CHAPTER 10

Maintenance Evaluation

Objectives

After reading Chapter Ten, you should be able to:

• describe the role of maintenance evaluation;

• use various tools to collect data which will be helpful in answering questions about the adequacy of an interactive learning system to continue meeting the objectives originally established for it; and

• utilize reporting strategies to increase the likelihood that maintenance evaluation will assist in decision-making.

Why should you conduct maintenance evaluation?

Maintenance can be defined as the act of keeping something in existence or keeping it working. Maintenance evaluation is the act of careful appraisal regarding whether something has been maintained appropriately. As illustrated in Figure 10.1, maintenance evaluation informs the revision and refinement of interactive learning environments. It enables the “prolonging of life of developed instruction while maintaining the original effectiveness and efficiency” (Tennyson, 1995, p. 52). This is an often-overlooked evaluation function.

The role of maintenance evaluation is to monitor the progress and the regular use of an interactive learning system so that decisions about support, modification, or reconceptualization can be influenced. Tennyson (1978) described this aspect of managing a technology-based learning environment by emphasizing the need to continually monitor the progress of an innovation, especially one dependent upon a complex technological infrastructure. Over time, many changes are likely to occur in an instructional system. As people move on and change roles, as equipment becomes obsolete and is replaced, maintenance the system becomes the key to ongoing effective use. It is also likely that the environment in which an interactive learning system is used will evolve, throwing the system’s continued viability into question.
### Figure 10.1. Typical decisions and questions in maintenance evaluation.

<table>
<thead>
<tr>
<th>Decisions</th>
<th>Example Questions</th>
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<tbody>
<tr>
<td>Should an interactive learning project be reconceptualized?</td>
<td>Is the system still being used? Are its objectives still relevant?</td>
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<tr>
<td>Should the implementation plans for an ILS be modified?</td>
<td>How have teachers integrated a program into courses? What aspects of a program have been dropped?</td>
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<tr>
<td>Should a program be moved to another delivery system?</td>
<td>How has the computing environment changed? What is the quality of Internet access in the school?</td>
</tr>
<tr>
<td>Should video and other media aspects be updated?</td>
<td>Do the students perceive the program as current? Have styles changed dramatically since the first edition?</td>
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Consider, for example, an interactive learning program popular with teachers and students that was produced for an older Windows operating system. The school has just decided to replace all remaining computers with new Macintosches. The software is machine specific and when the change is made, it will no longer run. Similarly, if the processes at a plant have been modified to reduce the number of steps in the manufacturing cycle, any associated computer-based training (CBT) programs will need to be modified to eliminate the production steps that are no longer relevant.

Alternatively, consider the training of a bricklayer. There is a need for bricklayers to understand construction plans. In the past, this was taught by teaching the novice bricklayer to draw a simple plan for a house or wall, and then to add the dimensions and other specific notations. Nowadays, building plans are usually drawn using a computer-aided design (CAD) package, and manual drawing skills in drafting are not required. If drawing by hand is still included in a vocational course for bricklayers, this should be examined with respect to its relevance and value. Of course, the skill of reading construction plans may still be important, but current practice requires bricklayers to learn something about how CAD programs are used. What is gained and lost when new technologies are integrated into practice must be continuously examined in reference to training. Keeping training up-to-date requires vigilance.

**When should you conduct maintenance evaluation?**

For effective maintenance evaluation, there must be continuous monitoring of the learning environment, delivery systems, and other resources so that they can be kept accurate and current. The purpose of maintenance evaluation is “to determine the contextual validity of the technology-
based learning program” (Alexander & Hedberg, 1994, p. 242). As the context changes, maintenance evaluation becomes paramount.

In most presentations of instructional design models, the authors give the impression that the process is a linear and predictable one, when it is more often an iterative process, seeking ever closer approximations to learning outcomes. Viewing development tasks as a lockstep set of procedures, creativity may be ignored as a key component. We have presented an alternative model for instructional design wherein the relationships between the functions of development and the functions of evaluation are essential to the effective completion of a project (as illustrated in Figure 3.2 in Chapter Three).

