Evaluation Methods of Technology Based Instruction: A Literature Review.

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Evaluation Methods of Technology Based Instruction: A Literature Review.

Abstract
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Evaluation Methods of Technology Based Instruction: A Literature Review

A Master's Project Submitted to the Graduate School

In Partial Fulfillment of the Requirements

For the Degree

Master of Science

Department of Human Resource Development

By

Krista Berry

April 2002
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Abstract

The purpose of this literature review is to examine the present methods of evaluating technology based instruction. Effective and efficient evaluation methods are imperative to the instructor who uses technology as a means to deliver instruction. It is important that the instructor is able to measure if the training objectives were achieved. A review of literature yields the historical contribution of instructional technology as well as evaluation to the present training trends. There are many accepted and widely used methods for evaluating training. Five of these instructional evaluation models are uncovered and discussed. This study revealed no specifically designed model for evaluating technology based instruction or no difference in the evaluation methods employed by technology based instruction and traditional classroom based instruction.
Chapter 1

Introduction

It is first quarter of the twenty-first century, a time when civilization seems to be declining too rapidly for comfort and yet too slowly to be exciting. Much of the world sits on the edge of an increasingly expensive theater seat waiting with various combinations of dread, hope and ennui for something momentous to occur (Robbins, 1980).

Technology is here. It may arguably change humanity in ways not thoroughly measurable, not yet at least. It has become the dominant delivery method of training and other forms of learning. It is essential that practitioners and HRD professionals accept and understand this current trend. Because technology is becoming recognized as a predominant delivery method, it is necessary to know how to evaluate technology based training. There are many accepted and widely used methods for evaluating instructor led training, but none designed specifically for technology based training. Evaluating training requires defining learning objectives, planning an intervention, measuring learning objectives, and improving for future events. Elemental in the course of any instructional event is the process of evaluation. This paper addresses the evaluation components of current evaluation models and reflects on trends in the technology-training field.

Effective and efficient evaluation methods are imperative to the instructor who uses technology as a means to deliver instruction. It is
important that the instructor is able to measure (a) satisfaction (b) transfer of learning (c) transfer of training (d) knowledge gained and (e) skills gained. The purpose of uncovering the methods that are currently used to evaluate technology based instruction is to offer the instructor or practitioner a variety of methods or models to adopt when employing evaluation techniques. Through the examination of current evaluation methods and strategies, it is encouraged that a technology specific evaluation model be developed.

Many organizations are shifting to technology based training in order to cut costs and increase productivity. This reason is not the only one for the growing need for evaluating educational outcomes. It is necessary to know to what extent the needs of the organization, the academic institution or the needs of learner are fulfilled. Educational outcomes are considered exemplary when the objectives presented have been achieved. Educational achievements by the learner lead to a greater sense of effectiveness in the workplace, or in the classroom. In order to measure the objectives or the purpose of the training event, evaluation must take place.

Evaluation and effectiveness are linked and should be approached in the accompaniment of the goals set by instructor. The goal of the instructor is to facilitate material successfully to achieve transfer of training. The evaluation method is crucial in measuring the learning result.
Evaluation

Background

For the purpose of this study, technology based instruction is understood as automated forms of instructional design and delivery or any non-classroom-based instruction. In this study, technology based instruction (TBI) will encompass all delivery methods and disciplines. Defining TBI and discussing its purposes and applications, brings focus to this study.

Technology Based Instruction

TBI can be thought of as "education or training delivered to individuals who are geographically dispersed or separated by physical distance from the instructor using computer and telecommunication facilities" (Belanger & Jordan, 2000).

TBI or Web-Based Instruction is defined by Khan (1997) as "...a hypermedia-based instructional program which utilizes the attributes and resources of the World Wide Web to create a meaningful learning environment where learning is fostered and supported" (p.6).

Usage

TBI is now a widely accepted form of teaching used in various organizations including academia. The Web has become a dominant means to deliver instruction. There are two reasons for this movement. One is that the Web is easy to use. "The universal appeal and ease of use of the Web is the reason that many institutions deliver their distance learning courses via the Internet or their organizational Internet" (Belanger
& Jordan, 2000). The second significant reason the Web has become a dominant means to delivery information is that it is "a relatively inexpensive medium" (Belanger & Jordan, 2000).

**Purposes of Evaluating TBI**

The reasons for evaluating are important to the designers and developers of any TBI program. According to ASTD, there are seven reasons for evaluating TBI:

1. To determine whether a TBI solution is accomplishing its objectives;
2. To identify the strengths and weaknesses in the TBI process;
3. To determine the benefit and cost ratio of a TBI result;
4. To decide who should participate in future TBI results;
5. To identify who benefited the most or the least from the TBI result;
6. To reinforce major points made to the target group; and
7. To collect data to assist in future TBI initiatives.

(http://www.astd.org/virtual_community/research/What_Works...).

Another reason to evaluate is because technology is costly and TBI demands accountability and results. This reason brings a sense of urgency to technical instructors and developers because TBI is considered a new learning approach. It is important to measure its effectiveness in order to validate TBI as a successful means for delivering information.
According to Breakwell and Milward (1995) there are three basic rationales for evaluating: to validate, to improve, and to condemn:

1. Validation. Evaluation of TBI may be used to validate or to justify what was taught. Validation allows for TBI to be accepted as a fitting method of delivering instruction.

2. Improvement. Evaluating TBI is an attempt to improve existing practices. It is also a clear effort or believing that things could be better (Breakwell & Milward, 1995).

3. Condemn. Evaluation of TBI "can be designed to condemn existing practice" (Breakwell & Milward, 1995, p. 4). This is not an attempt to improve current conditions, but an acknowledgement that what is currently in practice is unsatisfactory.

