A Computer-Based Employee Training System

for Resource-Limited Small Businesses

A Project

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Abstract

Well-trained employees are as critical as ever if a company wishes to succeed in the competitive business markets of today. Yet, under the financial pressures due to increasing competition, corporate training is frequently an area that is subject to resource cutbacks. These cutbacks are especially hard on Small and Medium Sized Businesses (SMB's), whose resources cannot match those of the Fortune 500 corporations. A small business with less than 30 employees cannot afford the luxury of a training department, or even

This project will illustrate an example of limited-budget educational media production that is developed according to principles of andragogy (adult learning), learning theories, and instructional design. The use of an authoring tool to supplement PowerPoint presentations will provide expanded capabilities in the form of learner control and interactivity and learner assessment. Formative assessments will be developed to improve each student's learning progress. The overall goal of the project is to show an example of an effective and professional training course that can be used asynchronously and at a distance; and that is developed with the latest principles of instructional design by a one-person staff with limited budget expenditure.

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In dedication to Marie and Joe, who patiently put up with the many late-night hours that were spent in pursuit of knowledge.

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CHAPTER ONE

INTRODUCTION

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Well-trained employees are as critical as ever if a company wishes to succeed in the competitive business markets of today. Yet, under the financial pressures due to increasing competition, corporate training is frequently an area that is subject to resource cutbacks. These cutbacks are especially hard on Small and Medium Sized Businesses (SMB's), whose resources cannot match those of the Fortune 500 corporations. A small business with less than 30 employees cannot afford the luxury of a training department, or even a dedicated training person.

The purpose of this project is to address the specific example of a small company that sells technically advanced products to science markets. The primary targeted students are sales representatives who need to develop a solid foundation of knowledge about not only the products they are selling, but also the basic scientific concepts that drive the use

of the products. In many cases, sales representatives possess skills in their chosen field of sales, but do not have the technical and scientific background that is required to understand their products and also to effectively communicate with their customers, who are scientists. The project will illustrate a real-life example for a small business with less than twelve employees. The number of students is between three and ten and the development of the training is the responsibility of one person (the author). In this case, the students are geographically dispersed throughout the United States.

Statement of Purpose

The overall goal of the project is to show an example of an effective and professional training course that can be used asynchronously and at a distance, and that is developed with the latest principles of instructional design by a one-person staff with limited budget expenditure.

The research portion of this project will address the following questions:

1. What is the current status of e-learning in corporate employee training today, and how has it evolved?
2. What is the economic impact of e-learning on corporate training, including specifically the financial impact on small companies?
3. What methods, standards, and processes have been developed and/or implemented that use e-learning in corporate training?
4. What fundamental principles or concepts of educational theory can be applied to the use of e-learning for corporate training?

5. What fundamental principles or concepts of instructional design theory can be applied to the use of e-learning for corporate training?
6. What methods, standards, and processes have been developed and/or implemented for assessment when using e-learning in corporate training?

Rationale

Corporate training is as important as ever, yet increasing financial pressures have caused cutbacks in that very area for many companies (Webster, 2001). The training of employees who are geographically dispersed presents even greater financial costs due to the requirement for travel expenses. Added to this is increasing resistance to travel on the part of employers and employees after the terrorist events of the past several years (Gallagher & Mullins, 2001). The result is that there is an increasing focus on e-learning as a solution to the problem of employee training. Gallagher and Mullins also point out that corporate e-learning is still in an early stage, and is expected to grow from about $2 billion in 2000 to $18 billion in 2005.

While continual development of corporate e-learning is likely to continue, much of it is likely to occur within the structure of larger corporations that can afford the resources to develop dedicated e-learning departments. This project will show that an effective e-learning strategy can be implemented for a small company with limited resources as well. Effective employee training is as important for a small company as for a large one, perhaps even more so, since each employee has a proportionally larger impact on the success of the company.

Definition of Important Terms

Authoring

Authoring refers to the creating of learning tools by educators using computers, interactivity, and multimedia. The authoring is directly related to the method of delivery of the content, and includes web pages as well as self-contained computer programs.

Asynchronous Learning.

An educational delivery method where the learners can individually access the materials at any time and place.

Computer-Based Learning (CBL).

Education or training where the learner interacts directly with a computer. This term is interchangeable with Computer-Based Training.

Computer-Based Training (CBT).

Education or training where the learner interacts directly with a computer. This term is interchangeable with Computer-Based Learning.

Corporate Training.

Any training of employees provided by their employer as part of their job.

E-Learning.

This will be used as an encompassing term that includes any education that is structured around electronic means of content delivery.

Multimedia

Multimedia refers to communication using some combination of graphics, animation, video, audio, and interactivity.

Small and Medium Sized Enterprise (SMB).

Businesses with less than 250 employees. A small business has less than 50 employees. This term is commonly used in the United States, but does not have any formal standardization for the definition.

Small and Medium Sized Enterprise (SME).

Enterprises with less than 250 employees. A small enterprise has less than 50 employees. These are definitions provided by the European Commission (European Union, 2003).

Traditional Classroom.

This term will be used to refer to the educational situation where the instructor(s) and students are all physically together at the same time in the same room.

Web-Based Learning.

Education that is delivered via the Internet or World Wide Web.

Assumptions and Limitations

The writer has made the following assumptions:

1. The primary targeted students are sales representatives who need to develop a solid foundation of knowledge about not only the products they are selling, but also the basic scientific concepts that drive the use of the products.
2. The number of students is between 3 and 10 and the development of the training is the responsibility of one person (the author).
3. The students are geographically dispersed throughout the United States.

4. Each learner has the basic requirements necessary to receive and use the provided e-learning project. These include a suitable computer, the ability to use the computer, and high-speed access to the Internet.

The writer has established the following limitation:

1. The project itself will contain specialized technical content that will be of interest to the target audience. Other users or reviewers of the project will most likely have less interest in the subject material itself.

Overview of Remaining Chapters

Chapter two provides a review of literature that is related to this project. This includes scholarly publications that deal with instructional design, pedagogy, andragogy, and other learning principles as well as general references that address the issues of corporate employee training. Chapter three first discusses the methods that have been used to develop the ideas for this project and generate the material. Then the evaluation plan for the project is discussed. Chapter four provides a detailed overview of the instructional project itself. This information is based on the original Project Proposal document. Chapter five discusses the findings that are developed from the return of the assessment evaluations, and finishes with conclusion and recommendations. Appendices will contain important reference information for this paper, including the list of references, summary of evaluations, and production documents from the project.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

Introduction

This chapter will provide an overview of published research and information that directly pertains to the topic of this report. The history, implementation, and financial aspects of technology-based corporate training will be covered with an emphasis on small companies, followed by an analysis of the concepts of educational theory, instructional design theory, and assessment that will be applicable to this project.

E-Learning In Corporate Employee Training

Employee training is considered to be of ever-increasing importance within the current business environment. This is part of a fundamental shift in the role of workers in general. Modern business is more competitive than ever, and there are good reasons for companies to focus on employee training, including gaining a competitive advantage and improving employees' job activities to reduce turnover (Mangelsdorf, 1993). Where in the past employees might have been considered as interchangeable and replaceable parts of the organization, they are increasingly being viewed as an important asset of the corporation. One survey reported that 70 percent of large companies consider the lack of properly trained employees to be a major barrier to growth (Clarke & Hermens, 2001). From the 1950's into the 1970's, corporate training was modeled after traditional classroom-style teaching. As the trend toward improved employee training continued,

corporate training evolved through the 1970's and 1980's into a model patterned after the university system. This led to the implementation of the "corporate university", a dedicated system within a company with various courses, instructors, and even completion degrees. As late as 1994, 400 businesses in the United States had a formalized corporate college or university (Meister, 1994). In her book that covers a detailed analysis of these corporate universities, Meister predicts that alternative methods of learning would evolve in 2000 and beyond. This prediction turned out to be a good one, as continual improvements in technology have opened the doors for the possible use of technology-based training processes such as e-learning, computer-based learning, and web-based learning. For the purposes of this discussion, the term e-learning will be used to generically refer to any of these three definitions.

Cross and Hamilton (2002) provide an excellent overview of the evolution of e-learning from the early 1990's to the present. E-learning started out by taking advantage of the multimedia abilities of computers with courses that were custom-developed and published on multimedia CD-ROM's. These tended to be of high quality, but were very expensive and required long production times. In the late 1990's as computer networking became more common, Learning Management Systems (LMS) were built that delivered the computer-based courses across corporate networks. Database compilation and tracking of student progress and test results also were developed. At the end of the 1990's, the Internet became ubiquitous, making e-learning more easily deliverable to students anywhere and at any time. This effectively killed the need for the multimedia CD-ROM-based method of delivery and led the way to web-based learning content delivery systems that are becoming more common today. The authors conclude with

trends for 2002 and beyond, with “do-it-in-house eLearning” being the next wave (p.13). Large-scale learning management systems add large process layers that only slow down the development process, and even Fortune 200 companies are converting to fully homegrown e-learning development rather than following the previous practice of contracting from outside sources.

