CHAPTER 9

Impact Evaluation

Objectives

After reading Chapter Nine, you should be able to:

- identify decisions involved in evaluating the impact of interactive learning systems;
- specify questions that should be answered before making decisions related to the impact of interactive learning systems;
- identify the information needed to answer questions about the impact of interactive learning systems; and
- decide how to collect and report information so that the impact of interactive learning systems can be judged.

Why should you conduct impact evaluation?

The overall purpose of impact evaluation is to determine whether the knowledge, skills, and attitudes (KSAs) learned via interactive learning systems transfer to the intended context of use, e.g., the work place. As illustrated in Figure 9.1, different types of decisions must be made concerning the adoption, dissemination, or certification of interactive learning systems. These are critically important decisions that should be informed by reliable and valid answers to the types of questions that can be addressed through impact evaluation.

Impact evaluation is the fifth facet or function of the evaluation model presented in this book. Evaluating whether learners actually apply the knowledge, skills, and attitudes they learn via interactive learning systems "on the job" or in another learning environment is rarely easy. There is usually some aspect of an impact evaluation that remains ambiguous. In fact, impact evaluation may well be the greatest challenge faced by evaluators, regardless of the context or the type of interactive learning system being evaluated. Not surprisingly, it is also the most neglected facet of evaluation.

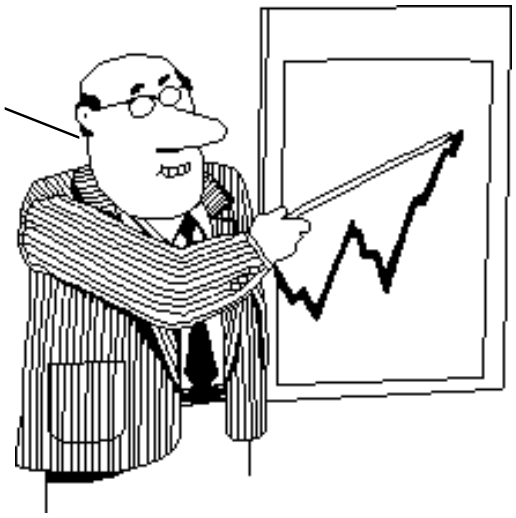
Decisions	Example Questions
Should workers who have completed an e-learning program be certified?	Do trainees transfer knowledge, skills, and attitudes to the workplace?
Should this interactive learning system be adopted?	What evidence supports the impact of this program on sales and profits?
Should workers be given bonuses for completing this e-learning program?	Is the safety record in the workplace improved by this program?
What price should be charged for this ILS?	How does the impact of this program compare to alternatives?

Figure 9.1. Typical decisions and questions in an impact evaluation.

When should you conduct impact evaluation?

Impact evaluation provides answers to the questions that most people ultimately ask about the results of using interactive learning systems or any other sophisticated (and costly) information technologies, such as knowledge management systems. Impact questions are related to "the bottom line" in business and industry. Typical questions include: Does an interactive learning system increase sales, reduce complaints, or save lives? In education, impact questions are related to the long-term effects of a learning environment. For example, does an interactive learning system enhance literacy, encourage minority students to pursue careers in engineering, or promote lifelong learning habits? Or does interactive training have undesirable social costs (Meyrowitz, 1985)?

Our sales have increased dramatically since we released the "Sell or Else" e-learning system to all our employees.



Although an interactive learning program may have "production value" that is comparable to broadcast video or commercial film, if the program doesn't increase profits, enhance client loyalty, decrease accidents, or significantly influence the lives of students, it has no real value. After all, an interactive learning system is not an end in itself, but a means to ends such as higher motivation, better learning, enhanced performance, greater profitability, or in some cases, even corporate survival.

In Kirkpatrick's (1998) well-known evaluation model, there are four levels of evaluation (see Figure 8.2 in Chapter Eight). The last two levels in Kirkpatrick's model, "Behavior" and "Results," fit within the facet of evaluation we call "Impact." We have not separated behavior from results because we know from experience how complex it is to detect evidence of the impact of education or training in any form. Thus we promote an approach that consists of gathering as much evidence as possible in different formats to build a convincing case for impact. In our experience, there are plausible alternative explanations for most "results." Hence, we advise against putting too much effort into any single type of evaluation strategy if you think that it alone will allow you to definitively attribute results to a specific interactive learning system. Triangulating evaluation results, i.e., collecting data from multiple sources using multiple methods, is essential in impact evaluation.

What kinds of decisions can you anticipate?

