a training method, organizations must also consider the impact of the training method upon the job performance capabilities. The third issue analyzed—employee skill enhancement—provided the strongest support for continued use of traditional training methods. It received the highest mean effectiveness ratings across all issues and methods from both respondent groups (See Table 4). However, the groups' perspectives diverged on the TBT methods. Independent samples t-tests revealed that TBT users rated TBT distance learning methods and TBT computer methods significantly higher than TBT nonusers in terms of skill enhancement.

Further strengthening the case for TCT was the within group analysis results. Paired samples t-tests revealed that TBT users rated traditional classroom methods significantly higher than TBT distance learning methods (p -value = .000) and TBT computer methods (p -value = .000) in terms of the ability to enhance employee skills. The group indicated no difference between the two TBT methods (p -value = .570). Similar results were garnered for the TBT non-users.

Collectively, these mean efficiency ratings across three issues—cost, time, and skills—do not identify a clear cut winner among the training methods. TCT methods received the highest mean ratings in terms of cost effectiveness and skill enhancement, while TBT computer methods rated highest in terms of time efficiency. In

TABLE 2
COST EFFECTIVENESS OF TRAINING METHODS

Type of Training	Mean Effectiveness Ratings		T-Test Results	
	TBT Users	TBT Non-Users	p-value	Rated higher by
Traditional classroom-based	5.23	5.38	.612	
TBT—computer/web-based	5.14	4.42	.046	TBT Users
TBT—distance learning-based	4.86	4.17	.030	TBT Users

Seven-point scale: 7 = Very Effective, 1 = Not At All Effective

TABLE 3
TIME EFFICIENCY OF TRAINING METHODS

Type of Training	Mean Effectiveness Ratings		T-Test Results	
	TBT Users	TBT Non-Users	p-value	Rated higher by
TBT—computer/web-based	5.44	4.83	.063	
TBT—distance learning-based	5.05	4.58	.158	
Traditional classroom-based	4.86	4.85	.958	

Seven-point scale: 7 = Very Effective, 1 = Not At All Effective

TABLE 4
SKILL ENHANCEMENT CAPABILITIES OF TRAINING METHODS

Type of Training	Mean Effectiveness Ratings		T-Test Results	
	TBT Users	TBT Non-Users	p-value	Rated higher by
Traditional classroom-based	5.70	5.54	.569	
TBT—distance learning-based	4.76	3.87	.002	TBT Users
TBT— computer/web-based	4.68	4.04	.046	TBT Users

Seven-point scale: 7 = Very Effective, 1 = Not At All Effective

general, the TBT users rated the TBT methods higher than their nonuser counterparts, suggesting that TBT experience is needed to see actual benefits.

Further review of the TBT users' (who are in a stronger, experience-based position to objectively evaluate TBT methods) responses did not reveal an exclusive penchant for TBT. Table 5 indicates that the TBT users' mean ratings of training methods varied across the three issues.

Ultimately, the results suggest that widely cited TBT benefits have not been fully attained in the

supply chain area. TCT remains an effective, important tool in the eyes of supply chain managers. For now, a blended solution consisting of traditional and innovative training methods may be most appropriate and effective.

Return on Investment

The ultimate question regarding training is: "what do we get out of it?" Organizations have great interest in this question because training can have a dramatic impact on their success. The potential for improved productivity, increased customer satisfaction, and competitive advantage

TABLE 5
COMPARATIVE ANALYSIS OF TRAINING METHOD EFFECTIVENESS
(TBT USER RESPONSES ONLY)

Issue	Method Comparison	T-test results	Statistically Significant Differences
Cost Effectiveness	Classroom vs. Computer	.724	No difference in mean ratings
	Classroom vs. Distance Learning	.234	No difference in mean ratings
	Computer vs. Distance Learning	.086	No difference in mean ratings
Time Efficiency	Classroom vs. Computer	.037	Higher rating for computer
	Classroom vs. Distance Learning	.421	No difference in mean ratings
	Computer vs. Distance Learning	.001	Higher rating for computer
Skill Enhancement	Classroom vs. Computer	.000	Higher rating for classroom
	Classroom vs. Distance Learning	.000	Higher rating for classroom
	Computer vs. Distance Learning	.570	No difference in mean ratings

due to enhanced employee knowledge and learning are all driving executive focus on training and its ROI (Emrich 2003; Anonymous, 2004). The final section of the survey focused on this critical aspect of supply chain training. Two relevant issues were addressed: the benefits created and the ROI achieved.

The respondents indicated that supply chain training provides tangible benefits that positively impact their organizations. Every respondent identified at least one positive outcome, with the vast majority (90 percent) citing two or more benefits of supply chain training. Table 6 highlights the fact that the benefits are not limited to supply chain operations, as supply chain training also positively impacts the organization and its customers.