While there has been more than a decade of development for e-learning, it is still far from being adopted as a universal process, or as a replacement for traditional classroom teaching. In published survey results Gallagher and Mullins (2001) report that 75 percent of companies still use classroom training. Also, Reiser and Dempsey (2002) report that 70 percent still use classroom training, and in Bonk’s (2002) survey 98 percent of companies report that they still use conventional classroom training. Even though traditional instructor-led classroom training is still common, survey results also show that there is more and more interest in implementing e-learning as a replacement for classroom-style employee training. Bonk’s survey of 201 corporate trainers indicated that 75 percent are committed to e-learning, and also that close to 75 percent are currently using some type of e-learning. In a poll of chief learning officers, 90 percent indicated that training would move rapidly into e-learning (Webster, 2001).

Clarke and Hermens (2001) list some of the perceived advantages that e-learning can bring to the corporation. Scalability means that e-learning content can easily be distributed to many students, something that is more difficult for a single instructor. Being accessible anywhere and anytime is another advantage that an instructor cannot match. Finally, e-learning can be more easily updated than traditional methods of course construction.

While a general interest in exploiting the current state of the art technology is a factor in the increased interest in e-learning, there are other key influences as well. The potential accessibility that e-learning offers is a major factor because many companies have geographically dispersed employees. For example, e-learning helped train 80 percent of 84,000 dispersed learners for Wachovia Bank (Nelson, 2003). Geographically dispersed learners must all travel to a central location for traditional classroom training. The terrorist events of September 2001 have directly impacted the amount of corporate travel by causing reductions in employee travel and subsequent reductions in employee training. The potential of e-learning to address the training needs of geographically dispersed employees consequently became of higher interest (Gallagher & Mullins, 2001; Webster, 2001).

There is one additional factor that impacts the use of e-learning within the corporation, which is the ever-important economic impact. This will be covered in the next section.

The Economic Impact Of E-Learning On Corporate Training

Corporate training is as important as ever, yet increasing financial pressures have caused cutbacks in that very area for many companies (Webster, 2001). This can create a continual conflict as companies struggle to cut costs while realizing that they must invest in training to be successful. Corporate training is certainly a big business in the United States, with more than $50 billion spent in 2003. Yet this large number is six percent less than the previous year's spending (Galvin, 2003). Another data point indicates that

training accounts for about two percent of employee payroll, or $700 per employee per year (Saba, 2001).

E-learning is viewed by many companies as offering a direct cost savings for their training programs. E-learning is considered by some to offer "the biggest bang for the buck" (Galvin, 2003, p.2). Strother (2002) states that IBM Corporation saved $200 million in 1999 with e-learning programs, and offers similar anecdotes for other companies. Much of the potential cost savings that e-learning can offer is related the reduction of travel expenses. When employees are geographically dispersed, the travel costs of bringing them together for classroom training is substantial, as high as two thirds of the total training cost (Clarke & Hermens, 2001). The result is that e-learning continues to increase as a focus point for corporate trainers, at least in thought. One survey shows that 75 percent of corporate teachers are committed to e-learning (Bonk, 2000) and another survey that 60 percent of training directors have an e-learning initiative (Strother, 2002). Spending on corporate e-learning is expected to grow at a high rate over the coming years, from about $2 billion in 2000 to $18 billion in 2005 (Gallagher & Mullins, 2001).

Large companies tend to have departments or other groups that are dedicated to training, for example Bonk (2002) reports that 80 percent of surveyed companies fall in this category. However, small and medium sized businesses, also known as SMB's, make up a large portion of the business world. In 1999, there were more than six million businesses in the United States with less than fifty employees (Brown, 1999). Many of the various surveys that are reported in the literature do not reflect what small businesses are experiencing with their employee training. For example, Training's Industry Report

focuses only on companies with 100 or more employees (Galvin, 2003). Reports that do focus on the training practices of small companies show that training is much less formally implemented than within medium and large sized companies. For example, Wagar and Langrock (2003) surveyed 350 businesses of less than 100 employees, and found that only 29 percent had a formal training program. Of those businesses, 63 percent had less than ten employees, and only 23 percent of those small businesses had a formal training program. Mangelsdorf (1993) reported that in 1993 only three to five percent of small companies had formal workplace education, although 20 percent expressed a desire to have such a program.

Not only do most reports and surveys that focus on corporate e-learning tend to leave out small businesses, but reports that focus on the training needs of small businesses discuss e-learning little if it all. For example, Mangelsdorf (1993) recommends that small businesses improve their training programs by using books, outside sources, and their own employees. No mention is made of e-learning as a training possibility for small businesses. Brown (1999) points out that small companies by nature have limited budgets, space and staff for training. Yet small companies have the same needs for training as the large companies do, namely for improving productivity and increasing employee retention. Brown discusses the difficulty that small companies have as far as getting into e-learning, given that many small companies lack even a technology specialist and don't have the required budget to outsource e-learning.

E-Learning Methods, Standards, And Processes

The concept of e-learning has only been around for a decade or so, yet there is a large amount of process standardization that has already occurred, driven by several organizations. Sonwalker (2002a) points out that the development process of formal standards is "laborious, tedious, time-consuming, and requires numerous components" (p.1). Sonwalker lists three of the major bodies that are developing standards for e-learning: The IMS Global Learning Consortium, The Aviation Industry CBT Committee, or AICC, and Advanced Distributed Learning, or ADL. While these are separate organizations, they do work together to promote e–learning standardization.

The IMS Global Learning Consortium develops technical specifications for delivering learning, and these can be implemented by the public with no fees. The technical documentation is very comprehensive, is freely downloadable from the Internet and covers a wide range of e-learning topics, including learning design, content packaging, and implementation guidelines for the enterprise (IMS Global Learning Consortium, n.d.).

The AICC primarily focuses on computer-based training for the aviation industry, but they also promote interoperability standards across multiple industries with the goal of decreasing overall costs. The AICC seems to focus more on validating products that are offered by companies that specialize in computer-based training products (Aviation Industry CBT Committee, n.d.).

ADL is an initiative that is sponsored by the United States Office of the Secretary of Defense. ADL's goal is to unite government, industry, and academia to promote the development of processes for e-learning, including tools, specifications, guidelines,

policies, and prototypes. ADL has developed a collection of specifications known as SCORM, or Sharable Content Object Reference Model. This is a system that is designed to allow sharable content between different organizations. SCORM has undergone several revisions, and has recently announced the latest version named SCORM 2004. The SCORM documentation is quite broad and comprehensive, with 555 documents available for download from ADL's Resource Center web page (Advanced Distributed Learning, n.d.).

The SCORM specifications seem to be the most commonly utilized as learning development standards. In fact, SCORM is incorporated into components of the IMS and AICC initiatives (Sonwalker, 2002b). The goal is to make SCORM more universal, which in turn will allow more sharing of content. The Department of Defense (DoD) is a major driver for this idea with the goal of improving learning efficiency and reducing costs (Advanced Distributed Learning, 2004). SCORM has also become incorporated into the authoring tools that are used to create e-learning courses, for example Macromedia offers SCORM extensions for Flash MX software for making SCORM-Conformant content (Macromedia, Inc., 2002a).

Two other concepts for corporate e-learning are Learning Management Systems, known as LMS, and Learning Content Management Systems, known as LCMS. These are computer-based, database-driven systems that focus on storing and tracking information. The LMS focuses on basic parameters such as completion of courses and scores for students. The LCMS covers a broader range related to the course content, including profiling each learner's skill levels for various categories of knowledge. The

LCMS could be capable of delivering customized earning material to each student based on their individual needs (Click2learn, Inc., 2001).

The Learning Object, or LO, is a commonly used concept for corporate e-learning as well. Cisco Systems Corporation was a pioneer in the development of the Learning Object idea and built a large infrastructure around it in an effort to improve the training of their employees. Their system has been through several revisions and is now offered as a product for other companies. The benefits of using a learning object strategy for e-learning development are more consistent course material, better reusability, and the ability to deliver course content on multiple platforms, such as desktop computers and handheld devices (Cisco Systems, Inc., 2001). The exact definition of a learning object varies. One definition is the smallest learning element that can stand on its own as a learning piece. Another definition as proposed by the Learning Technology Standards Committee (LTSC) is any entity that can be used and reused in technology-supported learning (Macromedia, Inc., 2002b). The learning object plays a key role in the development of corporate e-learning, and is an area where the individual course designer can decide what will work best. For example, Cisco Systems, Inc. (2001) states that it is up to each organization to decide what is the best size and shape for learning objects within the context of their own goals. Focusing on the concept of learning objects rather than following a given definition is what is important when developing e-learning for corporate training.

Educational Theory Applied To The Use Of E-Learning For Corporate Training

From the broad point of view, learning principles are often discussed within a structure of three categories: behaviorism, cognition, and constructivism. It is not the intent of this paper to delve into the philosophical depths of these complex principles, but a summary of these is worthwhile as many practical theories and practices are directly tied in with these concepts. Alessi and Trollip (2001) provide a concise discussion of these principles in their second chapter that will be summarized here.

Behaviorism focuses on observable behavior. The concepts of behaviorism begin with the famous Pavlovian response, which is based on conditioning. Further refinements for more useful learning than salivating without food include positive and negative reinforcement, the definition of objectives, and feedback during the learning process. Behaviorism was established and developed throughout the 20th century, and was the primary driver for teaching until more recent times.