Evidence of impact influences a wealth of decisions, some of which can affect your career as a developer of interactive learning systems. An interactive learning system is not the solution to every problem, but its ultimate value as a solution cannot be established without impact data. In a corporate environment, interactive learning systems compete with other problem "solutions," such as changing incentives, modifying managerial structures, and increasing employee participation in decision making. At some point, managers must make difficult decisions about how to increase productivity, save costs, or improve safety. Should more or less interactive training be provided? Should interactive learning systems be developed in-house or contracted to external vendors? Should workers' pay and/or benefits be increased to bolster corporate morale, or should motivational e-learning programs be provided on each worker's desktop computer? Should dangerous equipment in the workplace be replaced, or should safety training be intensified? These and other realistic decisions will be affected by information you can provide about the impact of interactive learning systems in business and industrial settings.

The comprehensive implementation of interactive learning systems in education is still rare, and thus it is more difficult to define the type of decisions that should be anticipated in schools and universities. However, one decision we would like to see erased from any list is whether teachers should be replaced by interactive learning systems. The best evidence is that, instead of replacing teachers, interactive learning systems generally increase the importance of teachers (Coley, Cradler, & Engel, 1997). Instead of teacher obsolescence, what is likely to happen is that teachers will find themselves in different roles, e.g., changing from primary deliverers of information to facilitators and mentors within a more effective, more efficient, and more complex learning environment (Jonassen & Reeves, 1996; Pittinsky, 2003; Roblyer, 1999).

Although we firmly believe that instructors can be empowered by new technologies, it must be acknowledged that others have predicted more drastic changes. In 1992, Perelman predicted that "In the wake of the HL [hyperlearning] revolution, the technology called 'school' and the social institution commonly thought of as 'education' will be as obsolete and ultimately extinct as the dinosaurs" (p. 50). More recent predictions have been made about enormous changes in higher education. Although he himself does not advocate this future vision, James J. Duderstadt (1999), former president of the University of Michigan in the USA, described business people and educators who believe that the:

> … emerging domestic market for educational services could be served by a radically restructured enterprise consisting of fifty thousand faculty "content providers," two hundred thousand faculty "learning facilitators," and one thousand faculty "celebrities," who would be the stars of the commodity learning-ware products. The learner would be linked to these faculty resources by an array of for-profit service companies handling the production and packaging of learning-ware, the distribution and delivery of these services to learners, and the assessment and certification of learning outcomes. (p. 12).

Whether such predictions come to be will be determined to a large extent by the willingness of educators to conduct rigorous evaluations of present and future interactive learning systems in realistic contexts. In the absence of better evaluations that yield credible impact data, external attempts to reduce the role of instructors may be more likely to succeed.

What questions should be answered before making decisions?

Questions about the impact of training and education programs are concerned with examining the transfer of knowledge, skills, and attitudes

(KSAs) from the context of education and training to that of performance. Do health care workers follow federally mandated safety procedures? Do assembly line workers actively participate in quality circles? Is work place morale high? Has industrial recycling increased? Are profits up? Do students have greater self-esteem? Are more females pursuing careers in science and mathematics? Have scores on standardized tests increased? These are the types of questions addressed by impact evaluation. It should be obvious immediately that these types of questions are not easy to answer.

The challenge of evaluating impact is further complicated by the fact that many impact questions raise political issues in the school, community, or workplace. School system administrators and politicians who have invested heavily in classroom technologies may not support rigorous, in-depth investigations concerning the ultimate benefits of their pet innovations. In business and industry, relations between unions and management often add complications. For example, one of us was once asked to evaluate the effectiveness and impact of an interactive multimedia program used to train workers at a large U.S. auto manufacturing corporation to read hazardous chemical safety management data sheets. The training was mandated by the Occupational Safety and Health Administration (OSHA) of the U. S. federal government. However, the United Auto Workers (UAW) union would not permit their members to be tested on their ability to read and interpret these data sheets. Further, the management of the auto company did not want the workers to be interviewed during the time when they should be working. In the end, no impact data could be gathered and the only implementation data that could be collected was the time a worker signed onto the interactive system and the time the worker signed off!

What kinds of information do you need to answer questions?

In business, impact data can range from the testimonials of front line supervisors about how their workers' morale has improved to the profit figures generated by the accounting department. As a developer and/or evaluator of interactive learning systems, you may often feel isolated from what others characterize as the real action centers of business, e.g., production, marketing, sales, and/or service. This is not an unusual position for training or human resources development (HRD) personnel. In the face of this marginalization, you are advised to take a responsible attitude and a proactive stance. Collecting and reporting impact data about sales, customer satisfaction, worker morale, safety records, and similar aspects of the business environment is critical to success. You can't expect to "prove" in a scientific sense that you caused positive

changes, but failing to build a case that there is a relationship between your training program and these bottom line criteria could make you an easy target when budget cuts are considered within a corporation.

There have been numerous predictions about the role of training in the 21st century (Cohen, 1991; Kemske & Weingarten, 1989; Rosenberg, 2000). One that appears again and again is that trainers will be held responsible for the *effects* of training, not just its delivery. Increasingly, training departments are being held accountable for their impact on the bottom line. This pressure is unlikely to disappear, so you must learn to deal with it. If interactive learning systems are to have a place in the corporate world, then you must attempt to demonstrate impact on the kinds of indicators that executives, stockholders, and others in power accept as ultimately important, e.g., profits.