Belanger and Jordan (2000) also stress three other reasons for evaluating TBI:

1. To conclude whether or not the instructional objectives have been met;

2. To determine what the actual return on investment is; and

3. To provide feedback so the instruction can be uniformly improved.

These rationales or reasons for evaluating are important to organizations because they illustrate the need to show improvement in performance, or an increase in knowledge. The overall impression of the
learning incentive may not become apparent immediately. It may be
difficult to sum up all the benefits. In order to measure the results
effectively, the instructor must know why the outcome is being measured.

TBI and Organizational Learning

Many organizations today are investing in corporate universities. The goal is to create a learning organization that is an "environment and a culture that encourages knowledge generation and sharing, supports an atmosphere of learning from mistakes, and assures that what is learned is incorporated into the future activities, decisions, and initiatives of the organization" (Rosenberg, 2001, p.14). People are scattered and schedules are full, yet the demand for learning is still high. The Web is just the tool needed to effectively overcome these obstacles. It is an essential piece in the world of organizational learning.

Purpose

The purpose of this study is to examine the present methods of evaluating technology based instruction. Through a review of related literature, this study will explore the historical background of instructional technology and evaluation and will present current models used in evaluating instruction.

The reason TBI was chosen as a research topic is because of its accelerated growth as a means of delivering information. "The increasing popularity of online courses naturally leads to a consideration of the effectiveness of these courses..." (Gagne & Sheperd, 2001, p. 1). Both
employers and educators are concerned with the attitudes of the learner toward TBI, and the cognitive outcome of the experience. In this study, an extant literature review will reveal the immediacy issue and the present evaluation techniques of TBI.

Organization of the Paper

The remaining components of Chapter 1 present the methodology employed to approach this examination, a glossary of terms to provide clarification, and a historical review of instructional technology and evaluation. Chapter 2 presents a review of literature. This chapter presents evaluation methods of instructor led training as well as technology based training. Finally Chapter 3 offers a comprehensive discussion about recommendations for future studies and implications for HRD professionals.

Methodology

The methods of research used in this literature review vary greatly. The material was obtained primarily through the web, library databases, and college and university web sites, using technology related search terms. The literature search produced few surprises, as there were many articles available with the keywords of evaluation and instructional technology.

First, literature was gathered from library databases using keywords such as evaluation, technology, instruction, outcomes, learning, and training. Articles were retrieved based on relevance to the search
topic. Secondly, after much of the retrieved articles were sorted and categorized based on topic, they were read for content and relevance. Much of the selected literature included clear descriptions of evaluation models and their connection to technology, as well as a historical significance to instructional technology. Third, after reading and conceptualizing the content of the literature, secondary sources were consulted. This search led to many other related articles and books. Many of these articles and books were obtained and used as primary sources in this study.

An examination of literature, refereed articles, anecdotal articles, and empirical and non-empirical based articles as well as a variety of books was conducted. The primary focus in the literature examination was on the discussion of evaluation strategies and models utilizing TBI. The selected sources contained valid and clear information directly related to technology, evaluation, or methods of evaluating technology based instruction. Specifically, the examination of the literature focused on portions of the text that discussed evaluation including process, steps, techniques, criteria, and models. Much of the literature reviewed offered a general discussion of evaluation. This general information was not useful or applicable to the scope of this study. The scope of this study focuses on specific evaluation models, methods and techniques of TBI. For the purpose of this study, the instruction or training that is evaluated is primarily instructor led, aided with technology.
Five evaluation models are presented for evaluating TBI. Of the five models only two met the TBI model criteria developed by this researcher. The criteria used for defining a TBI model has two conditions:

1. The model was retrieved from a source directly stating that this method is employed to evaluate TBI.
2. The model seeks to evaluate the outcome of the training event while taking technology sensitive issues into consideration.

Technology sensitive factors are conditions that may contribute to or hinder the learning process:

1. Technological competencies of the instructor;
2. Technological competencies of the learner; and
3. Delivery of the course material

Two of the five models came from TBI related sources. The remaining three models were chosen because they appeared to have TBI model criteria, but need to be modified or customized to fit the TBI purpose. These three models had a heavy emphasis on evaluating the training design, not the outcome. These models also don't include any technology sensitive factors to consider when evaluating.

Ten articles and sixteen books were selected for review. Many of the selected material gave no insight into their methodology or techniques used to gather the contained information. Many articles were excluded due to irrelevant information and validity concerns.
Limitations

Much of the excluded material contained information regarding design issues such as usability design, interface design, graphic design, and navigation support. The technical design issues are not relevant to this paper solely because this paper is focusing on evaluating the outcome of the instruction. Other excluded sources emphasized evaluation of the HRD effort. The scope of this study focuses on specific evaluation models, methods and techniques of TBI.

A glossary of terms provides definitions of the different varieties of TBI.

Glossary of Terms

Asynchronous Learning – Any learning event where interaction is delayed over time. This allows learners to participate according to their schedule, and be geographically separate from the instructor. It could be in the form of a correspondence course or e-Learning. Interaction can use various technologies such as a threaded discussion.

Audio-conference. An electronic meeting in which participants in different locations use telephones or audio-conferencing equipment to interactively communicate with each other in real time. The number of participants may be as small as three or as large as one hundred.

Computer Based Training (CBT) – Training or instruction where a computer program provides motivation and feedback in place on a live
instructor. CBT can be delivered via CD-ROM or Internet. Teams of people including instructional designers create a CBT programs.

**Correspondence Course** - A course completed from a distance using written correspondence for interaction and to submit assignments. Correspondence classes became popular in the 1890's.

**Distance Education** – The formal process of distance learning. This term is traditionally latent at the higher education level.

**Distance Learning** – Learning where the instructor and the students are in physically separate locations. Can be either synchronous or asynchronous. Can include correspondence, video or satellite broadcasts, or e-Learning. It usually infers the higher education level.