The principles of cognitive learning began to be established in the 1970's. Cognitivism explores learning beyond strictly observable behavioral events. Rather than viewing the knowledge to be obtained as a discrete series of facts that are transferred from the teacher to the learner, cognitive principles view the learning as a more complex internal process for each learner. Concepts such as short-term and long-term memory are considered as critical components of the learning process. Each learner's built-in store of prior knowledge is also considered to have a major influence on learning. Internal processes such as perception, comprehension, and motivation are important. The way each learner stores information internally and can retrieve knowledge as needed is part of

this process, and when the learner achieves self-awareness of his or her own learning, “meta-cognition” is achieved.

Constructivism is a more recently developed principle. It is based on a more relativist philosophy than the other two principles, which might seem to be structured on a positivist worldview. A constructivist view might claim that each learner forms a unique and individual interpretation of reality. Proponents of constructivism may create a bipolar philosophy, viewing themselves as opposed to the positivist thinking that is associated with behaviorism and cognition.

A more targeted approach for people that are developing corporate employee training might be to focus on teaching strategies. There are many different ways that a given set of learning content can be taught. Joyce and Weil (2000) provide detailed analysis of more than twenty different teaching styles in their book dedicated to the topic. Gaining a basic understanding of the three educational principles discussed above is helpful when tackling such a broad scope of teaching strategies, as these strategies can be grouped depending on their relationship to behaviorism, cognition, and constructivism. Some key behaviorist strategies include Mastery Learning, which proposes that every learner can master the course material if they are given enough time; Direct Instruction, which is used for a highly structured learning environment, and Simulations, which are typically technology-based and provide learners with a simulation of a real-life activity. Some cognition-related strategies include Mnemonics, which provide interesting and different ways to help students memorize facts and information; Advance Organizers, which help students prepare for learning large amounts of information by presenting them prior to class with structured information that is related to their previous knowledge or

experience; and Inquiry Training, which helps students develop their natural curiosity by asking questions and then applying intellectual strategies to what they learn. Finally, important constructivist strategies include Role Playing, where students achieve understanding of a complex problem from different points of view by acting it out; Group Investigation, which encourages group interaction and collaboration; and Structured Inquiry, which provides students with an opportunity to make discoveries on their own with hands-on experience.

Any of the teaching strategies discussed by Joyce and Weil could conceivably be applicable when developing a corporate training course. As pointed out by Williams (2002), designers in business and industry typically do not have educational background in these theories, and professional development for them is needed in this area. Businesses should not assume that the knowledge of these important theories is present in their instructional design team members just because they have had the responsibility for developing training classes. Williams also note that published literature on web-based learning tends to focus on the technical aspects of the course development and mostly ignores learning theory and principles.

Motivation of the learner is another area worth consideration. Reiser and Dempsey (2002) provide a detailed analysis of motivation and performance in the sixth chapter of their book on instructional design and technology. Motivation is identified along with capability and opportunity as one of three major categories that influence learning and performance. Motivation is generally divided into two types. When a student engages in a learning task for no other apparent reason than self-satisfaction, this is labeled intrinsic motivation. In contrast, extrinsic motivation is influenced by external

behavior modifications such as rewards. The combination of intrinsic and extrinsic motivation within individuals is a complex subject that has been extensively studied. A useful way to understand how motivation should be considered in an instructional design is to organize the concepts in a model. A useful example is the ARCS model as proposed by Keller in 1984 and summarized by Reiser and Dempsey. The ARCS acronym refers to attention, relevance, confidence, and satisfaction. Attention focuses on arousing the learner's interest and curiosity, relevance means providing training materials that are directly relevant to the learner's needs and jobs, confidence of the learner is built through positive feedback and a supportive environment, and satisfaction refers to a feeling of accomplishment and direct applicability to their job that the learner will feel after completion of the training. Reiser and Dempsey point out that many instructional designers tend to ignore motivation, but they should be aware that their design can have a positive or negative influence on learner motivation and the efficiency of the training.

Since corporate training deals exclusively with adult learners, it is worthwhile to also review the principles of andragogy, which was developed by Knowles in 1968 in order to focus exclusively on the adult learner, as opposed to the concept of pedagogy, which tends to focus on the learning of children. Holton, Swanson, and Naquin (2001) provide an excellent overview of andragogical principles and how they can be applied in practice by performance improvement professionals. This includes full coverage of all of Knowles' principles, which have evolved over the years as he has improved his model. While andragogy is often discussed as a theoretical model, "there is clear evidence that Knowles intended for them to be viewed a flexible assumptions to be altered depending on the situation" (p. 125). There are six basic principles of adult learning that are worth

considering when developing education tools for adults: The learner's need to know why they are doing this training, the learner's self-concept will drive a need towards self-direction, the adult learner brings a solid background of prior experience, adults are ready to learn when it will directly benefit them in their job or life, adults view learning within the context of their life experience, and finally, the adult learner is primarily driven by intrinsic motivation rather than extrinsic motivation.

There are various theories that focus on human variability and how individuals may possess different inherent capabilities that directly impact how they learn. Gardner (1999) is a leader in this area and proposes that humans have multiple intelligences, each of which is unique to each learner. Gardner originally proposed seven intelligences, and has left the door open for additional ones. The original seven are linguistic, logical-mathematical, musical, body-kinesthetic, spatial, interpersonal, and intrapersonal. It may not always be possible to determine individual learner styles in advance of the development of a training course, but if this information is available, it can influence the construction of the course. For example, if learners are individually oriented to the linguistic and/or musical intelligences, then the use of audio in instruction could directly benefit them. Conversely, the use of audio may not have as much of an effect on learners who are more strongly influenced by other intelligences (Brualdi, 1996).

Instructional Design Theory Applied To The Use Of E-Learning For Corporate Training

An analysis of instructional design typically begins with the concept of systems design, which brings structure and control to the process of designing education material. A common model is known as ADDIE, which stands for analysis, design, development,

implementation, and evaluation. This type of process is especially useful for managing a project that involves multiple team members. Another process is rapid prototyping, where a functional prototype is developed very early in the development process, then tested and revised (Reiser & Dempsey, 2002). The authors also provide guidelines for ADDIE activities for both behaviorist and constructivist designs, showing that different educational theories can by tied into the instructional design process.

Williams (2002) also provides a good discussion of instructional design principles that should be considered in relation to the learning paradigm that the designer wishes to focus on. Behaviorist courses contain stated objectives, task analysis, pre-assessment, competency-based assessment, and drill and practice exercises. Constructivist designs include consideration of learner skills, free learner movement and control, information that is provided in different ways, and problem-solving activities and assessments. While there is often a polarized debate over the philosophical advantages of behaviorism versus constructivism, Williams believes that these can both be integrated into web-based training for adult learners, and the author provides a comprehensive list of thirty-six principles for web-based design that combine behaviorist and constructivist ideas.

Recent attention has been given to the application of constructivist principles in technology-based instructional designs, which have traditionally been heavily oriented towards behaviorist principles. Gance (2002) points out that web-based interactive courses tend to have minimal user interaction and multiple-choice quiz questions, concepts which have roots in the behaviorist tradition. Gance takes exception to the idea that technology-based instructional design inherently supports constructivist principles, but does go on to say that the designer can bring constructivism into a technology-based

design by focusing on engaging the learner, developing hands-on interaction, and providing real-life problem-solving scenarios.

The selection of multimedia will be a natural part of the process when developing corporate e-learning. The term multimedia is commonly used but the definition of the word is not standardized. Strictly interpreted it means combining two or more media. Today it is more commonly associated with the ability of computers to work with different types of media, and refers to the any combination of text, graphics, animation, audio, and video (Reiser & Dempsey 2002, chap. 23). While text and graphics are likely to be a natural part of an e-learning course for employees, designers will need to give careful consideration to the addition of other elements such as audio and video. Audio and video require attention to details such as copyright and royalty fees for materials, and will also increase the budget for the project dramatically. These multimedia elements require extensive planning, product, and editing. The addition of even a few minutes of video can add many thousands of dollars of cost to a project (Alessi & Trollip, 2001, chap. 13). Furthermore, including additional multimedia elements such as audio in an e-learning course can directly impact the learning experience of the students both positively and negatively. For example, the sometimes-popular usage of both onscreen text and voice narration of that same text can cause a redundancy effect that overloads the verbal system and actually decreases learning efficiency (Moreno & Mayer, 2000).

Many companies already have a large amount of “legacy” training material, that is, various books, papers, and lecture materials that have been developed over the years for traditional classroom training. Edgar (2001) outlines a plan for converting these materials within a short time in order to simplify the conversion to e-learning. Despite the

advantage of having already-created learning materials, this is still a major process. The required team of people includes writers, programmers, graphic artists, and a project manager. It is projected that one hour of e-learning will require two and a half hours of work from these team members, illustrating that developing e-learning training is not necessarily an inexpensive process.

Pettenati, Giuli, and Khaled (2001) discuss the need for a team of people with specialized competencies for a technology learning development project. These include roles such as instructional designer, curriculum developer, media manager, tutor, content expert, programmer, and usability engineer. People fulfilling these different roles would be involved in different parts of the ADDIE process where appropriate. Of course, a small company would not be able to afford such a large and specialized staff just for training. This is specifically discussed by Reiser and Dempsey (2002) who point out that in a small company there is likely to be a sole designer. The sole designer will have complete responsibility for the ADDIE process, but would most likely consult with subject matter experts and possibly contract services such as media production.