— WEB LINK —
For examples of educational technology evaluation reports provided by the U.S. Department of Education, go to: http://www.ed.gov/Technology/reports.html

Similarly, in education contexts, the technology honeymoon is over (Cuban, 2001), and the impact of interactive learning systems in technology-infused schools must be demonstrated if these systems are to enjoy continued support (Reeves, 1992). Political enthusiasm for school reform via technological innovations will evaporate quickly if the impact of interactive learning systems and related technologies cannot be demonstrated. As difficult as it is to collect impact data in the business world, the challenge is even greater in education. Nonetheless, you must try to estimate impact. The standardized test data commonly collected within educational contexts is rarely an adequate indicator of impact. Instead, you must attempt to collect data about the quality of life experienced by students after they leave school, their aspirations and motivations, and the opportunities they perceive as well as the careers they pursue. Long-term, follow-up data are required. This may seem especially daunting in light of what, at times, seems like a steady decline in educational indicators (drop-out rates, achievement scores, international comparisons, etc.), while critics grow increasingly shrill in their condemnations of public education (Gross, 1999; Sykes, 1996). However, if you believe, as we and others do (diSessa, 2000, Kallick & Wilson, 2000; Means, 1994; Papert, 1993), that interactive learning systems can be the vehicles for pedagogical reform, then it is critical to track long-term indicators of educational impact.

How should impact information be collected?

Impact evaluation should begin with a well-specified evaluation plan. The real challenge in evaluating impact is establishing causal relationships between interactive learning systems and various types of desirable outcomes. In the corporate world, you should not expect to establish

unassailable causal links between your e-learning programs and results, such as higher profits, greater safety, and improved efficiency. There are many other factors that will influence the bottom line, such as advertising, market shifts, government mandates, and the general economy. But you should be able to build a case that supports the benefits of e-learning programs designed to influence performance and results.

In the absence of direct causal links, triangulation of data sources is the best strategy for evaluating impact. Triangulation involves seeking to compensate for the imperfections inevitable in any single type of measure by using multiple methods that may give you a clearer estimation of what you are evaluating (Mark & Shotland, 1987).

Suppose you want to assess the impact of sales training on profits for a large toy company. An innovative interactive multimedia sales training system has been placed in each of the toy company's regional offices, and your online data collection indicates that 93% of the sales force has completed the new program. Accounting indicates that sales figures are up in both quarters since introduction of the program. Can you conclude that this interactive learning system has had a beneficial impact on sales? Probably not without arguments from other business sectors. The marketing department wants a share of the credit for its national television advertising campaign. Marketing insists that its tie-in with a major motion picture aimed at children has attracted most of the new business. Sales managers claim that modifications in bonus structures deserve the credit, and so on.

Obviously, you will need other data sources to support your claims about the value of interactive training. A prerequisite, of course, is to establish the degree of relationship between the contents of the training and specific business results (Brethower, 1989), a process that depends heavily on the quality of the initial needs assessment conducted for the program (see Chapter Six). Where can you get additional data to support your case that the program deserves credit for the sales increase? You might interview sales personnel, sales managers, and customers to gather data about impact. It would help to build your case if you could report that sales persons are saying, "This e-learning taught me a new technique that helped me to close sales with formerly reluctant customers." What if you could provide evidence of customers claiming that what convinced them to buy your product was "the amount of competitive information the salesperson was able to give me about the other brands of toys?" Your argument would be enhanced if competitive sales information was stressed in your interactive training program.

You can conduct observations to provide valuable evidence of impact. Although it may be difficult to observe sales procedures, observations of other types of performance are more feasible to observe, e.g., the safety

practices of workers on an assembly line. In education contexts, observations are sorely needed to determine the impact of interactive systems on the learning and socialization of students. There remains a dearth of understanding about how interactive learning systems are actually being used by teachers within school computer labs and classrooms.

Observing classroom performance (or any type of workplace performance) may sound like a straightforward, relatively simple process, but there are practical, technical, and even ethical considerations that must be taken into account before beginning actual observations. Patton (1990) has described five dimensions that characterize the different approaches to observations (see Figure 9.2).