**Distance Training** - A reference to distance learning for the corporate or professional levels. It is more commonly referred to as distributed learning, WBT or e-Learning.

**Distributed Learning** – Distance Learning that makes use of information technology. Includes most types of distance learning but not plain correspondence (very similar to e-Learning).

**e-Learning** – Any learning that utilizes a network (LAN, WAN or Internet) for delivery, interaction, or facilitation. This would include distributed learning, distance learning (other than pure correspondence), CBT delivered over a network, and WBT. It can be synchronous, asynchronous, instructor-led or computer-based or a combination.
Instructor-led Training (ILT) – A learning event which is led by an instructor and either held in a physical location or delivered via a network (WBT, or e-Learning). It usually suggests the professional or corporate context and is synchronous learning.

Online Learning – e-Learning over the Internet (as opposed to a local or wide area network).

Online Training – Same as online learning, only it suggests the professional or corporate level.

Synchronous Learning – Any learning event where interaction happens simultaneously in real time. This requires that learners attend class at its scheduled time. It could be held in a traditional classroom, or delivered via distributed or e-learning technologies.

Teleconference - Simultaneous conference to multiple sites distributed via an audio instrument, usually by phone.

Web Based Training (WBT) - Training which is delivered over a network (LAN, WAN or Internet). Can be either Instruct-led or Computer-based. Very similar to e-Learning, but it suggests that the learning is in the professional or corporate level.

(Clark, 1996).

To accurately assess the present state of instructional technology, one must first know its history. The following section offers a brief review of the history of instructional technology. In order to move forward, it is essential that instructors know how far technology has come.
The History of Instructional Technology

"The history of using technology for learning is replete with promise and disappointment" (Rosenberg, 2001, p.20). The word 'technology' is derived from the Greek form of technie, translated as art, craft or skill. It was conceived by the ancient Greeks as a particular activity and as a kind of knowledge. The development of a new process for doing something, for example, is now considered technology (Saettler, 1990).

Correspondence Education

The predecessor of TBI was primary correspondence education. Correspondence education began in Europe and the United States near the middle of the 19th century. Correspondence education allowed individuals who could not attended regular classes the opportunity to enroll in and complete classes at home. Assignments were completed at home and delivered to the instructor via mail. During this era, the use of correspondence education was considered an innovative advancement, or otherwise, a luxury. Correspondence education during the mid 19th century is comparable to the present variations of TBI, such as the availability of on-line Ph.D. and Master's programs. Many of the so-called technologies used in instruction date earlier than the Web itself.

Film

The US first used film as a modern technology during WWII. Military trainers were able to deliver information by using film technologies to personnel around the world. The military was so successful in this
endeavor that they continued using film for training events. In fact, the military dedicated sophisticated research resources on how best to use film and later, television, for delivering instruction (Rosenberg, 2001).

Allying with universities, the military helped to lead the way in promoting the use of film as an educational tool. Film technologies flourished and allowed for a more creative approach at teaching. Film soon became a central part of the school curriculum (Rosenberg, 2001). Soon, the television was introduced.

Television

The television (TV) could bring almost any style of learning to the classroom. The TV didn't bring about any sort of learning utopia, mostly because during the fifties and sixties, we didn't know how to create instructional television. After many attempts by networks such as PBS, it was concluded that the main reason TV didn't become one of our teachers was because it lacked the essential quality of teaching, which is the ability to interact with the students. Presently, this quality has impact on the TBI effort because many learners are hesitant to enroll or participate in a non-traditional style of learning. Throughout much of the seventies, eighties and even the early nineties, instructors advanced on finding out exactly how people learn best. New strategies of learning and encouragement were brought into existence and the field of instructional design soon emerged. "Characterized by a systems approach, this...soft technology helped identify the critical success factors for learning and incorporated
them into methodologies that began to be used to create more effective training" (Rosenberg, 2001, p.24). Some of these identified success factors include learner motivation and the understanding of how people learn best.

*The Computer*

After film and TV, we moved into more advanced forms of technology to deliver information. The first prevailing use of the computer in instruction occurred by IBM in the late 1950's. This effort offered computer-aided instruction in elementary schools (Horton, 2000). Superior technology soon emerged. Following the mainframe came the personal computer, then the development of software programs, Windows, CD-ROM's and then came the most astounding delight of them all: the Internet. The rise of the Internet in the nineties created an information highway. "Once such a great network was developed, a true...metamorphosis began to take place" (Horton, 2000, p.4). The Internet, also known as the Web, has created a new appearance to virtual learning environments. As the Web became more formatted and more organized, it became much easier to use. The Web soon became an illustrated user loop for the valuable and complex wealth of the Internet. (Horton, 2000). Training and education were inevitable.

The advanced development of TV, film and then the computer offered to distance education efforts were not intended. They also have not been implemented to completely replace the human element of
teaching and learning. Technology's essential role is to nourish the learning process, with the help of the instructor. Technology also provides additional opportunities for learning by those who wish to utilize them. "In recent times, new information delivery systems and communication technologies have emerged. The most well known of these delivery medium is the Internet (Belanger & Jordan, 2000). "Machines and software are changing at exponential rates. Every eighteen months the speed and capacity of computer machines doubles" (Jones, 1995, p.1).

Today, the World-Wide Web is the fastest growing instructional delivery method. This electronic learning revolution has sparked the interest of educators and employers due to the possibility that they maybe able to reduce the cost of instructional delivery (LaRosa & Whitten, 2000). Computer based learning provides increased access to courses with flexible scheduling and less travel for learners and student. For the institution, computer based training provides the ability to increase enrollment with out expansion costs to accommodate the increased number of learners (Gagne & Sheperd, 2001). Distance education will continue to grow in acceptance, use and quality. The benefits of distance education include delivery of education/training to large numbers of geographically separated learners, long-term cost-saving, reproducible material, better prepared material, individualized instruction, and a learn at your own pace approach.
Electronic information systems are the marvel of the second half of the twentieth century. Technology and information have forever changed the world. The effects of this metamorphosis are apparent to any instructor and offer a practical means to deliver and receive information.