In terms of ROI, 79 percent of the respondents felt that supply chain training provided a positive outcome with the benefits exceeding the

costs. The remaining 21 percent indicated that the ROI was neutral (the benefits gained were equal to the costs). No respondent believed that the ROI was negative. The highest percentages of positive ROI responses were provided by the respondents who rely exclusively on traditional classroom methods (84.6 percent of that subgroup) and those who use a combination of traditional and TBT methods (83.9 percent that subgroup). In contrast, the respondents who have migrated completely to TBT methods were almost equally split in their assessment of supply chaining training—53.8 percent reported a positive ROI and 46.2 percent reported a neutral ROI.

Nearly 60 percent of the respondents make some attempt to quantify the ROI of training, with the vast majority assessing ROI informally. Overall, they estimated an average ROI of 104.5 percent for supply chain training with an average payback period of 10.3 months. Organizations who use a combination of training methods reported the highest ROIs (mean = 127 percent) and the fastest payback periods (mean = 6.4 months), followed by those who use traditional classroom methods exclusively, and those who use TBT methods exclusively.

TABLE 6
IMPACT OF
SUPPLY CHAIN TRAINING

Benefit Achieved	Percent of Respondents
Competitive advantage in our industry	70.0
Improved productivity	68.6
Superior customer service	62.9
Enhanced profitability	55.7
Labor savings realized	45.7
Reduced staff turnover	32.9

The results suggest that supply chain training is a worthwhile effort. According to the respondents, a wide range of benefits can be attained cost effectively in a relatively short time frame. For now, it appears that employees benefit the most from a mixture of TCT and TBT methods. Used independently, TCT and TBT methods

provide a lower ROI impact. A combined approach may overcome each method's individual limitations, resulting in greater employee skills and knowledge.

IMPLICATIONS

The results of this exploratory study provide mixed signals regarding supply chain training. While the overall results suggest that supply chain training provides positive benefits, there is not a consensus regarding the best method for achieving these benefits. Managers with supply chain training responsibilities must consider a wide variety of issues and opinions when selecting from among the growing number of training options. Hence, a set of research-based recommendations has been developed to assist managers with this daunting task:

- Recognize the value of training. First and foremost, the training benefits and outcomes realized by the survey respondents should prompt other supply chain managers to adopt a proactive, positive outlook on training. Taking the time to develop integrated training programs that focus on relevant content and employ effective training methods will have a positive net impact on employee skills, organizational performance, and competitive advantage.
- Keep an open mind about TBT. Numerous studies have shown that TBT is a viable option for some training topics and needs. Supply chain managers should not rely on the opinions of inexperienced non-users when investigating TBT options as the results of this research found a tendency on their part to rate TBT effectiveness low across the board. Instead, managers should consult with actual TBT users to access experience-based insights regarding appropriate applications of TBT.
- Filter the TBT hype. The results of this study did not fully support the TBT benefits and promises found in other articles regarding TBT effectiveness. Regardless of what technology vendors promise or training

experts preach, TBT is not a panacea for an organization's supply chain training needs. TBT methods are valuable for some training applications but are not best suited to all situations.

- Adopt a blended solution of TBT and TCT methods. While the respondents indicated that all types of training methods are beneficial, those who combine innovative and traditional training methods claim to enjoy higher ROI's and faster payback periods. Supply chain managers should leverage the strengths of multiple training methods to produce a comprehensive, cohesive program that builds key employee skills, enhances their decision making abilities, and promotes appropriate behaviors.
- Accurately quantify the ROI of training. Half of the respondents informally evaluate the ROI of supply chain training and less than ten percent formally do so. While some training benefits are intangible and difficult to measure, a number of accounting techniques and quantitative methods are being developed for comparing training benefits to the costs (Allen, 2003; Staples, 2003). Supply chain managers would do well to adopt these formal methods as they can provide an accurate assessment of a training program's value (Freriks, 2004).

SUMMARY

The development of effective training programs is important to the successful preparation of supply chain employees. An important aspect of training is the method used to deliver training. Today, organizations can employ multiple methods, both traditional and innovative to distribute supply chain content. While the promise of these innovative, technology based training methods has been well publicized, limited research has been conducted regarding their actual implementation and impact on supply chain performance.

This study provides insight into the views of 70 U.S. organizations regarding the use of TBT and

its perceived effectiveness. Analysis of the survey data revealed that TBT users find these methods to be as good as or better than TCT in terms of cost effectiveness and time efficiency. The research also found that organizations using TBT in combination with TCT appear to benefit from higher ROI and faster payback periods.

Supply chain managers with training responsibilities can gain valuable insights from these findings and the related research implications. The study can help them benchmark current training initiatives and gain insight into the abilities and strengths of TBT methods. Clearly,

TBT is here to stay and supply chain managers should make it a core component of a balanced, blended supply chain training program.

ENDNOTE

1. Technology-based training includes all training methods that involve the use of technology to deliver content. Thus, it covers the broad array of Internet-based training (Internet, intranet, and extranet), computerized self-study (CD-ROM, DVD, and diskette), and distance learning (video-conferencing, audio-conferencing, and satellite broadcasting) (Galvin, 2003).

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