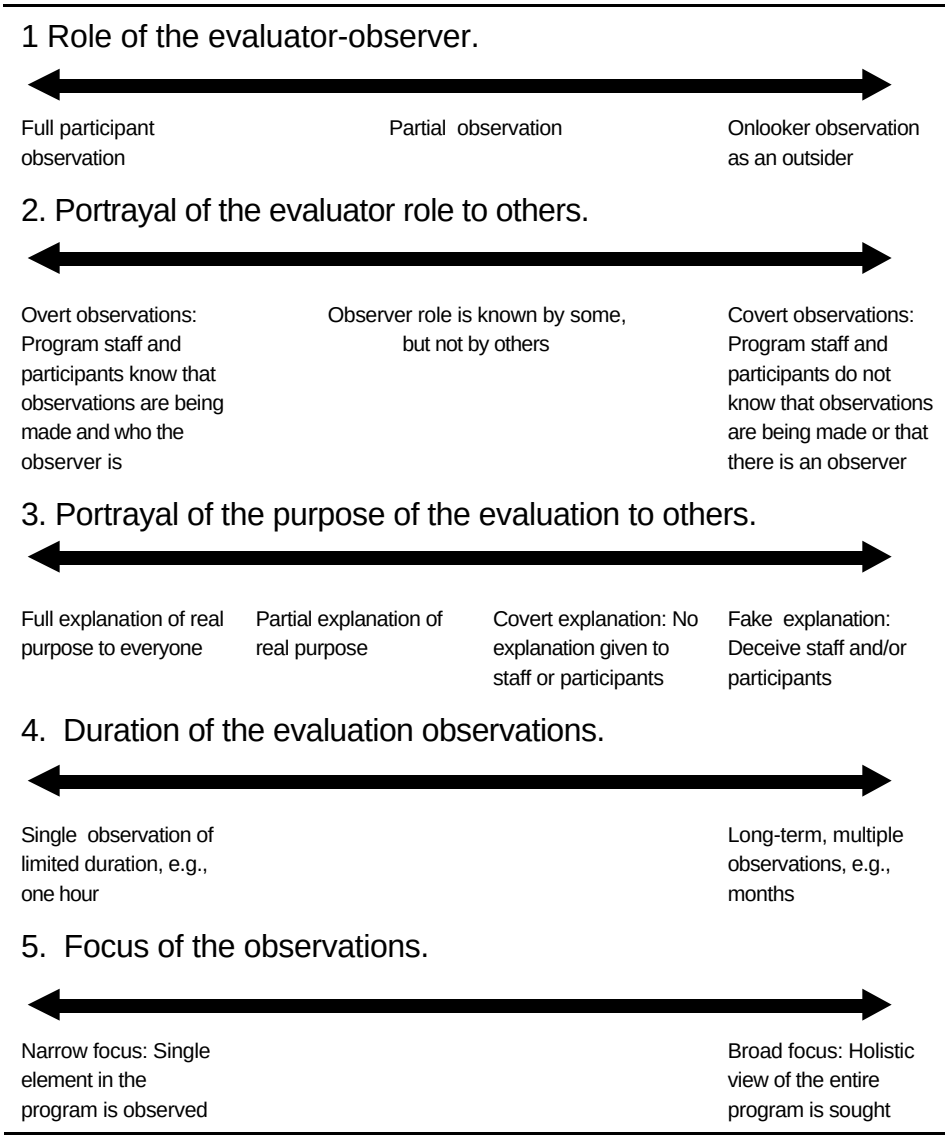


Figure 9.2. Dimensions of classroom observation (Patton, 1990).

It is useful to review these dimensions before undertaking an observation in an instructional context. In addition to considering the general dimensions shown in Figure 9.2, it is also useful to think about concepts or categories that might be used to direct your observations. Figure 9.3 lists seven factors that are relevant to the task of observing applications of interactive learning systems (or other forms of instructional technology, such as teleconferencing) in the context of education or training.

There are several things to remember when preparing to conduct observations:

- You can't observe everything.
- What you see and how you interpret it are influenced by your entire life's experience.
- You need to be sensitized to the goals of the observation and your relationship to those you are observing.

Setting – Where are you? A classroom? A lab? An auditorium? What does it feel like to be there? Is the space amenable to the technology? Are people comfortable in this space?

Objectives – Why are people here? Who is in charge (if anyone)? Are activities self-directed? Who maintains goal directed behavior? To what degree are people on task?

Implementation – Are things going as planned? Does the technology work? Who handles problems? Are people confident in their use of technology?

Interactions – How do people interact among themselves? Is the atmosphere formal? Informal? Friendly? Unfriendly? How are you viewed?

Nonverbal Behavior – What does body language tell you about this product or program? Are people interested? Going through the motions? Intimidated?

Unobtrusive Factors – What areas of the setting are heavily used? What areas are less used? Dusty? Cluttered? Can people hear? Air-conditioning?

Unexpected Things – Have you seen anything you didn't expect? What surprised you? What delighted you? What depressed you?

Figure 9.3. Seven factors relevant to classroom observation.

Before going onsite to conduct observations, it is useful to write down your expectations. Try to describe any biases or prejudices that might affect your observations. Having these expectations on record before observing provides you with a better basis for interpreting what you actually saw when you observed. Figure 9.4 provides a brief example of such a statement.