To accurately assess the present state of evaluation, one must first know its history. The following section offers a brief review of the history of evaluation. In order to move forward, it is essential that instructors know how far evaluation has come.
The History of Evaluation

Evaluation research has developed as a result of training and evaluation activities conducted during the World War II era. It provides answers to the questions such as: (a) Do we execute or repeat a program or not? and (b) if so, what changes should be made? (Stone & Watson, 1999). What goes on in the classroom is not what is being evaluated. That is an unimportant measure. An important training outcome answers the question such as: How have you used what you learned? This type of evaluation is difficult to conduct because it usually happens months after the training event (Stone & Watson, 1999). Adding to the difficulty is the fact that the evaluators need to be instructors or outside customers of the participant who took part in the training event.

Kirkpatrick

In order to classify areas of evaluation, Donald Kirkpatrick created what is still one of the most widely used evaluation approaches. Kirkpatrick's model of evaluation has governed the evaluation contention since its inception, forty years ago (Holton, Trott, & Twitchwell, 2000). Exhibit 1 is an illustration of Kirkpatrick's four levels of evaluation and what is measured at each level (Kirkpatrick, 1959).
Exhibit 1: Kirkpatrick's Four Level Model of Evaluation and Measurement

Criteria

<table>
<thead>
<tr>
<th>Level One</th>
<th>Level Two</th>
<th>Level Three</th>
<th>Level Four</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement of Reactions</td>
<td>Measurement of Learning</td>
<td>Measurement of Behavior</td>
<td>Measurement of Results</td>
</tr>
<tr>
<td>• Were the participants pleased?</td>
<td>• What skills, knowledge, or attitudes have changed?</td>
<td>• Did the participants change their behavior based on what was learned in the program?</td>
<td>• Did the change in behavior positively affect the organization?</td>
</tr>
<tr>
<td>• What do they plan to do with what they learned?</td>
<td>• How much?</td>
<td></td>
<td>• Has performance levels increased?</td>
</tr>
</tbody>
</table>

Even though Kirkpatrick's (1959) model is now over 40 years old, its refined clearness has caused it to be the most commonly used method of evaluating training efforts. An ASTD survey, which reports feedback from almost 300 HRD executives and managers, unveiled that 67 percent of organizations use Kirkpatrick's model to conduct evaluation (Stone & Watson, 1999).

Although the Kirkpatrick (1959) model has served instructors well in terms of evaluating whether learners liked their instruction, whether they learned something from it, and whether it had some effect for the organization, evaluation experts are now pointing out that the four-level approach has weaknesses (Stone & Watson, 1999). Mainly, it cannot be
used to determine the cost-benefit ratio of training (ROI), and it cannot be used diagnostically.

When looking at ROI and cost benefit analysis, three essential items to remember are (1) improving efficiency means achieving the same results with lower costs; (2) improving effectiveness means achieving better results with the same costs; and (3) it is possible to get better results with lower costs (Stone & Watson, 1999).

In addition to Kirkpatrick’s four levels of evaluation, there are a few suggested modifications to the model. One model, proposed by Phillips (1983) focuses on return on investment, and the other proposed by Hamblin (1974) entails a fifth level of measurement considered to be the ultimate value of training which is organizational results.

**Phillips ROI**

This model is considered a modification of Kirkpatrick’s model. Furthermore, Phillips (1983) actually demonstrates how to place monetary worth on training and calculate the return on investment of a training event. Exhibit 2 is an illustration of the ROI model proposed by Phillips (1983).

**Exhibit 2: Phillips ROI model.**
Hamblin's Fifth Level of Evaluation

Hamblin (1974) regards the evaluation of training as a continuous process that begins with the training itself. Reactions, learning, behavioral changes and organizational results follow each other like a chain of events. Hamblin's fifth level of evaluation is the ultimate utility of training or organizational results. This level requires collecting data from all four levels of evaluation and then comparing those results with the impact the training has made on the organization. The models of Kirkpatrick (1959) and Hamblin (1974) bear close resemblance to each other. Exhibit 3 is an illustration of the Hierarchy of evaluation (Rothwell & Sredl, 2000) as suggested by Hamblin (1974) and Kirkpatrick (1959).

Exhibit 3: The Hierarchy of Evaluation.

<table>
<thead>
<tr>
<th>Focus</th>
<th>Evaluation</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did the learners like it?</td>
<td>(Kirkpatrick)</td>
<td>Organizational evaluation</td>
</tr>
<tr>
<td>Did the learners change from the event?</td>
<td>Learning</td>
<td>Experimental research</td>
</tr>
<tr>
<td>Did the change affect behavior or performance?</td>
<td>Behavior</td>
<td>Demonstrations</td>
</tr>
<tr>
<td>What are the behavioral results?</td>
<td>Results</td>
<td>Tests</td>
</tr>
<tr>
<td>How do the results affect the organization?</td>
<td>(Hamblin) Ultimate Value</td>
<td>Participant evaluations</td>
</tr>
</tbody>
</table>
After looking back to the time when Kirkpatrick's model was developed almost forty years ago, the literature suggests that there has been little change in the amount of evaluation conducted within organizations (Holton, Trott, & Twitchell, 2000). Even though Kirkpatrick's model appears to be the most widely used evaluation method, there are several other proposed methods and models. Practitioners continue to search for a replacement model for the four levels. However, because of the simplicity of Kirkpatrick's model, and because of its early entry into the evaluation emporium, few people have managed to dispense with his model entirely. Although this model is a favored approach in the evaluation of instructor led training, this study revealed that there is no valid research that suggests it is the best choice when evaluating TBI. An examination of some other evaluation models of TBI and suggested models of TBI are illustrated in Chapter 2.