Maintenance evaluation is a key function that informs the implementation of interactive learning systems and, in particular, their renewal. Data should be collected from multiple information sources using a variety of maintenance evaluation techniques to inform decisions about the need to revisit or rework interactive materials. This helps to ensure products are meeting current purposes and changing curriculum requirements. It is difficult to specify exactly when maintenance evaluation should be conducted simply because it is very challenging to predict how other aspects of the education and training environment will change. Few predicted the enormous changes currently underway in the online learning industry because even fewer people foresaw the rapid deployment of the Web around the globe (Khan, 1997, 2001). Many legacy education and training systems are being re-examined in light of the availability of high-speed Internet access in homes today. Whether the people doing these investigations actually think of their work as maintenance evaluation is doubtful, but the goals and tools are similar to what we recommend in this chapter.

**Maintenance evaluation and instructional design**

The maintenance evaluation aspect of our evaluation model has been influenced by Tennyson’s (1978) Fourth Generation Instructional System Development Model in which he identified four kinds of evaluation that should occur during the stages of an instructional design project. These are feasibility, formative, summative, and maintenance evaluation. The goal of maintenance evaluation is to “ensure quality control and currency of the material over time” (Ross & Morrison, 1995, p. 497). The target audience for Tennyson’s model was instructional developers rather than evaluators.

Tennyson has updated this model (see Figure 10.2) and now calls the development phase “production” and justifies this “because of the
increased use of electronic media as an integral part of instructional design” (Tennyson, 1995, p. 36). In the new model, Tennyson recommends that instructional developers design, implement, and operate a maintenance system for the learning environment. In what Tennyson calls his Fourth Generation Instructional System Development (ISD) Model, there is a much stronger focus on evaluation than in the previous models. In fact, Tennyson describes evaluation as taking on the central role “by becoming the interface between the author and the ID prescription in use” (p. 37). We concur with Tennyson’s emphasis on the centrality of evaluation within ISD.

**Figure 10.2.** Fourth generation ISD model (Tennyson, 1995).

**What kinds of decisions can you anticipate?**

Two primary types of maintenance decisions involve the compatibility of different versions of software with various hardware platforms, and keeping interactive instructional systems updated on a regular basis. The rapidly changing specifications for Web-based e-learning make these decisions more complex than ever. Seemingly, hardly a month goes by without the introduction of a new Web-based media format (e.g., ever better streaming video) or a faster, easier Web authoring tool.
The challenge of different versions of software

Most interactive learning systems depend upon specific versions of software, e.g., effective operation may depend upon having the latest operating system or high-speed hardware. If these attributes are not present, the interactive learning system may not run, or it may be tediously slow and frustrating. It is a delicate balancing act to ensure that the development of the technical resources occurs along with the management of the software systems. Mismatches can be overlooked by instructors until the system grinds to a halt. The implementation of any system must include provisions for maintenance of the hardware and the software required to run on it. Sometimes, it is found that a very useful program can no longer run on new or upgraded hardware, so a new version must be purchased. The newer version may include new features, but often at a cost. This cost may take the form of an inability to do various tasks. Or the increased complexity of the software may mean that routine tasks are not as readily undertaken as previously.

As a developer, you may need to release new versions of software to correct bugs in earlier versions, to extend the instructional program to cover new content or teach new skills, or even to demonstrate a new range of features flowing from advances in hardware or software. Consider the arrival of Apple’s QuickTime digital video technology; suddenly simple animations could be replaced with crude movies. Then, in rapid succession, new versions of the software were released and increasingly sophisticated movies (such as QuickTime Virtual Reality) could be incorporated into interactive learning environments. For users of earlier versions of QuickTime, movies seemed pixilated and slow by comparison with what was available a few months later (or they could not be played at all). Thus, sometimes the technology alone may drive the need for renewal. Often the change is unexpected. For example, a seemingly simple change in the equipment available in a computer laboratory might necessitate an upgrade or purchase of new versions of authoring software simply to continue working.