I am going to observe high school sophomores using an interactive multimedia science program in a rural area. I expect the school to be old fashioned in construction because I heard that it has been around for 60 years. This technology-based science program is probably the pride of the school. The interactive systems in that school will look like space shuttles parked in a barn. The teachers will probably be intimidated by the technology. The students may be too, but there are probably a few "whiz kids" who are really into it. I doubt that the interactive video is closely coordinated with the rest of the science program. It may be viewed as a privilege to get to use the interactive video. I am a little nervous about being in a high school again. After all, it has been a long time. I wonder if I can relate to the students? Will the teacher feel that I am a threat?

Figure 9.4. Sample expectations statement for classroom observations.

There are several guidelines for recording your observations in an educational context:

- Collect field notes. This is not optional! Don't trust everything to your memory.
- Don't try to write down everything. You can't! Record your notes in some sort of outline or shorthand style that fits your experience and skills. Flesh out your notes with more details as soon as you can.
- Make your notes as descriptive as possible. Don't try to interpret what you are seeing at the same time you are describing it. Try to separate description from interpretation.
- Add interpretations and your own feelings later.

Separating observations from interpretations is not easy. Figure 9.5 provides a poor example and a good example of descriptive field notes.

Poor Notes

- The classroom was a warm and friendly place. The teacher loves her students.

Better Notes

- bright walls - like the colors

- some noise, but teacher doesn't seem bothered

- students very busy - cooperative within groups - some competition

- well-used bulletin boards - look fresh - lots of student work shown

- teacher very active - helping kids - standing - sitting on floor - doesn't use her own desk during whole period

- students are eager to demonstrate their work to me; the teacher allows me complete freedom to explore this classroom

Figure 9.5. Poor and better field notes from classroom observations.

As soon as possible after you have completed your observations, you will want to do a "mind dump" (writing down everything you can recall) concerning what you have observed. It takes practice to develop good descriptive skills, and you are encouraged to work at developing these

skills. Figure 9.6 provides an example of elaborated field notes written after observations have been conducted.

The classroom walls are painted in pleasant colors rather than traditional institutional beige or green. Indirect lighting is used to soften the room. I feel very comfortable here. The bulletin boards feature student work, presented in an attractive manner. They have obviously been updated recently. The teacher's desk has an aquarium on it and there are lots of plants in the room. The teacher moves around the room a lot, getting close to the students. She even sat on the floor with some of them during part of the time. The teacher seems to have real rapport with these students. The students are talking among themselves, but the noise level is acceptable. The students appear to be including each other in the work to be done. No one seems unengaged in the tasks at hand. There is some competition, but it does not seem adversarial. I wish more of my own schooling had been like this, doing real projects, working in teams.

Figure 9.6. Example of detailed field notes written after observations.

One of the major problems with evaluations occurs when development team members are the only people who observe its use in the field. As honest as they might be, it is difficult for people to be objective about their expectations for the success of what they themselves have created. It is not bad practice to involve developers in such evaluations, but their work should be supplemented with external evaluators as well.

In addition to observations, anecdotal record forms, logs, and diaries can be used to evaluate impact. Supervisors may be asked to keep anecdotal records of unusual incidents related to the long-term outcomes of training. Workers or students themselves may be asked to keep logs or diaries of their activities related to what they are supposed to have learned and applied as a result of using an interactive learning system. The good news about anecdotal records, logs, and diaries is that they can provide pearls of evidence that an interactive learning program has had real impact. The bad news is that people need to be constantly reminded and rewarded if you expect them to keep these types of records.

Interviews are frequently used to collect evidence of impact. Telephone interviews can be used to follow up with trainees to find out if they are using the knowledge, skills, and attitudes from an interactive program on the job. The interviews can be conducted with the trainees, their supervisors, or even their clients or customers. Unfortunately, due to the frequency with which people are subjected to telemarketing today, some respondents may be reluctant to be interviewed via telephone.

Also, interviews can be conducted online, especially if the respondents are not expected to key in long responses to complex questions. Many workers have access to e-mail today. Therefore, if face-to-face interviews are not feasible and telephone interviews are too difficult to schedule, you

might consider conducting interviews about program impact via e-mail or other Internet tools, such as chat or discussion forums.

— WEB LINK —
For information about SphinxSurvey and other survey software, go to: http://www.scolari.com/

Questionnaires and other forms of survey can be used to collect impact data. Although the mails continue to be the dominant mode of distributing surveys, distribution through e-mail and the Web is increasing and is an alternative worth exploring (Dillman, 1999; Nesbary, 1999). There are some potential disadvantages to e-mail surveys (e.g., sample is limited to those people with e-mail, difficult to guarantee confidentiality, and limitations in question formatting), but there are many advantages (Thach, 1995). Distribution of electronic surveys is usually inexpensive, and the results are easy to edit and analyze because the responses are already online. The turn-around time is often much quicker, and the response rates may be higher than for a mailed interview. Surveys can also be conducted via the Web using interactive forms that, in turn, send the data to an address for analysis. As more people become Internet proficient, the utility of using the Internet for surveys is enhanced. A number of commercial companies now exist to support Web-based survey methods. The SphinxSurvey software program is one example of software that can assist in the design and implementation of surveys.