TBI is now a predominant delivery method in training. In Chapter 2, five evaluation models are presented. There are two models that are specifically used to evaluate TBI. The remaining three models are presented, analyzed, and then suggestions are offered as to how to customize these models into TBI models.
Chapter 2

Literature Review

The purpose of this paper is to examine the present methods of evaluating technology based instruction. This chapter is a review of related literature focused on evaluation model and methods. The introduction explores the breakdown of evaluation such as why evaluate, who evaluates, when to evaluate, and what to evaluate. Following the introduction is an illustration and discussion of five current models used in evaluation. In conjunction with the models, is a brief discussion of the practice of each model. This includes some mention of suggested improvements, or amendments.

Introduction

What is Evaluation?

Thorpe (1988) defines evaluation as "the collection of analysis and interpretation of information about any aspect of a program of education or training as part of a recognized process of judging its effectiveness, its efficiency and any other outcomes it may have" (p. 5).

Evaluation is defined by Rothwell & Sredl (2000) as "the process of appraising something carefully to determine its value" (p. 275). According to the Taxonomy of Educational Objectives (as cited by Rothwell & Sredl, 2000) "evaluation is at the highest level of cognitive domain: It requires some combination of all the lower levels: knowledge, comprehension, application, analysis, and synthesis" (p.275).
Breakwell and Milward (1995) consider evaluation as a way "...to establish whether specified activities, systems and physical arrangements are effective. They are used to assess how far certain provisions, practices, or procedures are actually achieving the objectives set for them" (p. 2).

Why Evaluate?

Rothwell and Sredl (2000) concur that evaluation is worthwhile. They state four steps why evaluation is rewarding:

1. To improve the contents and methods of instruction;
2. To ensure that facilitation methods are effective;
3. To assess to what degree the pre-established objectives have been met; and
4. To determine whether learners enjoyed the learning experience and to what extent (p.277).

Overall, these steps assist in finding out the value and impact of the training effort.

Who Evaluates?

The individuals involved in the evaluation process should be the same individuals involved in the training event: the instructor and the learners. The evaluation process promotes expectations as to which changes should occur. "Evaluation furnishes feedback on the relative success of actions taken to satisfy those expectations. It is only fair to include the same people in both processes (Rothwell & Sredl, 2000,
p.278). This involvement allows the evaluator to set the objective for change and examine its results.

**When Should Evaluation Take Place?**

According to Rothwell & Sredl (2000), evaluation should take place whenever the training efforts are carefully thought about, presented or completed.

The role of the evaluator is to assess the changes made from a training effort, the action taken in the effort, and the outcomes produced. The evaluation of training "examines the relative success of a training intervention" (Rothwell, 2000, p.7). Evaluation is important in workplace learning because it ensures accountability and provides the necessary feedback concerning the training effort. Evaluation allows for continuous improvements and focused on how much people liked the training event, how much change occurred as a result of it, and how much impact training had on the organization.

Evaluations are seldom conducted as an end in themselves. They are done mostly to assess the need for change and to determine the potential for change. Therefore, it is important to explore how evaluation outcomes are used to advocate change.
Evaluation

Evaluation procedures rely on the result or the decisions to be made, the resources available for the evaluation, and the restrictions under which the evaluation is conducted (Dick & Carey, 1991). There are as many evaluation methods employed as there are administrators, instructors, and learners, but the most commonly used form of evaluation is a test.

Gronlund and Linn (1990) state that testing can "help improve learning by assisting in (1) pre assessing the learners’ need (2) monitoring learning progress (3) diagnosing learning difficulties, and (4) determining the degree to which the intended learning outcomes have been obtained (p.459). Although the test may be considered the most basic of any evaluation methods, it is also a very important one. According to Shriver (1997, as cited in Kirkpatrick, 1998) " testing generates among the most measurable, objective, and reliable data possible for evaluating employee performance". (p.34). Shriver (1997) concludes five reasons why testing serves as a useful evaluation tool:

1. Learning is evaluated against the program objectives;
2. Selection and placement decisions are partly based on test data;
3. The motivation to learn is affected by tests. Research suggests that expectancy of a test may cause the student to study more;
4. Instructional improvement is often overlooked as a benefit to testing employees. The test is a key component to measure if the instructional material. High test scores indicate that the material may need to be delivered at a more advanced rate and low test scores indicate that the material may need to be re-taught; and

5. The test is an ultimate learning tool. The learner can be alleviated by the test results and becomes aware of individual weaknesses. This ultimately helps the student to assess the learning effort in order to become more engaged.

Evaluation has become an essential component in any training event. Testing has become an integral part of evaluation methodology. The value of performance testing as an objective evaluation method allows the evaluator to see the learner, or trainee demonstrate actual skills and knowledge on assigned tasks. This approach has gained acceptance in the HRD and training field because is measures real behavior and closely resembles actual work related demands (Marrelli 1993, as cited in Kirkpatrick, 1998). Testing is a universal method of evaluating. Because a test can be customized to adhere to specific training objectives, it is an appropriate method for evaluating TBI. There are a plethora of evaluation models that encompass many of the learning objectives and offer more of a complete approach when contemplating evaluation. There are two types of evaluation within these models.
Types of Evaluation

There are two basic types of evaluation; summative and formative evaluation. Summative evaluation is "a final assessment" (Belanger & Jordan, 2000, p.186). Formative evaluation occurs continuously or as it is developed. "Formative evaluation has a long and rich tradition in the assessment of instructional technologies..." (Belanger & Jordan, 2000, p.186). Formative evaluation yields several models or approaches. These models provide levels of understanding in the evaluation process.