Sometimes the changes can be managed through automated procedures. Consider the use of a Web browser that can retrieve updated references by actually finding each page whenever it is updated by the owner. However, if your learning environment depends upon a set of resources being available on the Web, it can be difficult to keep the environment current if a Web server is given a new address and any links that you have developed are rendered useless. A requirement that learners work cooperatively with instructors and with each other on site maintenance tasks can circumvent this problem, but we are convinced that the problem of “dead links” will be a major challenge in maintaining complex learning environments on the Web in the foreseeable future.
Maintaining software

Maintenance evaluation is increasingly important in view of the array of options for delivering interactive learning available today. Imagine a simulation designed to help adults learn a second language by immersing them in a foreign scenario. There are a variety of delivery options for this interactive learning environment, including CD-ROM, digital videodisc (DVD), and the World Wide Web. Although each of these delivery systems is different, the programs could have the same mix of pedagogical strategies. For example, the learner could be interacting within the context of a real task (e.g., asking for directions in a foreign country) that would require him or her to listen to a native speaker, select the best response from a menu of choices, receive feedback, and subsequently be linked to remedial instruction as indicated by his or her success or failure in selecting the appropriate response within the simulation. Regardless of the instructional design, some delivery systems are easier to maintain than others. At the same time, some delivery systems are more secure or stable than others. There are always tradeoffs that must be considered.

Maintenance evaluation is a cost that few project managers anticipate. Since the time when mainframes were the primary delivery platforms, maintenance has often been ignored in the costing of software projects (Arthur, 1988; Martin & McClure, 1983; Sommerville, 2000). Software maintenance is considered to consist of: “The activities required to keep a software system operational and beneficial after it is accepted and placed into production” (Arthur, 1988, p. 235). Historically, it has usually been assumed to be a problem that developers could ignore.

In large software development projects, the costs of running a package would often only become evident after a system had been implemented, by which time it was too late to limit those costs because a large devel-
development investment had already been made. The importance of investigating the implementation and the ongoing maintenance of interactive learning systems cannot be underestimated. Several training and education systems have been developed by designers with good intentions who later found out that the required combinations of hardware and/or the software architecture were no longer being supported. In the past, whole systems have been scrapped because certain hardware was no longer available or because the authoring tools employed were no longer being supported by their vendors for use with a new hardware system or operating system.

The instability of today’s hardware and software environments may mean that the ratio of development costs to maintenance costs can often be more like 1 to 2 rather than the 10 to 1 usually assumed. Initially the cost of maintenance is hidden, and yet it may represent up to 67% of overall costs for a large system (Zelkowitz et al. as cited in Martin & McClure, 1983). As software systems have evolved, maintenance has become more critical, especially when most companies seem to prefer investing in enhancing software so that they can issue a new release rather than in actually fixing bugs in the current version. Thus, the development of techniques to extract and monitor the ongoing costs of maintaining systems should be built into any evaluation process.

Nielsen’s (1999) contention that new technologies like the Web are likely to be more cost-effective than older systems only if the new products integrate simple design concepts is worth remembering. There is little point in allowing programmers or developers to specify fancy Java-based applets to handle complex instructional interactions that in the grand scheme of things add little except gimmicks to a learning environment.

Course management systems and learning management systems present special maintenance challenges. For example, in higher education, several products are currently marketed to support Web-based courseware development, e.g., WebCT and BlackBoard (Pittinsky, 2003). Although these systems have strong capabilities, they should be selected and reviewed continually. It is easy to become too invested in a system that, in our rapidly changing world, may become a dinosaur incapable of being upgraded or maintained except by a band of expensive specialists.

Maintenance costs may be reduced through rapid responses to the need to change. Connell and Shaffer (1989) suggest that rapid maintenance can be useful in reducing costs. In other words, waiting to conduct maintenance evaluation until the need for fixing problems is critical may well prove more costly than a planned program of preventative maintenance evaluation would have been.

— WEB LINK —
More information about WebCT can be found at http://www.webct.com and about BlackBoard at http://www.blackboard.com
What questions should be answered before making decisions?