Yet another approach to estimating the impact of training or education, particularly popular in corporate settings, is “return on investment” (ROI) evaluation (Reeves & Carter, 2001). Training personnel are sometimes called upon to carry out ROI studies to demonstrate that the resources expended on training programs have yielded profits or benefits that exceed their costs. This is difficult, but not impossible. Medsker and Roberts (1992) describe a unique ROI study conducted by a large company whose business is delivering packages overnight. This company relies upon an accurate, highly motivated staff. Before sending them out into the field, new delivery personnel complete an intensive and expensive two-week training course. To demonstrate the value of the training, the training department managers conducted a risky experiment. They allowed 20 new employees who had only been given a brief safety training program to start delivering packages without the two-week

training program. They compared their performance with that of 20 new employees who had completed the training and with 20 veteran delivery personnel. They found that the trained new employees made far fewer mistakes than the untrained workers, and that the savings resulting from their lack of errors more than made up for the costs of the training program. (Ironically, they also found that the veteran employees made almost as many mistakes as the novices, indicating a need for retraining!)

Another way of looking at impact involves consideration of the costs of training in relationship to effectiveness and benefits (Kearsley, 1993). In many contexts, cost-effectiveness and cost-benefit studies will involve complex and controversial methodologies. These studies are difficult to conduct and defend because whenever you begin to attach actual monetary figures to various effects and benefits, your calculations will be challenged by others who have a stake in a different set of values.

It is also difficult in many contexts to calculate the actual costs of developing and implementing interactive learning systems. In the business world, some training departments are included as an overhead cost charged to all departments, whereas in others there is an internal charging system whereby various units pay for training within the company. Increasingly, large and small corporations are contracting outside vendors for training development, but there are still costs within the corporations in terms of managing these outside contractors.

If the costs of developing and implementing interactive learning systems are hard to track, the monetary values that can be attached to various effects and benefits are even more difficult to calculate. If sales go up in a retail organization, that type of effect is relatively easy to detect (although often difficult to attribute directly to a training program). However, what monetary value should be attached to improved morale on the assembly line? How do you assess the value of a life that may have been saved as a result of a new e-learning program about workplace safety?

— WEB LINK —
A free *Cost Analysis Handbook* can be obtained from the Flashlight Project at: http://www.tltgroup.org/programs/fcai.html

Monetary values are even more difficult to attach to the effects and benefits of educational programs (Newman, 1990). What is the ROI on an innovative, but controversial, sex education program that reduces pregnancies among unwed teenagers? We are convinced of the wisdom of the bumper sticker that reads “If you think education is expensive, try ignorance.” However, we would be cautious in undertaking a cost-effectiveness evaluation of an interactive learning environment that is supposed to have long-term effects, such as improving problem-solving skills, encouraging intellectual curiosity, and promoting a positive attitude toward lifelong learning. The complexity of attaching unambiguous figures to these types of outcomes should be obvious.

Despite the difficulties, there is great interest in investigating the cost-effectiveness of interactive learning systems. Initial investments in interactive learning systems may be driven by a desire to be on the "cutting edge" or by the persuasive powers of dynamic individuals within an organization, but over the long haul, the cost-effectiveness of these systems will have to be supported through rigorous evaluation. Figure 9.7 presents a hypothetical cost-effectiveness comparison between two alternative methods of training flight attendants.

Problem: Alpha Airlines must provide 10,000 flight attendants with training every year to maintain certification by the Federal Aviation Administration (FAA).

Traditional Training Program: Flight attendants (10,000) are flown to the corporate base in Dallas twice a year for FAA-mandated safety training. Each day of training is leader-led with heavy use of airplane mock-ups. Costs per attendant per training session are listed below.

Travel Costs	$300
Hotel Costs	$100
Per Diem	$50
Average Training Costs	$50
Salary Paid to Attendant During Training	$150
Total	$650

Total Training Program Costs Per Year Based on Two Yearly Training Sessions for 10,000 Flight Attendants = $13,000,000

New Training Program: Flight attendants (10,000) are flown to corporate base in Dallas once a year for FAA-mandated safety training. The one day of training is leader-led with heavy use of airplane mock-ups. Costs per attendant per training session remain at $650. The other day of training is accomplished using e-learning systems distributed to all 25 Alpha Airlines bases around the country. Flight attendants accomplish the training objectives while waiting between flights. Travel, hotel, per diem, and salary costs are eliminated. E-learning development and implementation costs are listed below.

E-learning Development Costs	1,800,000
E-learning Delivery Systems Costs	500,000
E-learning Maintenance Costs	200,000
Total	$2,500,000

Total Training Program Costs Per Year Based on One Yearly Training Session Plus Dispersed E-learning Training for 10,000 Flight Attendants = $9,000,000

First Year Savings = $4,000,000

Figure 9.7. Hypothetical cost-effectiveness study.