According to Williams, Rice & Rogers (as cited in Belanger & Jordan, 2000), the primary step of the evaluation process is to define the objectives of the evaluation. These objectives include things such as the instructor, the course material, and the learning transfer.

Five Models of Evaluation

Evaluation methods and models have predominantly existed for traditional instructor led training. The emergence of TBI in the field of learning has forced evaluators to rely on instructor led evaluation models. These models are indeed useful and may be applicable in the technology domain, but are more frequently used in traditional instructor led training.

There are five models for evaluating discussed in this section. These models were chosen because they explicitly define impartial steps in an evaluation process. Two of the five models are specific TBI models adopted directly from technology related literature. The remaining three models are examined and analyzed, providing rationale as to why they are
not TBI sensitive and how they could be modified. In order to be accepted as a TBI evaluation model, these three models must be altered in their consideration of technology sensitive factors.

Two TBI Models

The Van Slyke, Kittner and Belanger Model. The Van Slyke, Kittner and Belanger Model (Belanger & Jordan, 2000) suggests all variables be taken into consideration when evaluating their effect. This framework identifies determinants of success as precedent variables and evaluation criteria as outcome variables. Determinants of success can be grouped into four categories of variables (Belanger & Jordan, 2000). The four categories are institutional characteristics, learner characteristics, course characteristics, and distance learning, or TBI characteristics:

1. Institutional characteristics. The characteristics of the institution include the organization's training objectives, the delivery method of the training, and the support system offered by the organization during the TBI event. The support system may include technological support or instructor support.

2. Learner characteristics. These variables relate to the skills of the learner. When a learner agrees to participate in a TBI training event, it is expected that the personal skills and computer proficiency of the learner will affect the training outcomes. Proficient computer users are more likely to learn more than unskilled users.
3. Course characteristics. Course characteristics and learner characteristics are similar to each other. Course characteristics such as difficulty of assignments and group projects must be taken into consideration. Group projects may be difficult for some learners in a technology based learning environment. This relates to learner characteristics because the technological competencies of the learner must be considered when evaluating.

4. TBI characteristics. TBI characteristics relate to the technological environment of the learner, and the specific type of technology used. TBI can take place anywhere and at anytime. These factors don’t always comply with an ease of learning, therefore weigh heavy on the likelihood of learning transfer.

This model is used to idealize the learning environment, as it seems. Because the learning environment is technology based, there are technology sensitive factors that must be taken into consideration when evaluating. These factors allow the evaluator to define the scope of the research. "An evaluation program should explicitly define which of these variables are being measured and which are being controlled for, and what the outcome variables are" (Belanger & Jordan, 2000, p.187). Exhibit 4 is an illustration of this evaluation model.
Exhibit 4: The Van Slyke, Kittner and Belanger framework for evaluation

<table>
<thead>
<tr>
<th>Learner Characteristics</th>
<th>Institution Characteristics</th>
<th>Course Characteristics</th>
<th>TBI Characteristics</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learner</td>
</tr>
<tr>
<td>Instructor</td>
</tr>
<tr>
<td>Society</td>
</tr>
<tr>
<td>Institution</td>
</tr>
</tbody>
</table>

All of these variables must be examined concurrently. Van Slyke et al (Belanger & Jordan, 2000) suggest that there are two levels of outcomes and two measures of success. These include one level for the institution, and one for the student. The suggested outcome is the variable impacted by the TBI effort.

*Marshall and Shriver’s PBT Model.* Marshall and Shriver (as cited in Belanger and Jordan, 2000) propose a five-level evaluation model of performance based training (PBT). This model requires the learner to demonstrate knowledge and skills. The elements of this model include five steps for evaluating knowledge and skills:

1. Measure learners attitudes and feelings about the training event;
2. Measure knowledge by itself using a traditional paper and pencil test;
3. Measure performance by demonstrating skills and knowledge;
4. Measure transfer of skills or behavior modification through observations; and
5. Measure organizational impact such as ROI.

Marshall and Shriver (1994) also assert that there are five factors for the instructor to consider when evaluating a technology based learning event:

1. Self. In technology based learning environments, the instructor may be separate from the student. It is crucial that the instructors present themselves in an understanding and supportive way through communication media. “Projecting concern warmth, and competence is as important for virtual instructors as it is in the traditional classroom” (p.190).

2. Course material. Learners feedback about course material such as the level of difficulty, interest or effectiveness, are valuable for improving future efforts.

3. Course curriculum. When evaluating the course curriculum, the learners perform a cross evaluation where multiple courses are evaluated and compared across the curriculum.

4. Course modules. Evaluating course module assists in the transfer of learning because it evaluates the course syllabus as well as the organization and delivery of subject matter.

5. Learning transfer. This level of the model is a summary concept based on Kirkpatrick's model: learner reaction, knowledge of transfer, behavior transfer, and organizational impact. These five factors are technology sensitive and fit the criteria of a TBI evaluation model.
Three Universal Models

These three models don't specifically meet the TBI evaluation model criteria established in Chapter 1. They are specifically designed to evaluate classroom-based instructor led training and are not technology sensitive. In this section three evaluation models will be illustrated. Following each illustration is a brief analysis with suggestions as to how these models could be altered or changed to be used in the evaluation of TBI. These models do not consider the technology sensitive issues that may contribute to or hinder the learning process:

1. Technological competencies of the instructor;
2. Technological competencies of the learner; and
3. Delivery of the course material

*The IBM IPO Model.* The IPO model stands for "input-process-output. According to Bushnell (1999 as cited in Kirkpatrick, 1998) "IBM has found that an IPO approach to training evaluation enables decision makers of to select, from several options, the package that will optimize the overall effectiveness of a training program" (p. 39)." The four steps in this evaluation process are illustrated in Exhibit 5.
Exhibit 5: The Input, Process, Output Model