Project reconceptualization decisions have so many implications for developers and practitioners that many questions must be addressed before making these decisions. First, let’s consider a real example. A few years ago, a sophisticated multimedia authoring system (which shall remain unnamed) had just begun to attract the attention of some of the best multimedia developers in the world when it was purchased by a larger corporation and shortly thereafter dropped as a viable product! It seems that the larger corporation engaged in little or no maintenance evaluation before making the drastic decision to drop the product. Maintenance evaluation could have addressed questions about the product that may have influenced a different decision. What was the number of designers who had adopted the product? What were they willing to pay for the product? If internationally recognized multimedia designers used the product, what did it mean for the future viability of the product when these same designers won design awards for programs developed with the software?

Second, let’s consider a hypothetical example within a training context. Suppose a clothing manufacturer has been using computer-based training (CBT) delivered via CD-ROM for sales training for four years. Every salesperson carries a laptop computer whenever he/she is on the road, with travel averaging 15 days per month. In light of increasing bandwidth, high tech consultants recommend the development of a company Intranet for account tracking and sales management that would also enable the delivery of Web-based training (WBT). Before making the decision to move to WBT, a careful maintenance evaluation of the existing CBT should be conducted to address multiple questions. How widely used are the current CBT materials? How much does it cost to update and distribute CD-ROMs for this sales force? How would the sales personnel maintain easy access to the Intranet when they are on the road, e.g., waiting in airports or spending nights in hotels? What features of the CD-ROM CBT would be lost with Web delivery? What would be gained? These and other maintenance evaluation questions should be addressed carefully before making major decisions about reconceptualizing a training delivery system.

How should maintenance evaluation be conducted?

It is no longer acceptable for a development team or an instructional designer to implement a program and assume that it is finished. Just as in the software industry, the high costs invested in an interactive learning
system indicate a need to support the program so that the end users can keep implementing it until a reasonable return on investment has been realized. Whether it is a DVD program or an online course, it will need continual maintenance evaluation until it becomes obsolete.

As noted above, the role of maintenance evaluation in a technology-based learning environment is to monitor the progress of the regular use of a product or system. Consider the following maintenance questions (as proposed by Tennyson, 1995, pp. 72-75):

1. *Is the interactive learning system still meeting its goals and objectives?*

   Whether an interactive learning system continues to achieve its objectives is an issue at the core of maintenance evaluation. To address this issue in depth, consider questions such as:
   - Do these materials/systems still produce the intended learning outcomes?
   - Do learners view their learning experience positively?
   - Is the system easy to manage and maintain?
   - Are technical staff spending too much time to keep the system running?

2. *Is the content current?*

   The content of some fields changes a great deal over a period of just a few years whereas other fields have more stable content. It is unlikely that interactive materials will remain useful in highly volatile curriculum areas for more than a few years. Consider questions such as:
   - How is the curriculum changing in this domain?
   - Are changes being required or mandated by other agencies (such as political, technological, or social groups)?
   - If the materials are related to a specific product, is it still being sold or marketed?
   - Have the prerequisite courses changed in content or approach?
   - What new advances are being discussed and do they need to be added to the curriculum? What needs to be deleted?

3. *What do the students think about the interactive learning system?*

   Surveying end users periodically is a critical method to review the curriculum and the instructional strategies used in the knowledge domain. Tastes and styles change over time, and often students will vote
with their feet in taking or not taking courses they believe are poorly taught or uninteresting. It is a buyers’ market in today’s e-learning world (Pittinsky, 2003; Rosenberg, 2000). Conducting interviews or focus groups will provide valuable insights if a range of questions are asked, such as:

- What is the continuing motivation among students in using these materials?
- How up-to-date do the materials appear to the current population of learners?
- What alignment among the objectives, materials, and assessments do students perceive in the learning environment?

4. How is the target learner changing over time?

As students become more familiar with the use of technologies, not only will they find some older approaches too slow or boring, but also their skills and understanding might require access to new software tools. Modern software systems provide helpful adjuncts such as instant messaging tools that allows students to ask questions of instructors or peers on the fly or digital notebooks for students to make notes as they work through the material. These systems might also provide support for linking students to instructors, so that authentic learning communities can evolve (Palloff & Pratt, 1999, 2001).