Assessment Models For E-Learning In Corporate Training

Assessment and evaluation are often used synonymously to refer to the collection of information that is used to determine what the students learned as well as the quality of the educational material. As learners, students are familiar with taking tests which generally fall into one of two types. Norm-referenced tests measure an individual student's performance against a large population of students, placing a student somewhere in a rank of performance. Criterion-referenced tests differ dramatically by

attempting to measure each student's accomplishment of the learning task at hand. Modern instructional design practices tend to focus on the criterion-based model of testing (Reiser & Dempsey, 2002, chap. 3).

Instructional designers also view assessment as a means to measure the usefulness and efficiency of their training courses. One way to do this is to perform some sort of measurement of student learning after a course is completed and a number of learners have participated. This is known as summative evaluation. Summative evaluation can provide useful information, but if this information indicates that the training course did not function very well then it is of little help since the course has already been developed. For this reason, instructional designers prefer to use formative evaluation. Formative evaluation is performed prior to the completion of the project at any time during the development process. This allows the training material to be improved based on the feedback that is received (Reiser & Dempsey, 2002, chap. 11).

Kirkpatrick's four-level model of evaluation has had a huge influence on the assessment of employee training. Kirkpatrick (1996) provides an excellent analysis and updating of his own original work and this article will be referenced here to summarize his ideas. Kirkpatrick's model begins with level one, which measures the reaction of the learners. This is typically done through the use of surveys after a training course. Level two measures the actual learning that took place. This might be a measurement of gains of knowledge, skills or attitudes as a result of the training. Level three measures behavior, specifically whether employees' daily work activities have improved. Finally, level four measure results, referring to actual benefits to the entire organization or company as a result of the training, such as increased sales or bigger profits. The basic ideas of

Kirkpatrick's four levels are straightforward, and the author states that his model is meant to be used as a guideline, with the details of implementation left up to each individual or company. One thing that Kirkpatrick does state is that the difficulty of obtaining a realistic assessment increases dramatically as one progresses from level one to level four. This is reflected in real life, where the usage of Kirkpatrick's four levels declines with each increasing level. For example, a 2002 survey of corporate training showed that level one was measured 78 percent of the time, level two was measured 32 percent of the time, level three 9 percent, and only 4 percent attempted to measure level four.

Discussion

This research shows that the field of computer-based corporate training is relatively young. There have been many advancements and developments over the course of the last fifteen years or so. Yet while there are many methodologies, standards, procedures that have been developed, the implementation of e-learning within the corporate training environment is far from universally applied, despite the developing idea that technology can greatly reduce the costs of training. Small businesses in particular are presented with a difficult problem as they do not have the size or resources to support the structure that is required to implement computer-based training. The rest of this paper will focus on a project implementation that makes good use of the positive aspects of e-learning for employees of a small business while maintaining a reasonable expenditure of resources.

CHAPTER THREE

DEVELOPMENT OF THE OVERALL PROJECT/ METHODOLOGY

Overview

The major deliverable for this project is an interactive, multimedia, computer-based learning course. The subject material for this course consists of the background knowledge and specific product knowledge that is necessary to achieve a good understanding of the products of Apricot Designs, Inc. (Apricot). The target audience consists of employees of Apricot who are responsible for selling the products. These sales representatives need to develop this knowledge in order to be successful in their jobs. Their individual success in turn will directly impact the success of Apricot as a company.

At the time this project is being implemented, Apricot is building its own internal sales force for the first time. This target audience therefore will be receiving this project as their first formalized training session.

Besides directly addressing the current training needs of Apricot, the purpose of this study is to test the possibility for the development of a professional and effective computer-based e-learning program for geographically dispersed employees by a small company with limited resources. Therefore, this project is being designed and implemented by a single person within the company for whom training is only one aspect of his job requirements. The evaluation of the project will therefore serve to measure not only the effectiveness of the product itself, but also the effectiveness of the overall project as implemented in this manner.

Participants

The participants in the study represent the entire available target audience for the specialized instructional material. This population consists of four sales representatives that presently work for Apricot Designs. This is defined as a nonprobability sample. A probability sample where a sampling of a large population is used for a study is not applicable when the entire population is small (McMillan, 2000). Since the entire available population is being used, there is not a need to analyze the validity of the sampling process. However, the overall conclusions for this project will need to take into account that this population only represents one example of a small business and therefore the validity of comparison to all small businesses will need to be carefully considered.

The participants have varying degrees of pre-existing knowledge of the subject material in the project. For all four subjects, the project will represent their first exposure to a comprehensive learning course about this material, that is, they have not previously attended a previous classroom-style training session. As discussed in the literature review, it is common for a company to be faced with the requirement for training employees who are geographically dispersed. This is the case for this study as well. The participants are located in Massachusetts, New Jersey, and northern and southern California.

Instruments

Two measurement instruments were selected for this project. The first is a questionnaire, the most common measurement tool in educational research and suitable

for measuring a variety of traits (McMillan, 2000). Questionnaires are also an integral part of Kirkpatrick's model for evaluating training programs, which will be discussed in the next section. The questionnaires are constructed with a Likert-type rating scale that is designed to allow the students to provide their assessment of specific aspects of the course. The Likert-type scale is configured with five possible responses. This method was chosen because it allows the students to select a neutral response (the one in the middle) or one of two gradations of negative and positive responses. This model was selected to provide the best chance for a valid assessment. For example, if an even number of responses is used, it is not possible for a student to select a neutral answer and if that is the way they truly feel, then they will be forced to provide an input that is not truly representative of their thoughts (McMillan, 2000).

The Likert-type responses are also numbered. This will assist with the data collection and subsequent analysis. Each question also provides space for the learners to provide their own comments. This will allow each learner the opportunity to provide more subjective responses, and is recommended by Kirkpatrick (1996).

Two different questionnaire instruments will be used. The first is designed to measure the students' attitude toward the project itself. The questions ask the students to rate the visual experience, instructions, navigation, and overall user experience of the course. The second is designed to measure the students' learning from their own point of view. These questions are directly tied to the defined learning objectives of the course.

Each of the questions includes an area for the students to provide any comments that they may wish to add. This is a voluntary submission of data for the learners that will allow them to elaborate any thoughts that they may wish to add to the Likert-type rating.

An example question from each questionnaire follows. The complete questionnaires are available in Appendix A.

Reaction questionnaire: sample question

Rate the overall visual experience for the course. Were you able to easily read all of the text, and was the overall visual appearance pleasing and interesting?

1. Excellent 2. Very good 3. Good 4. Fair 5. Poor

Comments:

Learning questionnaire: sample question

After using this course, how do you rate your own overall knowledge on the concepts of liquid handling theory?

1. Excellent 2. Very good 3. Good 4. Fair 5. Poor

Comments:

The second instrument is an online discussion prompt that is placed on a web-based asynchronous discussion board that all of the students regularly use. This prompt is designed to bring a more constructivist approach to the measurement of the project as well as to the project itself. The interactive nature of the discussions will help reduce the isolation of each learner by providing an opportunity for them to interact with others (Huang, 2002). Also, this will allow interaction to be implemented as part of the learning process. This is a recommended method of promoting a constructivist online learning environment. The asynchronous discussion will allow learner-teacher and learner-learner interaction (Vrasidas, 2000). Similar online discussion tools such as Blackboard have been proposed to promote constructivism is a computer-based learning environment (Gance, 2002).

The online discussion prompt is as follows:

> *The Apricot Designs training course is an interactive, computer-based training course that was designed to allow you to gain the knowledge you need for your job by working independently and at your own pace. Due to ever-increasing competition, the drive for efficiency, and the expenses associated with travel, we would like to substitute self-directed training such as this for "traditional classroom training" where everyone travels to a central location and an instructor-led training session is provided. In this discussion area, please provide your thoughts on this idea. They can be positive inputs, negative inputs, general comments, or new ideas. This discussion should be considered an interactive discussion where we can all freely exchange our thoughts.*

Validity

As described above, the five-point Likert-type scale used for the questionnaire was designed to give the students a feedback structure that will let them submit a result that matches their true feelings as closely as possible. The subjective written feedback portions of the evaluation are by definition meant to be reflective of the students' true thoughts. The primary factor that can potentially cause the validity of this evaluation to be called into question is dishonest feedback from the learners. Validity is never a perfectly defined characteristic of a research study, but it is the evaluative judgment of the author that the provided feedback will be honestly provided by the learners (McMillan, 2000). The project is being provided to the students as a means for improving their personal success, so there should be no reason for them to provide feedback that is not a true reflection of their feelings. Also, open and honest communication is a general

operational principle within the corporation in general, with no adverse effects for employees who express opinions that might be considered as negative. Instead, all feedback is acknowledged and accepted as a means toward improving the overall business model of the company.

Reliability

Reliability defines how much error there is in the measurements themselves. Some common sources of reduced reliability in a study such as this are tired or sick students, test anxiety, motivation, and attitude (McMillan, 2000). The issues of motivation and attitude have also been addressed as part of the validity analysis. The general environment that the project will be used in is one of positive attitude and motivation on the part of the learners. This is expected to produce both reliable and valid evaluation results. The other potentially adverse effects to reliability are expected to be minimized by the extended time period that is provided for the learners to complete their feedback at their own pace and when it is comfortable for them to do so.