<table>
<thead>
<tr>
<th>Steps</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>Trainee qualifications, Instructional material, Budget, Instructor abilities</td>
</tr>
<tr>
<td>1. Identify evaluation goals</td>
<td></td>
</tr>
<tr>
<td>Process</td>
<td>Establish a match between the data and the measurement tool. Will the tool provide an accurate measure?</td>
</tr>
<tr>
<td>2. Develop an evaluation design</td>
<td></td>
</tr>
<tr>
<td>3. Select a measurement tool</td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td>Trainee reactions, Knowledge gained, Performance Improvement</td>
</tr>
<tr>
<td>4. Analyze Data</td>
<td></td>
</tr>
</tbody>
</table>

Modification for the IPO model to become a TBI evaluation model would require a specific mention of technology in step one when identifying evaluation goals. For example, evaluation factors in step one include trainee qualifications, instructional material, budget, and instructor abilities. There are some questions to consider when revising this evaluation model to fit TBI:

1. What kind of instructional material was used?
2. What technology was used in the delivery method?
3. What are the trainee's technological competencies?
4. What are the instructor's technological competencies?

These questions or conditions must be taken into consideration when evaluating the outcome of training because these conditions may impair the transfer of learning.

*Instructional Systems Design.* The Instructional Systems Design (ISD) model is an example of formative evaluation. This model is an effective measurement strategy because it has a built-in means for
monitoring the training event. The five elements of the ISD model are illustrated in Exhibit 6:

Exhibit 6: The ISD Model for Evaluation

Heidman (1993 as cited in Kirkpatrick, 1998), states that by conducting formative evaluation and an end of course evaluation, the evaluation "...focuses on the continuous improvements to the instructional materials and instructional design process itself" (p.70)

During this evaluation process, there are questions for the instructor or the evaluator to consider:

1. Are the objectives written in enough detail for the desired learning to occur?
2. Are the objectives consistent with the identified training needs?
3. Have any of the needs been overlooked?

(Heidman, 1993).

To modify this model into a TBI evaluation model, there are technology sensitive questions for the instructor or evaluator to consider:
1. Was the right technology chosen to deliver the desired material?
2. Are the learners technologically competent to perform and benefit from the TBI event?
3. Did the end of course evaluation inhibit any learning objectives caused by the use TBI?
4. Has the technology made learning more effective?
5. Was the technology sensitive to different learning styles?

This model is presented in general terms. To evaluate TBI, traditional ISD model steps must become more specific to the training event. For example, step one of the ISD model implies that a needs assessment should be conducted in order to see where the training need is. In TBI, conducting a needs assessment would be more like an conducting an assessment of training objectives, or finding out what is it that needs to be learned. Because this model is an example of formative evaluation, the TBI event would be constantly evaluated. Step two, three and four could be customized depending on the type of TBI used, such as distance learning, or WBT.

*Rothwell & Sredl's Model.* Rothwell & Sredl (2000) suggest a model for evaluating and analyzing instruction. This model suggests that evaluating and analysis are alike because "both involve problem-solving and investigative research."
The outcomes of a training event, or intervention should improve individual and organizational performance. The ultimate value is to improve performance and enhance individual life and career plans (Rothwell & Sredl 2000). In order to measure training events against ultimate values, it is necessary to encourage data about intervention into human resource plans, strategic plans, and individual career plans. "If these things are done, the result will be long-term organizational and individual learning—the ultimate goal of every workplace learning and performance endeavor" (Rothwell & Sredl 2000, p.309). The ten steps of this model are illustrated in Exhibit 7.
Exhibit 7: Ten Key steps in instructional evaluation.

1. Decide what is to be evaluate

2. Collect background information on the training event

3. Design the evaluation approach

4. Locate relevant criteria about performance prior to the training event

5. Select a data collection approach and procedure

6. Collect data and compile results

7. Analyze results

8. Compare results with previous performance criteria

9. Report on the value of the training event

10. Use this information to improve future training event
Rothwell and Srdel's model (2000) is specifically designed to evaluate all aspects of traditional instructor led training. This model includes several steps in the evaluation process and requires the evaluator to research previous training events and outcomes. To alter this model to meet TBI criteria, specific technology sensitive steps must be supplied. For example, in step one, when evaluating TBI the evaluator would focus on whether transfer of training occurred. That would be the measured learning objective. The purpose of evaluating TBI in this study is to measure if learning occurred.

In step two, when collecting background information on the training event, the evaluator could consider the TBI factors asserted by Van Slyke, Kittner and Belanger (2000): institutional characteristics, learner characteristics, course characteristics, and TBI characteristics. When evaluating TBI, these factors are considered background information. Step four could be omitted because the relevant criteria needed would be uncovered in step two.

Step five requires the evaluator to select a data collection tool or instrument. Before selecting an instrument, the evaluator must consider the training objectives. Next, the evaluation instrument must suit the TBI design. The instrument should allow the evaluator to make the necessary link to measure the training objectives. There are three other questions to consider when choosing an evaluation instrument:
1. Is the instrument valid? It is crucial to choose an instrument that will accurately measure the defined training objectives.

2. Is the instrument reliable? The chosen instrument must be proven to offer a consistent reliable measure over time.

3. Is the instrument practical? The instrument must be appropriate to the specific TBI, the training objectives, and the specific needs of the learners. (Marrelli 1993, as cited in Kirkpatrick, 1998).

Marrelli (1993), suggests that there are ten evaluation instruments appropriate for TBI.

1. Face to face interviews;
2. Questionnaires;
3. Focus groups;
4. Critical incident reports;
5. Work diaries;
6. Performance records;
7. Role-plays;
8. Observations;
9. Written tests; and
10. Performance tests.