The popularity of electronic games means that for many people the conventions of how a package can be navigated and manipulated are familiar. Recently, one of us finished a product that was designed as a learning game in which users were challenged to complete several tasks and problems. During the design phase, the client continually asked that detailed instructions be included about where to click to find information. There was an interesting standoff between the designers and the client because the changes the client was suggesting might have been appropriate for older users, but testing indicated too many instructions would ruin the product for the younger target audience.

There are many questions that should be addressed about how users may be changing, such as:

- What are the computing skills of the current population of target learners?
- What expectations do the new learners have for media elements such as digital video?
- How is the instructor population changing with respect to expertise and comfort with technology?
5. **What is happening with the underpinning technology?**

This last question is critical to the costs of maintenance in the brave new world of Web-based training delivery. For example, the U.S. Defense Department is establishing standards for e-learning products through its Advanced Distributed Learning (ADL) initiative that all new interactive training and education products must follow (Oehlert, 2001). The underpinning technology for interactive learning systems is also being affected by the rapid development of learning management systems (LMS) and learning content management systems (LCMS) (Schelin, 2001). To address this issue, you might ask many questions, but consultation with experts who have differing views is mandatory if you wish to avoid a technological dead end. Ask questions such as:

- When should the system be updated for a new platform?
- What seems to be happening to the technologies we are using?
- What are other groups (such as competitors) using to deliver this content or this instructional strategy?
- Can the system be moved to other technologies, and what is the cost?
- Can new media be integrated to extend the life of a program?
- Does the interactive learning system have to meet government and/or corporate standards?
- Does the interactive learning system have to be made compatible with various LMS or LCMS?
- Is there provision for updating instructor training?

**Tools for maintenance evaluation**

Asking the right questions informs the important decisions you and your clients must make, but you also must use the right tools to find the best answers. Consider some of the following tools and how they might inform better decision making.

**Quick sources of ongoing data**

Every system should have capabilities built into it for routinely collecting and collating data to identify important changes occurring over time. Each user of a package might simply be asked to complete a small card and deposit it in a “suggestions” box. Another simple method is to require that every user fill in a brief online questionnaire about the system or product. Consider the simple questionnaire in Figure 10.3.
Please answer the following questions to help us monitor this package.

- Please rate this package overall
  
  Poor 1 2 3 4 5 6 7 Excellent

Any comments?

- Were the objectives relevant to your studies? If no, why not? If yes, how?
- What are the best points about this package?
- Describe any problems you experienced with this package.
- What changes should be made and why?

**Figure 10.3.** Sample quick evaluation for routine package use.

**Using automated data collection techniques**

Information can be accumulated and analyzed in cost-efficient ways through the use of technology. This data can be used to obtain information about learning outcomes and can be manipulated as the learners interact with the materials. Several approaches have been used. For example, intelligent test scoring can provide feedback on student performance and yield an individual profile that can be reviewed by the instructor. If a diagnostic profile is collected, the student might be presented with options and choices based upon it. Alternatively, the package might suggest some options based upon artificial intelligence built into the software (Ross & Morrison, 1995).

Automated routines can help identify the location of strong and weak points in an interactive learning system. Reviewing data patterns can assist with modifying a system to produce the desired outcomes. Automated data collection can provide up-to-date and constant information about a program, e.g., by pointing to sections of an e-learning program that have had the highest change in traffic.

Automated systems can also determine if there are components that are constantly failing. For example, a Web server can provide a report giving information about access to a Web site. This information can determine when the server crashes, such as when a large number of people hit the server at the same time. This might occur the first time a new chat space is used. Automated systems can also provide information about which files are accessed frequently and which are not being used at all, thereby identifying files which might be removed to save space or accelerate access. Most proprietary learning management systems provide this kind of data, but the utility of the data must be questioned. For example, the frequency of use might mask other problems. Frequent access to a
portion of an interactive learning system would seem at first glance to be desirable, but it might mean that those parts are so badly designed that they require inordinate amounts of time as learners try to fathom their meaning.