Procedures

This project will be evaluated using a descriptive nonexperimental research study. This is a suitable methodology for this project due to the selection of the participants and the available timeframe. The small population of subjects available for this study makes it difficult to configure experimental control by setting up independent and dependent variables (McMillan, 2000). Also, due to the time pressure for the ongoing success of the business of Apricot Designs, it is not desirable to consume excess time and the resources

of the students themselves by setting up different learning environments for comparative purposes.

The basic structure of measurement for this project is based on Kirkpatrick's model for evaluating training programs. While it has been more than forty years since Kirkpatrick first developed his ideas, they remain applicable to today's business training environment and have heavily influenced corporate training evaluation (Kirkpatrick, 1996). Kirkpatrick's four levels of evaluation can be simply summarized as follows: Level one measures the learners' attitudes about the training itself; Level two measures what the students actually learned; Level three measures how the students on-the-job behavior has changed as a result of the training; and Level four measures the overall results of the training for the company. As Kirkpatrick points out, his model is popular because it is simple yet effective. It is meant to act as a guideline, and the specifics of implementation are left to each user. Kirkpatrick also makes it clear that the difficulty of the evaluation process becomes higher as one progresses from level one through level four.

This project will focus only on levels one and two of Kirkpatrick's model. As was discussed in the literature review of this paper, the measurement of the first two levels and the neglect of the last two is a common occurrence in corporate training. For this project, there is not enough time available for a measurement of levels three and four. Yet, these results are very important to the success of the company that is sponsoring the training itself. It is the intent of the author to develop an ongoing evaluation plan after the completion of this project that will provide some insight into the success of levels three and four.

As described in the Instruments section, the questionnaire results for the Kirkpatrick level one and level two evaluations will be supplemented with an online asynchronous discussion that is readily available to all of the students as well as the instructor. This method was selected to promote a constructivist learning environment by reducing learner isolation and promote interaction among learners.

The project will be delivered electronically to each of the students at the same time, along with the questionnaires. A set of instructions will be included that will describe the learning and evaluation process to the students. The learners will be given a period of approximately two weeks to use the project in a self-guided manner at their own pace. Then, they will be requested to complete and submit the questionnaires as well as participate in the online discussions. This project is an integral and required part of their job functions and is also expected to provide a positive influence on their personal success and growth. For these reasons, complete feedback is expected from one hundred percent of the selected population. An additional two week period will be provided for submission of the questionnaire results and participation in the online discussion.

Data collection will consist of capturing and compiling the results of the questionnaires and the online discussion.

Data Analysis

The numerical rankings of the Likert-type responses will be used to produce descriptive statistics. Basic statistical parameters such as the mean and standard deviation are suitable ways to summarize and describe each question (McMillan, 2000). The mean will be calculated for each question and this result will serve as an overall indicator of the

students' rating of that issue. The standard deviation will also be calculated as a measurement of the spread of responses.

There will also be a number of subjective and descriptive comments that will be provided by the students, either as voluntary elaborations for the questions or as part of the online discussion. These will be gathered, sorted and ordered for each question as part of the data analysis for the project. Organization of this information will allow a subjective review and analysis of the feedback provided by the students.

CHAPTER FOUR

DESCRIPTION OF THE INSTRUCTIONAL PRODUCT

Overview

Apricot Designs, Inc. (hereafter referred to as Apricot) is a small business that offers high-technology products to the biotechnology and pharmaceutical industries. These products are high-performance robotics-based liquid handling systems that are used in science research and development. The features and functions of these products as well as the underlying concepts that they utilize are specialized and technical in nature.

Instructional Problem

As for any for-profit company, ongoing sales revenue is necessary in order for Apricot to be a successful and ongoing business. In this type of business, all sales are conducted by a team of sales representatives who visit the customers and discuss the product features, benefits and advantages and negotiate the purchase of products. In order to effectively accomplish this, the sales representatives must have a solid understanding of the technical aspects of the products, as this information is necessary in order to have meaningful discussions with their customers, who are scientists and already have that level of knowledge.

The sales representatives already possess a unique set of skills that include effective customer communications and negotiations. However, when initially hired at Apricot they typically do not also possess the required technical knowledge that is also necessary for successful selling to this market. Also, the sales representatives are

geographically dispersed throughout the United States so that they are near the customers in their assigned territories.

Apricot, being a small company with less than 30 employees overall, cannot afford the resources for a dedicated training department. In fact, the expenses of training in the traditional classroom style with all employees together in the same location are too high to be practical, particularly due to travel expenses.

The problem then, is the provision of effective employee training for the sales representatives at minimal cost, and with a delivery method that allows the geographically dispersed students to all receive the same education.

Proposed Solution

The solution will consist of a computer-based learning system that can be delivered to the learners electronically. This will allow the learners to receive the training material in a timely manner regardless of their physical location. Furthermore, each learner can implement their education asynchronously at their own choice of time and place, allowing them to implement their learning within the structure of their busy schedules and eliminating the need for travel to a single location for a training class.

The training project will consist of an interactive tutorial that covers the various concepts and product features and also provides links to supplemental reference information. Text, graphics, animations, and video will be used to provide an interesting and informative learning experience. The content will be accessible via the Internet.

Learning Task Analysis and Instructional Strategies

The goal is to produce an effective learning course that can be electronically delivered to geographically dispersed students at minimal total cost.

To meet these goals, the following objectives will be met:

- The course will be developed electronically and be delivered to the students electronically.
- The total budget for the course for all of the students will be less than $2,000, not counting the time of the developer and non-recurring software purchases.
- The students will each proceed through the course at their own pace and at the time and location of their choice.
- After completing the course, the students will be able to describe the concepts of liquid handling theory.
- After completing the course, the students will be able to correctly identify the various models of Apricot liquid handlers.
- After completing the course, the students will be able to describe the features and benefits of the various models.
- After completing the course, the students will be able to properly configure a proper model based on a specific set of customer needs.

This course focuses primarily on a behaviorist type of teaching model, providing a series of facts for the learner of ever-increasing complexity. Multiple choice quiz questions throughout the course are used by the learner to test what they have learned within each section. The students have as much time as they need to work with this course, and in fact are encouraged to take as much time as they need to achieve full

understanding of the subject material. This is very much in line with the concepts of mastery learning, a behaviorist teaching strategy. The assessment questionnaires will be used to measure the attainment of the above goals according to Kirkpatrick's model, focusing on level one and level and level two, which measure the students' reaction to the course and their opinion of how well they learned the material. In keeping with the basic principles of adult learning, the course allows a high degree of learner control throughout, with virtually no limits on the order in which an individual student may proceed through the course. The students will be encouraged to take part in an asynchronous discussion via the internet, bringing in a constructivist element as well.

Audience Analysis

The target audience for the project includes sales representatives for Apricot Designs, Inc. These are adult learners who already have experience in the work environment, but who generally do not possess the technical knowledge that will be covered in the project. The learners have an inherent high motivation to learn, as the very success of their careers, as well as their income, is directly tied to how well they know their products, which in turn increases their overall ability to sell and negotiate.

Media Selection

The Flash authoring environment will be used, providing a professional software environment for development that allows zero-cost deployment to the individual users, since the player is free. Flash is ideal platform for vector drawing and animation, both of which will be used for teaching technical concepts. Flash also offers a library of pre-built assessment tools that will minimize development time and cost. The current version is

Flash MX 2004. While Macromedia Director is often considered a useful authoring tool for developing interactive learning projects that can run in a browser, recent improvements have made Flash a more desirable alternative to Director, specifically for the following reasons:

- The Flash plug-in is more universally installed in user's browsers compared to the Shockwave plug-in. According to Macromedia approximately there is approximately a 98 percent adoption rate for Flash. (See http://www.macromedia.com/software/player_census/flashplayer/penetration.html). Macromedia seems less willing to post such a statistic for the Shockwave plug-in, but it is generally accepted to be much less than the Flash plug-in, possibly around 50 percent. (See http://www.du.edu/~aldean/js/plugins2.html).
- Any screen in a Flash player files can easily be printed by the user with no extra programming for the developer, even when running within a browser. While user printing is possible with Director, it requires extra plug-ins and programming and is difficult to implement. This is important for this project because many users prefer to print portions of the material for later review or reference.
- The new Flash ActionScript Version 2 authoring language offers a high degree of programming for interactivity, similar to Director's Lingo.
- Flash features superior vector drawing tools. This project will make use of many vector images and animations.

- Like Director, Flash is capable of importing virtually any multimedia for placement anywhere within the timeline, including graphics, audio, video, and even Flash files.

The project screen size will be 950 pixels wide by 500 pixels high. This was selected to offer maximum screen area for content while maintaining full visibility without scrolling on the screen when the project is launched in a browser on a computer monitor with at least 1024 x 768 screen resolution. All of the target students were confirmed to have computers capable of displaying this resolution.

Image files will be in JPEG format, a standard that allows viewing with commonly used software tools. Video files will be made as either Windows media files or QuickTime files, both of which can be viewed with free players. Most reference documentation will be in the form of PDF files, which can be viewed with a free version of Adobe Acrobat reader. Some reference files may also be in the form of standard Microsoft Office documents, including Word, Excel, and PowerPoint.