If only we could reduce cost-effectiveness studies to the simplicity represented in Figure 9.7! And even when cost-effectiveness can be

shown, experience indicates that other factors may influence decision making in unpredictable ways. For example, one of the U.S. military services conducted a series of studies that indicated that a self-paced interactive approach to electronics training was both efficient (saved training time) and cost-effective (saved money). However, the self-paced nature of the electronics training meant that some personnel were finishing what had been a 30-week training program at different times ranging from 20 to 35 weeks. The military system was not equipped to handle this individuality. It was deemed more important that classes graduate together. In fact, the local commanders believed that having personnel finish training at different times was bad for morale. As a result, despite the evidence in favor of the interactive approach, the training went back to the instructor-led, group-paced method.

How should impact studies be designed?

There are many ways that impact evaluations can be designed, but an especially important approach in today's financial climate is the ROI study. Such studies involve calculating the percentage of return for a dollar invested in training or another intervention. Phillips (1997) provides a simple formula for calculating ROI as:

$$\text{ROI (\%)} = \frac{\text{net program benefits}}{\text{program costs}} \times 100$$

— WEB LINK —
More information about ROI can be found at: http://www.roinetwork.org

How can Phillips' ROI formula be applied to interactive learning systems? Figure 9.8 illustrates an ROI study for a hypothetical Web-based training (WBT) program. In this example, the Omega Steel Company is confronting an absentee problem whereby employees are averaging 2.7 days away from work per month at a cost of $200 per day per employee. There are 5,000 employees in the company, so the annual costs of absenteeism exceed 32 million dollars. The training department produces a WBT program for all employees that stresses the effects of absenteeism on corporate profits and worker profit sharing rates. The primary goal of the program is to enhance employee motivation and lower absenteeism.

The costs of developing the WBT and providing the infrastructure to provide Web access to all employees are 3 million dollars. After only three months of usage, the absenteeism rate has fallen to 1.8 days per month. At first, this may not seem to be a significant outcome, but using Phillips' formula, the ROI for the first year would be 260% or, for every dollar spent on training, $2.60 in benefits are realized. (Of course, the workers' commitment to showing up at work may not endure, and the

company would need to do as much as possible to keep morale up and absenteeism down. If the absenteeism did not stay lower, then the ROI would decrease or disappear altogether!)

Problem: Omega Steel workers are averaging 2.7 days per month absenteeism rates. At an average cost of $200 per day and 5000 workers, company losses exceed 32 million dollars per year.

Solution: WBT is provided to all employees to motivate them and lower absenteeism. Absentee rates fall to 1.8 days per month.

ROI Calculation: The first-year savings are projected at 10.8 million. The ROI formula requires calculation of net program benefits (10.8 million minus 3 million equals 7.8 million) and dividing by the program costs as illustrated below.

$$\text{ROI (\%)} = \frac{7{,}800{,}000}{3{,}000{,}000} \times 100$$

$$\text{ROI (\%)} = 260\%$$

First-Year Results = For each dollar spent on WBT, $2.60 in benefits are realized.

Figure 9.8. Hypothetical ROI evaluation focused on WBT.

Other approaches to impact evaluation may involve long-term case studies (Merriam, 1998). Rigorous case studies as evaluations are relatively rare, perhaps because they require many hours of immersion in the context of learning and performance to yield robust interpretations of the impact of interactive learning systems on workplace performance and/or subsequent learning activities. Suppose you were asked to evaluate the impact of an online MBA program, such as the kind offered by UNext.com (http://www.unext.com/). With the cooperation of the clients at UNext, you could recruit some actual students to enroll in the online educational program so that they could carry out long-term participant observation case studies. Subsequently, you could interview graduates of the program at periodic intervals to find out how they perceive the impact of the program on their professional careers. You could also interview their supervisors and peers to get their opinions concerning the outcomes of the online program, especially in comparison to graduates of more traditional MBA programs. Through this triangulation of sources, you could build a case for the impact (or lack thereof) of the program being evaluated.

What are some examples of actual impact evaluations?

Phillips (1994) describes 18 case studies of ROI studies in corporate training contexts, although few involve interactive learning systems per se. These 18 case studies report ROI values ranging from 150% to 2,000% for training investments.