Developers can become overly dependent on the use of automated data, since it can be cheaper to obtain than asking direct questions of the users of a product. Interviews and other methods should be included in the evaluation plan to ensure that the interpretation is not simply a mechanical addition of meaningless numbers. Web servers often provide a numerical counter of hits on pages, thereby producing numbers, but the numbers are not always interpretable. For instance, a specific page can be set as the home page for a browser that automatically opens each time the browser is launched. Such hits are therefore meaningless unless they are linked to something that can provide indications of type of use.

There are numerous online courses available, and as with all information on the World Wide Web, their validity and utility must be questioned. Fortunately, by their very nature, Web-based courses can be modified easily, provided you have good data upon which to base changes. Maintenance evaluation of a Web course or even a Web page can start with simple observations of users. Or brief evaluation forms can be included within a Web site to collect feedback from users. If users report minor problems, updates can be quickly and efficiently completed.

If more sophisticated automated tools such as profile analysis and intelligent tutors are needed, the cost of setting up the maintenance evaluation system will be considerably higher. Currently there remains a large gap between the theory of “intelligent” advice and how it should be provided and the development of interactive tools for the application of this artificial intelligence theory (Shute & Psotka, 1996).

Automated systems produce large amounts of data. Unless collection of such data has been carefully thought out so that data can be analyzed efficiently and accurately, the data may not be useful. Sampling of the data to identify critical incidents or patterns may make the data more useful. Several methods have been suggested, but all have problems and each produces only part of the picture. Evans (1994) and Fritze (1994) have suggested several approaches. Figure 10.4 demonstrates the use of visual mapping techniques to represent the path of a student through a package. Note that a single student can produce quite a complex plot, and each student will produce a unique trace. Comparisons and generalizations using this type of data are not trivial tasks.
Critical incidents
Most organizations have routine methods of data collection. They may be as innocuous as the collection of ideas through a suggestion box or the monitoring of reports of accidents on the plant floor. Provided that the culture of an organization supports the routine collection of such data, it can prove invaluable in determining if related interactive training products need to be redesigned. Consider the standard safety programs that most organizations hold regularly. If the number or type of accident reports seem to vary, rise, or fall, then something has occurred and should probably be investigated. Training may no longer be adequate.

Collection of other routine data, such as absenteeism, attrition, popularity of certain interactive materials, or number of hits on a Web page can also inform decisions providing they are monitored and interpreted. Critical incidents, such as a shop floor accident, or informal insights shared by a typical user, can be important in instigating the review of a project.

Unobtrusive measures
Depending upon the type of context and the way interactive learning systems are implemented within an organization, you might consider “unobtrusive” ways of obtaining maintenance data. You might even
collect useful data from the custodial staff. For example, in evaluating interactive kiosks, the volume and frequency of cleaning the dust from interactive displays may give you an indication about the interest in particular kiosks. Suppose you want to know if your Web-based learning environment is encouraging students to go beyond the content provided in the course text. You could ask your librarian or school media specialist if there has been an increase in the rate that materials are checked out related to the topics in the interactive learning course. Although unobtrusive data will rarely tell a complete story and inferences must be made, such data can be usefully triangulated with evidence collected via more traditional methods.

Other methods

Several common methods might be employed in the collection of data about the ongoing use of an interactive learning system. In the evaluation of a school-based interactive learning system, data can be collected from administrators and office staff as well as from parents, teachers, and students who use the system. Often training departments collect routine reports and surveys about student comments. Taken over a period of time this might indicate a trend in certain training courses the department runs. This will certainly be the case if the course is a pre-packaged one with the same series of activities and exercises. Over time, you will begin to hear coffee-break stories about interactive products, such as “the content is not really relevant now,” or “the training needs have changed since the courseware was written.”