Groove collaboration software (www.groove.net) will also be used by all students as well as the instructor. This secure file-sharing system will allow access to the instructional content and also includes an asynchronous discussion board that will allow the students and instructor to share ideas and opinions about the course.

Project Description

The project will consist of an interactive multimedia tutorial. The tutorial will be designed to function both as a training tool and as a reference for the learners to return to when they need to recall important information. Since the information in the tutorial is

diverse, yet interrelated, the navigational structure will allow hyperlinking to various portions of the project, with standard navigational elements such as forward and back buttons for individual lessons. This design will offer a high degree of learner control. The learner will have the option to proceed linearly through the entire course by simple navigation buttons, or to randomly jump to any portion of the course at anytime via a hyperlinked menu. The menu will not only tell the learner where they are currently located within the program, but will also allow the learner to jump to any other location by simply clicking within that menu.

The project content is divided into six sections, and is structured on a building-block idea. It starts by introducing the learner to basic concepts that are important to know in order to gain a good understanding of the more advanced material that will be presented later. The project continues in this fashion, with each new section building on the knowledge of the previous sections, until by the end the learner will achieve a good understanding of the information about Apricot's products.

In order to simplify development, many components of the tutorial will be developed as individual Flash movies, which can then be incorporated into the main project, either by directly embedding them or via links. Some of these movies are interactive animations, allowing the learner to view an animated sequence that illustrates the material being presented on a given page. Other media includes Flash vector images and JPEG image files.

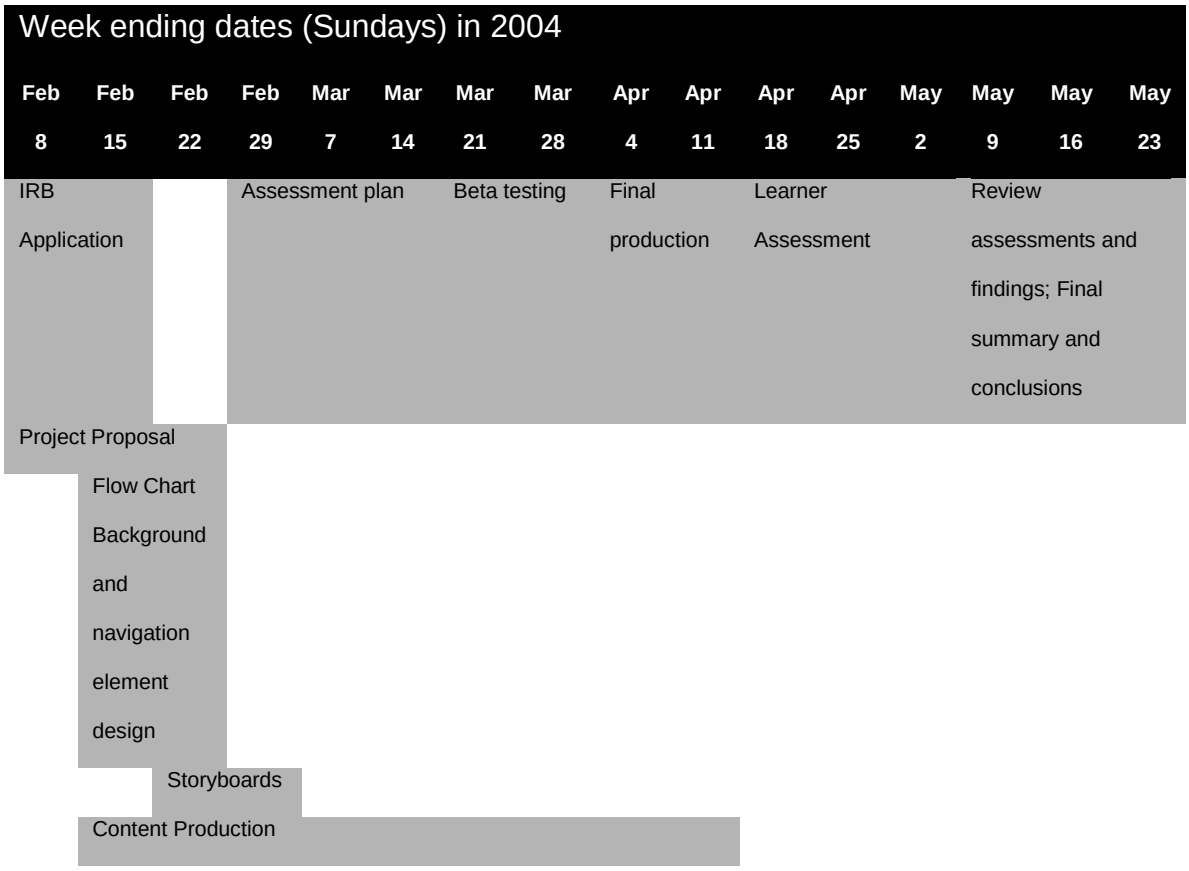
Appendix B contains sample screen captures from various sections of the project. Appendix C contains the original flow chart that was used as the guideline for the rapid prototyping and development of the project.

Personnel Analysis

For this project, a single person, the author, will perform the majority of functions for the design and development. These include pedagogy consultant, design manager, production manager, media manager, developer, and assessment manager. The author's supporting background information includes a Bachelor's of Science degree in Biological Sciences, completion of a Master's degree in Instructional Design and Technology via this project, and twenty fours years of experience in private industry in the marketing and selling of scientific instrumentation. When appropriate, technical content will be reviewed by a subject matter expert (engineer) at Apricot. Because this project is being entirely developed by a single person, the *rapid prototyping* method of development will be used, as opposed to the more traditional ADDIE (Analysis, Design, Development, Implementation, and Evaluation) approach. The project will immediately begin with the construction of the supporting backbone graphics and navigational structure, with content being filled in even during the early stages. Adjustments will be made as the project is developed based on the developer's experiences and the alpha and beta testing inputs.

Production Work Plan

Since a single author is producing the project using the rapid prototyping method, the production work plan does not include breakdowns of the project itself, nor assignment to personnel for sub-projects. The project is subject to a time deadline, so the following production calendar was used to organize and track the development of the project.



The project will begin with a project proposal that provides a basic overview for approval by the appropriate staff. At the same time, permission to publish the project will be applied for to the Institutional Review Board (IRB). Since the project does not require gathering sensitive information from the target users, it qualified for an exemption from a formal IRB review and approval.

The next step will be the development of a flowchart that provides the basic backbone for constructing the project, with the background graphics and navigational elements being designed and tested at the same time. After a short time these components

will be developed, and content will immediately start being added over a nine-week development period, with alpha and beta testing occurring concurrently to allow for any suggested revisions. This rapid prototyping process allows the project to be built in an efficient and timely manner by a single author. Since the author has a high degree of familiarity with all of the technical aspects of the project, it is easier to make even global updates than in this manner, rather than attempting a long and refined development process with production squeezed into a short time period at the end. Finally, once the project is completed, it will be delivered to the target learners along with the assessment questionnaires. Once the learners have had time to use the project, they will be requested to send in their inputs and these will be gathered and analyzed for the final findings analysis and conclusions.

Estimated Budget

The following budget acted as a guideline for the project development costs. The actual time and money spent was very close to the preliminary budget. Since this was the first e-learning project developed for Apricot, the budget reflects the purchase of the software tools that were used for the project development. These tools can be used for future projects without further capital expense, allowing for more economical projects.

	Preliminary Budget		***Final Budget***
Meetings with the Apricot Management			
Hourly Rate	$50		$50
# of Hours on the Project	8		4
Meetings Subtotal	**$ 400**		**$200**
Project Documentation (Proposal incl. Personnel and Work Plans)			

Hourly Rate	$50		$50
# of Hours on the Project	8		2
Planning Docs Subtotal	**$400**		**$100**
Other Costs			
Adobe Creative Suite	$1,000		$1,068
Macromedia Studio MX/Flash Pro	$1,000		$847
Groove licenses (5 x 70)	$350		$350
Other Subtotal	**$2,350**		**$2,265**
Assessment and Design Subtotal	**$3,150**		**$2,565**
Meetings with the Apricot Management			
Hourly Rate	$50		$50
# of hours	8		4
Meetings Subtotal	**$400**		**$200**
Multimedia/Web Costs			
per hour cost of development	$50		$50
# of hours	40		40
Multimedia/Web Subtotal	**$ 2,000**		**$2,000**
Development Subtotal	**$2,400**		**$2,200**
Meetings with the Apricot Management			
Hourly Rate	$50		$50
# of hours	8		2
Meetings Subtotal	**$400**		**$100**
Tryout and Revision Costs			
Hourly Rate	$50		$50
# of Hours on the Project	16		8
Contractors Subtotal	**$800**		**$400**

Evaluation Subtotal	**$1,200**		**$500**
Project Grand Total	**$ 6,750**		**$5,265**

CHAPTER FIVE

FINDINGS, CONCLUSIONS, RECOMMENDATIONS

Findings

First, the numerical data from questionnaires one and two was gathered and tabulated; these results are shown in Tables 1 and 2. For all questions a 5-point Likert-type scale was used with 1 being the highest positive result and 5 being the lowest negative result. Please refer to Appendix A for the complete questionnaires.