Once the evaluation instrument is chosen, the data should be collected and analyzed. A concise measure of the TBI training objectives should then be evident.
This Chapter presented five evaluation models for evaluating instruction. The purpose of uncovering these methods was to investigate if there is a specific TBI evaluation model. The literature examined provided no reference to a specifically designed TBI model. Although this finding appears disappointing, there is still hope to offer the instructor or practitioner a valid method to adopt when employing evaluation techniques. Chapter 3 provides a section of discussion, conclusion, and recommendations for the HRD practitioner when contemplating TBI evaluation.
Chapter 3
Discussion and Rationale of Training Evaluation

“HRD practitioners need to see evaluation in a broader context rather than merely a set of techniques to be applied. In a systems approach, evaluation is an integral part of the HRD function, which in turn is part of the whole organizational process” (Foxton, 1989, p.93).

Evaluating instruction is among the most imperative issues for HRD professionals. Because instruction comprehensively encompasses the design and the operation of HRD, evaluating instruction is the essence of this discipline. Through training evaluation, an HRD practitioner can measure organizational success. Internal effectiveness from the organization’s point of view manifests itself mainly in the evaluation of training. From this perspective, both individual and organizational perspectives share common interests. These interests might be, for example, well organized courses, general management of training, integration into total training program and an adequate and appropriate training staff.

Literature suggests that training events should be frequently evaluated from the earliest design stage in order to adjust and adapt to the demands of the organization and of the learner (Stone & Watson, 1999). The notoriety of Kirkpatrick’s (1959) model tends to promote evaluation only on the first level, trainee reactions. This notion promotes a retrospective approach at evaluation rather than formative or summative
evaluation (Foxton, 1989). Few evaluation methods of instructor led training or TBI were clearly defined or listed in the literature examined. One conclusion may be that HRD practitioners do not know more than basic evaluation and that is why Kirkpatrick's model is frequently employed. Because only two models for evaluating TBI were uncovered in this literature review, it can be concluded that HRD practitioners and instructors are using evaluation models of traditional instructor led training to evaluate TBI.

A Review of Evaluation Models

The five evaluation models presented in Chapter 2 were:

1. The VanSlyke, Kittner and Belanger Model
2. Marshall and Shriver's PBT Model
3. The IPO Model
4. The ISD Model; and
5. Rothwell and Sredl's Model

Of these five models presented, only the first two fit the designated TBI model criteria. The other three models were considered for TBI models even though the context in which they were retrieved did not support or indicate any connection to TBI. These three models were analyzed and suggestions were made to alter the evaluation steps in order to adhere to a technology based training event. The most significant modification suggested was that each model adopts a technology
sensitive perspective. Technology sensitive factors are conditions that may contribute to or hinder the learning process:

1. Technological competencies of the instructor;
2. Technological competencies of the learner; and
3. Delivery of the course material

Implications for the HRD Practitioner

One of the critical roles of the HRD practitioners is to assess the value of what learner's gain from the training event and how it will increase individual performance. This paper presents five models for evaluating instruction. Each of these models presents a clear and concise methodology on how to evaluate. An HRD practitioner or training instructor can select to adopt or alter any of these models as a TBI evaluation strategy.

The Future of TBI

The ease of the World Wide Web as a delivery method for instruction permits an increasing demand for training and education. "However, studies that compare results of educational content delivered over the Internet to that delivered in the classroom have been inconclusive" (Redding & Rotzien, 2001).

This study revealed no difference in the evaluation methods employed by TBI and traditional classroom based, instructor led training. This exhaustive literature review uncovered only two models that suggest a valid evaluation of TBI. It is recommended that HRD practitioners and
TBI instructors accept or even invent an agreeable model. Although Kirkpatrick's (1959) model is the most widely accepted and practiced model of evaluation, there is no valid research that suggests it is the best choice when evaluating TBI.

The development of technology based delivery systems has challenged the human ability to comprehend technology's impact on human performance. Keeping this in mind, evaluation methods of training and traditional instruction must change, or be re-invented to fit the technological paradigm. HRD practitioners and instructors must be able to recognize these changes with a sense of optimism. Technology is sensitive and does not appeal to everyone, but it is here and it is changing the world. Technology holds out the promise that we can adapt to it, and apply our new knowledge toward great opportunities in the HRD field. There is tremendous potential for bettering the human condition by shaping more productive people.

Recommendations

There are evident gaps in the evaluation models of traditional instructor led training and those employed in evaluating TBI. The most apparent of these gaps is that technology is sensitive. It has many components and factors that can support or deter learning. Furthermore, this must be taken into consideration when evaluating TBI. Through this literature review, it is evident that there is not a widely accepted TBI evaluation model. This conclusion leads to the speculation about what
models TBI instructors use when evaluating and if these models offer a valid measure. In that respect to this speculation, there are questions for instructors to consider when selecting a TBI evaluation strategy:

1. What are other gaps between traditional instructor led training and TBI?
2. Is there a need to develop a specific TBI evaluation model? Why?
3. Has TBI been proved as an effective delivery method?
4. What do instructors and evaluators think makes TBI different?
5. If traditional instructor led training evaluation modes are used to evaluate TBI, what are they and are they offering a good measure?

Conclusions

In the first quarter of the twenty-first century, civilization has declined too rapidly for comfort and too slowly to be exciting. The world is no longer waiting for something momentous to occur; it already has. Technology has happened. It is here. It has changed the world, and how people live. Technology is everywhere. As technology continues to change the world, it will continue to change how humans live and how they interact with one another. It is only logical that humans react to this invader of simplicity and innocence. Technology should not be considered an enemy, but a companion in the human quest for versatility. Technology has changed the humans, now the humans must change to accept its presence.
“If you want merely to believe that the universe is unfolding as it should, avoid evaluation, for it tests reality. Evaluation threatens complacency and undermines the oblivion of fatalistic inertia. In undisturbed oblivion may lie happiness, but therein resides neither knowledge nor effectiveness” (Halcom, n.d, as cited in Patton, 1997, p.116).
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