Serendipitous events may be overlooked, but they should be documented if the ongoing viability of interactive learning systems is being monitored. Casual comments in the corridor might lead to great insights. After all, recognizing that the mold growing on a glass dish could kill germs led to a great medical advance (penicillin); such things may occur in education and training contexts (although they are unlikely to have an analogous degree of impact). A great challenge facing the often scaled-down training operations today is the fact that training courses are often not monitored, and consequently no one within the organization is aware of the adequacy of the match to current training needs. If you have the responsibility to contract training or monitor career development processes for an organization, then you will need to design a documentation trail that will provide insights into the current utility of the courses and packages you are purchasing or managing.
What are some examples of actual maintenance evaluations?

In the following cases, we present ideas of how some systems have been developed to capture data about ongoing utility. Read each case and consider how the principles might be applied to other contexts, or best of all, to situations similar to the ones you have experienced.

**Library catalogs**
At most institutions, the library search catalog systems have automated data-collection functions embedded in the software. These functions provide details of the paths each user takes in his or her search for information, with the aim of improving and simplifying access to the database. This data is used to evaluate the system so that periodic decisions can be made to improve the design of the system. How can you employ these ideas within an instructional system?

**Instructor reporting procedures**
Most schools employ systems for recording and reporting student assessments. At one school, the system was modified in light of a number of critical incidents. In this school, teachers depended on other teachers to complete a section of a report card before the next section could be completed. Difficulties arose and reports were delayed when a number of teachers had difficulty reading files on their classroom computers. After interviewing the teachers, it was found that there were not only a number of different word processing packages being used, but also a number of versions of each package within the school. The software employed by each teacher was the version that was bundled with the computer he or she received when hired. Inevitably as new computers were purchased, later software versions were provided. Consequently, there were many problems throughout the school with people unable to read the files sent to them by others. Once the problem was identified, standard software was provided to ensure compatibility. All versions were updated by making a bulk purchase of word-processing software to be used on all machines for reporting and assessment. Can you envisage similar collaborative systems that might provide learners with an understanding of what they have learned and what gaps there are in their knowledge?

**A student and course administration system**
The “Mirage” administration system was designed for K-12 schools. After it had been used for five years to meet the requirements of school administration, there was an updating initiative within the school district.
A number of teachers were given time away from their schools to assist in revising the package. These teachers were self-taught programmers with a teaching and school administration background. Many software “bugs” were discovered in the revised package as it was implemented. These errors were particularly difficult to fix because of the way the package was coded. In addition, the documentation was not prepared to commercial software standards.

The original software was developed for a particular machine and a specific operating system, which meant it wouldn’t run on the new hardware and operating system being purchased in the district. The costs for maintenance were high and began to outweigh the advantages of the computerized data. Eventually a new version was developed, tested in three schools, and then rolled out to the other schools in the district after an evaluation was completed and some of the bugs were remedied. Unfortunately, staff had to be retrained, as there was a new screen design, and several frequently used features of the old system were not included in the new version. Maintenance evaluation strategies should have been utilized at an earlier point to reduce the types of problems encountered in this situation. Ongoing maintenance might have determined that the “Mirage” package needed updating or modification, or that a completely new system was needed. What processes should be put in place to collect this type of data for e-learning systems?

**How should maintenance evaluations be reported?**

Maintenance data reports are usually much less formal than the reports associated with other evaluation functions. The main concern for reporting in a maintenance evaluation context is that any data indicating problems with the implementation of interactive learning systems or the need to fix or enhance these systems must be put into the hands of decision makers as quickly and unambiguously as possible. A combination of Web-based reports and e-mails concerning critical data may be an efficient approach to reporting the results of maintenance evaluations. Having maintenance data accessible via the Web from a dynamic database may be a good approach to providing information rapidly.

**Summary**

Maintenance evaluation can be extremely influential in driving the implementation and redesign of interactive learning systems. The key questions this evaluation function seeks to answer are related to the continued relevance of delivery systems and products, and whether or not
strategic decisions need to be made about the continuation or renewal of these systems and products. Several approaches can be undertaken to collect data, but simple routine data collection and records of critical events occurring over the use of the system will be most useful in indicating the need for specific changes, or when complete overhauls should be made. There is an old saying that goes: “If it isn’t broke, don’t fix it.” However, this maxim is only meaningful if you know whether something is still working or not!

References