Unfortunately, ROI, cost-benefit, and cost-effectiveness studies are rare in K-12 and higher education. Perhaps the best known example of a technology impact study in education is the Apple Classroom of Tomorrow (ACOT) Project (Fisher, Dwyer, & Yocam, 1996). This study illustrated the enormous importance of implementation in efforts to infuse media and technology into classrooms. In 1985, Apple Computer, Inc. began a long-term collaboration with several widely-separated school districts around the U.S. Students and teachers were provided with computers and software for both school and home use, and research was conducted in the participating schools for over a decade. The ambitious research program focused on six major questions:

1. What kinds of collaborative environments and tools are most helpful in inquiry-based classrooms?
2. What happens when teachers and students have access to rich online resources and remote experts?
3. How can the computer's power to represent knowledge in multiple media support learning?
4. How can computers be used to support students in problem solving?
5. What happens to motivation and learning when students have the same access to the sophisticated tools that experts use?
6. How can the learning and competencies accomplished in a technology-rich environment be assessed?

Coley *et al.* (1997) summarized the results of the first decade of ACOT research:

> ACOT students:
>
> - Explored and represented information dynamically and in many forms.
> - Became socially aware and more confident.
> - Communicated effectively about complex processes.
> - Used technology routinely and appropriately.

- Became independent learners and self-starters.
- Knew their areas of expertise and shared that expertise spontaneously.
- Worked well collaboratively.
- Developed a positive orientation to the future. (p. 37)

— WEB LINK —
The latest information about the ACOT evaluations can be found at: http://www.apple.com/education/research/

Some of the most interesting findings from the ACOT research concern teachers and implementation. ACOT researchers found that teachers had strong beliefs about their roles and efficacy as teachers which changed very slowly as their classrooms moved toward child-centered rather than textbook-driven education (Sandholtz & Ringstaff, 1996). Teachers had to make significant changes in their classroom management styles, giving up more control to technology and students. This also changed slowly. Initially, media and technology were primarily used within the context of traditional pedagogical methods, and most teachers required years of experience before they adopted more innovative strategies such as project-based learning. Finally, teachers struggled with fundamental incongruities between traditional assessment measures and the kinds of learning occurring in their classrooms. In fact, assessment problems proved to be the most resistant to solutions and many remained unresolved (David, 1996).

The bottom line of the ACOT Project is that pedagogical innovations and positive learning results did eventually emerge from the infusion of media and technology into schools, but the process took longer than most people imagined. Educational administrators who think that a summer workshop or a few after-school seminars by consultants will enable teachers to implement media and technology in their classrooms are mistaken (Cuban, 2001). Huge investments in time and support for teachers are especially needed when the adoption of constructivist pedagogies accompanies the infusion of new technologies (Duffy & Cunningham, 1996).

How should effectiveness evaluations be reported?

Impact data can be presented in various formats, such as print, video, or dynamic Web sites. Observational data requires special care in reporting. When you get ready to report observations, you should first go back over your original biases statement. Look at it in comparison to what you actually observed and how you interpreted what you saw. Before writing your final report of the observations, ask yourself these questions:

a. What happened as you thought it would?

b. What didn't happen?

c. What have you learned?

d. What can you conclude?

e. What recommendations would you make?

Few things tell the impact of an innovation as convincingly as a good story. Instead of preparing detailed technical descriptions, it is better to write in a style that anyone would be comfortable reading. Evaluations that tell stories or relate anecdotes portraying what an interactive learning system meant to real people are bound to be influential because people remember stories much more than they do facts and figures. Tracy Kidder, author of *Among Schoolchildren* (1990), is an award-winning writer with a story-telling style that can be emulated in evaluation reports.

Another important factor in reporting impact evaluation is providing the information in a timely manner while the important decisions that it should affect are still unresolved. Evaluation data become "stale" very quickly. Getting impact information out quickly to the important stakeholders and decision makers should be a primary concern.

Summary

The bottom line of impact evaluation is that it demands a creative effort to build a case in support of the value of your interactive learning system. The impact of these systems (or any other instructional technology) is rarely, if ever, established beyond a shadow of a doubt. Indeed, there will almost always be rival claimants for any successes that are realized (Swanson, 1989).

Training personnel, especially developers of interactive learning systems, may be accused of being somewhat isolated from the "trenches" of business. Similarly, educational technologists in schools, such as technology coordinators, may be considered peripheral to the main business of schooling, at least in the eyes of some administrators and teachers. You are advised to combat these prejudices proactively by undertaking the difficult job of evaluating impact.

— WEB LINK —
The *Program Evaluation Standards* can be found at: http://www.wmich.edu/evalctr/jc/

Estimating impact will never be easy, but you have an ethical responsibility to seek this kind of outcome data, even though your colleagues or associates may argue against it. A survey of 1,200 members of the American Society for Training and Development indicated that most tended to use training evaluation questionnaires much more than measures of outcomes and impact because the latter were viewed as "too time consuming, too expensive, and beyond their level of expertise" (cited in

Sanders, 1989, p. 64). However, simply relying upon the ubiquitous "smilometer" for serious summative evaluation is no longer sufficient, if it ever was (Geber, 1995). Although you may not ever find the concrete evidence you desire to support the impact of interactive learning systems, you can build a credible case for interactive learning systems through the ethical application of the methods described above.

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