Table 1

Tabulation And Analysis Of Results For Questionnaire One

Questionnaire One	Visual Experience	Instructions	Navigation	Overall Experience
Student 1	2	1	1	2
Student 2	1	1	1	1
Student 3	2	1	3	2
Student 4	1	2	1	2
Mean	1.5	1.25	1.5	1.75
Standard Deviation	0.577350269	0.5	1	0.5

Questionnaire One was designed to measure Kirkpatrick's level one assessment concept which focuses on the learners' attitude about the project itself. The students provided ratings on the visual experience, usefulness of the instructions, navigation, and

overall user experience. The average results fall between the two highest positive ratings on the Likert-type scale, indicating a strong overall satisfaction with the project. The standard deviations are all a value of one or under, indicating a small and consistent degree of spread among the numerical results. In other words, the student feedback was consistent.

Table 2

Tabulation And Analysis Of Results For Questionnaire Two

Questionnaire Two	Overall Usefulness	Theory	Models	Features	Configuration
Student 1	2	2	2	2	2
Student 2	1	2	1	2	2
Student 3	1	2	1	1	1
Student 4	2	1	2	1	2
Mean	1.5	1.75	1.5	1.5	1.75
Standard Deviation	0.577350269	0.5	0.577350269	0.577350269	0.5

Questionnaire Two was designed to measure Kirkpatrick's level two assessment concept which focuses on what the students learned. In this case, the students are asked to provide their own assessment of how they learned from the course; this should be taken into consideration when drawing conclusions from these results, as they may not reflect actual learning. Once again, the average results fall between the two highest positive ratings on the Likert-type scale, indicating a strong overall satisfaction with the project. The standard deviations are under a value of one, indicating a small degree of spread

among the numerical results, and again the student feedback was consistent throughout the various questions.

Both questionnaires allowed the students to enter comments after any of the questions. In addition, an interactive discussion among the instructor and the students was used via the asynchronous discussion function of Groove software. Comments from students from both of these sources are listed below.

- *Overall the information presented was very helpful for the basic understanding of robotic liquid handling.*
- *The course was very good, very basic.*
- *Very clever setup and presentation. This is one of the better tools I've seen. Easy to maneuver.*
- *I personally like to see where I am in relation to the overall lesson at all times. It would be nice to click on a section of the lesson and go to that point.*
- *I have gone through some of this and it is EXTREMELY helpful and full of pertinent information I need.*
- *Overall, I like the idea of using this tool as a training/ development tool for new reps and overseas distributors. It has the potential to save the company a lot of money if people use this tool properly.*

Most of the written feedback indicated positive response on the part of the learners as to the overall usefulness of the project. One response indicated a desire to "click on a section of the lesson and go to that point." This desire for user control is a typical requirement for an adult learner, and in fact this capability was built in throughout the project. The learner's response may indicate that the instructions were not sufficiently

clear, or possibly that the student did not read the instructions before proceeding through the course.

Conclusions

There were seven objectives for this project that were outlined in Chapter four. The writer has listed these, again, and provides a discussion as to whether these objectives were successfully met.

- *Objective One: The course will be developed electronically and be delivered to the students electronically.*

All aspects of this objective were successfully met, showing that it is possible to develop and deliver a small company employee training course electronically and in a timely manner using a single developer.

- *Objective Two: The total budget for the course for all of the students will be less than $2,000, not counting the time of the developer and non-recurring software purchases.*

The total expenditures for this project were $2,265, slightly exceeding the target set for this goal. However, all of these costs represent the requirement to purchase software tools necessary for production of a project of this scale, and all of these tools can be used again for additional instructional projects as well as other tasks, therefore reducing the cost on a per-project basis. The low dollar expenditure for a learning project of this scale represents one of the advantages of e-learning. As a comparison, if this training were conducted in the traditional manner by bringing all of the students together for a one-time classroom style training, the total cost would easily exceed $4,000. This includes combined travel expenditures of air travel, car transportation, lodging and meals.

The economic benefit of the electronic course is further expanded by the fact that the students can easily return to the course at any time for refresher updates, and also that the course can immediately be delivered to any new employees at no further expense, something that is not possible with instructor-led classroom training.

- *Objective Three: The students will each proceed through the course at their own pace and at the time and location of their choice.*

Once the course was electronically distributed to the students, they each were able to study it whenever they wished; therefore, this objective was successfully met.

- *After completing the course, the students will be able to describe the concepts of liquid handling theory.*
- *After completing the course, the students will be able to correctly identify the various models of Apricot liquid handlers*.
- *After completing the course, the students will be able to describe the features and benefits of the various models.*
- *After completing the course, the students will be able to properly configure a proper model based on a specific set of customer needs.*

The last four objectives are more difficult to reliably quantify since they represent a degree of actual learning and synthesis of the information on the part of the students. The students' own feedback on their learning as provided by Questionnaire Two indicates that they strongly believe that they achieved these goals. Assuming that these results are valid, this indicates a successful completion of these four learning objectives.

The project's completion and successful implementation in real-world conditions illustrates that it is possible to produce a high-quality interactive computer-based course

within the resource constraints of a small business. The project represents a successful implementation of e-learning for employee training while also illustrating the strengths and weaknesses of this approach. The ability to deliver the course electronically and instantly to employees who are geographically dispersed represents one of the major strengths, especially in relation to a small company. The ability to perform employee training in this manner means a large cost savings compared to the alternative and traditional method of paying to bring all of the students to a central location for an instructor-led classroom training. The fact that the course is complete and ready to go for instant use by any new employees means that even more economic benefit will be realized.

The use of the Flash authoring environment for development of the project is also a strength for a project of this type. It is the author's experience that sales training courses are often developed by marketing personnel using a presentation tool such as Microsoft PowerPoint software. Such software is relatively easy to use, but it is more geared toward a presentation by a speaker than for use as an interactive learning tool. Two areas in particular where the Flash software is advantageous are for developing a good navigation system that is easy to use and for the use of animations. Although the use of animations may not be necessary for all types of content learning, this technique was valuable for this project to help illustrate some of the concepts that involve moving parts.

A potential weakness for this project is the reliance on each student to take the time to use it to improve their knowledge. After the course has been delivered, there is not a direct way to confirm that the students are studying the material. This situation is improved to a degree by virtue of the asynchronous discussion that supplements the

course. The discussion not only allows an interactive forum for the students to exchange ideas, but also allows the instructor the opportunity to see which students are posting feedback or questions, which in turn can be used as a gauge to determine who is using the course. Students who don't post on the discussion can be individually and privately contacted to determine if they are indeed studying the course. This can be a problem for any course that is delivered to students to use at their own pace. In the situation that this project is applied, it is assumed that students will take the time to use the course because it will directly benefit them in terms of their job performance, and as sales representatives, even their income.

Another potential weakness of a course of this type is related to the variability among learner personalities and capabilities. While it is common for computers to be used every day by employees in today's business world, there are still many people who may not be comfortable with extensive reliance on computers. Some learners may have a stronger preference for the more traditional classroom training because of the more socially interactive environment that it provides. This situation can be improved by supplementing an individual course with an asynchronous discussion as was used for this project.

Overall, the employees and management of Apricot Designs have indicated a positive response to this project and consider it to be valuable and of direct benefit to themselves and the company. Based on the success of this training course, which provides an introductory overview of the products of Apricot Designs, further projects are now underway that will use the same production approach for more advanced content.

The experience gained during the production of this original training course will make it even easier and more efficient to produce further content.

Recommendations

In the competitive business environment, everything that a company invests in should have a benefit to the bottom line of profitability, and employee training is no different. Kirkpatrick's popular model of training evaluation provides for a measurement of positive results to the company's profitability. However, this fourth level of evaluation in Kirkpatrick's model is rarely measured due to the time required and inherent difficulty of getting a direct measurement that can be correlated to training. Oftentimes training projects are viewed as complete after the course has been delivered and the students' feedback has been gathered on Kirkpatrick's level one (reaction to the course itself) and level two (direct learning from the course). In fact, that is the final level of evaluation provided in this paper, due to the fixed time window required for completion of the project. However, it is the intent of the author to continue to monitor the employees' job activities to see if their performance is better and more efficient as a result of the training (level three) and eventually, to correlate an improvement to the profitability of Apricot Designs as a result of employee training via e-learning (level four). This is a recommended procedure for any company that implements an employee training of any kind. This is an area where a small company can gain an advantage over a large corporation, as it is inherently easier to keep track of a small number of employees compared to monitoring hundreds or even thousands.

Employee training will continue to be of critical importance to small companies, and ever-increasing economic competition will mean that resources for training will continue to be constrained. It is doubtful that small companies will be able to afford an employee training department, or even a single person who is dedicated to training. However, even a small company can improve the economics and efficiency of their training by using e-learning as illustrated in this project. The difficulties are that an employee who is given the task of developing training may not have education or skills in educational theory, instructional design, and implementation of projects with authoring tools. This can be addressed in several ways. Instructional design and e-learning continue to grow and there are increasing numbers of people in the workforce who have capabilities in these areas. If a small company is hiring a marketing person that will take on responsibility for employee training, they can make these capabilities a requirement for the position. Another alternative is to contract an experienced instructional designer to provide advice and possibly aid in development. While this represents an additional expense, it could still be less of an investment than fully outsourcing the development of a training program. If an employee is already responsible for employee training, then the company should consider training for that person in the areas of educational theory and instructional design. Comprehensive programs such as the Masters program in Instructional Design and Technology from California State University at Fullerton are expanding in availability, and if this option represents a time commitment that is too large, there are individual courses or certification programs that are available. If a small company has the foresight to maximize the efficiency of their employee training using

the latest e-learning technologies and theories, they can not only directly benefit financially but can also gain a competitive advantage in the marketplace.

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Appendices

APPENDIX A:

EVALUATION FORMAT/MODEL

Questionnaire One: Measurement of Student Attitude About the Learning Course (Kirkpatrick's Level One)

Rate the overall visual experience for the course. Were you able to easily read all of the text, and was the overall visual appearance pleasing and interesting?

1. Excellent 2. Very good 3. Good 4. Fair 5. Poor

Comments:

Rate the course instructions (help). Did they help you understand how to use and navigate the course?

1. Excellent 2. Very good 3. Good 4. Fair 5. Poor

Comments:

Rate your satisfaction with the navigation of the course. Were you easily able to navigate throughout the project with the menu and control buttons?

1. Excellent 2. Very good 3. Good 4. Fair 5. Poor

Comments:

What is your assessment of the overall user experience for this project? This includes the overall look and feel, ease of user control, and functionality.

1. Excellent 2. Very good 3. Good 4. Fair 5. Poor

Comments:

Questionnaire Two: Measurement of Student Perception of Their Learning

(Kirkpatrick's Level Two)

Rate the usefulness of this course as far as helping you to understand the products of Apricot Designs:

1. Excellent 2. Very good 3. Good 4. Fair 5. Poor

Comments:

After using this course, how do you rate your own overall knowledge on the concepts of liquid handling theory?

1. Excellent 2. Very good 3. Good 4. Fair 5. Poor

Comments:

After using this course, how do you rate your own overall knowledge on the differences between the various Apricot models?

1. Excellent 2. Very good 3. Good 4. Fair 5. Poor

Comments:

After using this course, how do you rate your own overall knowledge on the features and benefits of the various models?

1. Excellent 2. Very good 3. Good 4. Fair 5. Poor

Comments:

After using this course, how do you rate your own overall knowledge on how to properly configure a model to meet a customer's needs?

1. Excellent 2. Very good 3. Good 4. Fair 5. Poor

Comments:

Discussion Prompt for Asynchronous Discussion

The Apricot Designs training course is an interactive, computer-based training course that was designed to allow you to gain the knowledge you need for your job by working independently and at your own pace. Due to ever-increasing competition, the drive for efficiency, and the expenses associated with travel, we would like to substitute self-directed training such as this for “traditional classroom training” where everyone travels to a central location and an instructor-led training session is provided. In this discussion area, please provide your thoughts on this idea. They can be positive inputs, negative inputs, general comments, or new ideas. This discussion should be considered an interactive discussion where we can all freely exchange our thoughts.

APPENDIX B:

INSTRUCTIONAL PRODUCT SAMPLE PAGES

Figure B1. Introduction Page.

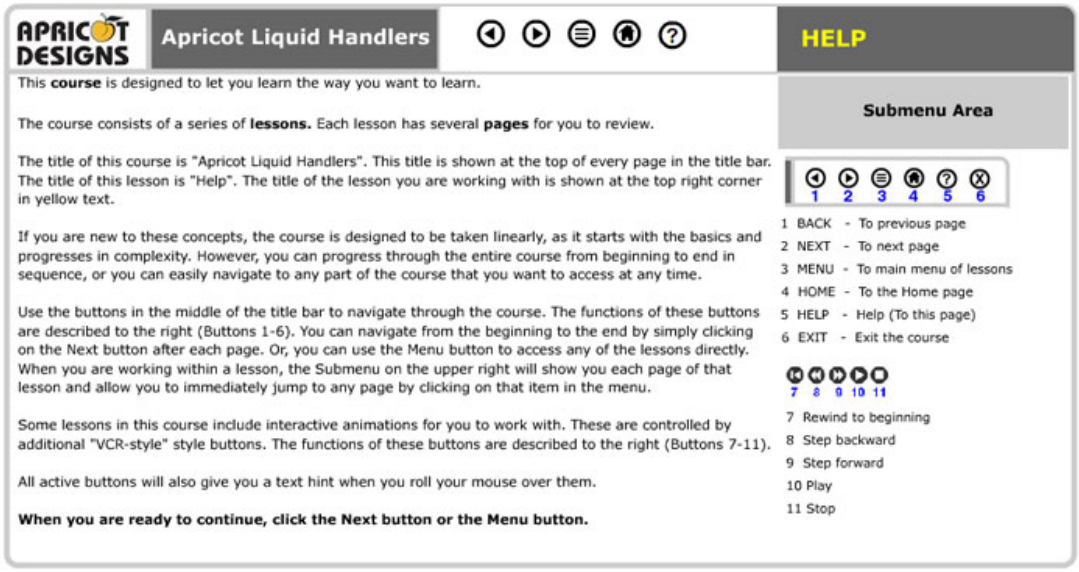

Figure B2. Help Page.

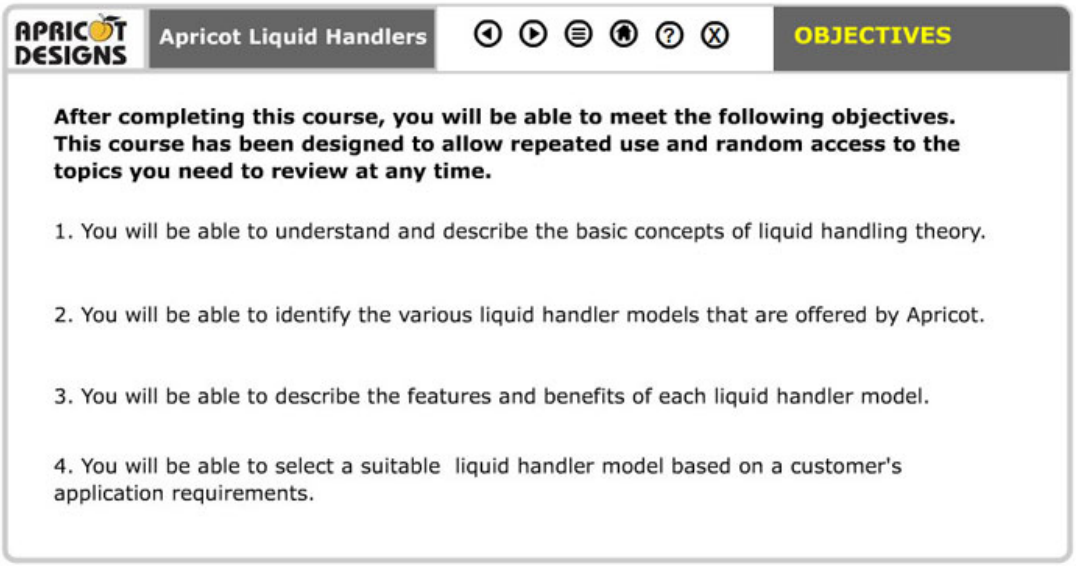

Figure B3. Objectives page.

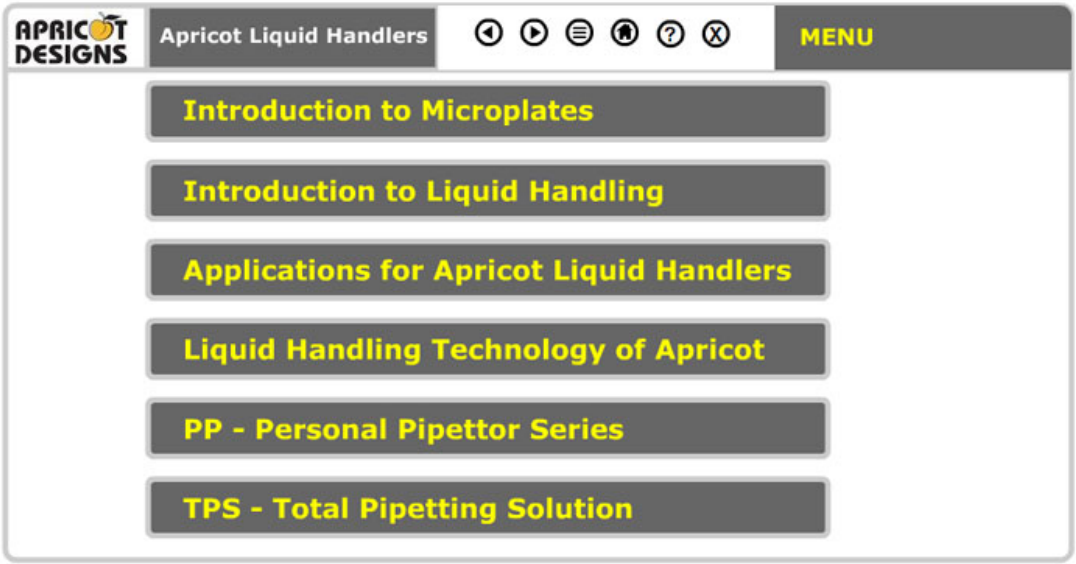

Figure B4. Main Menu page.

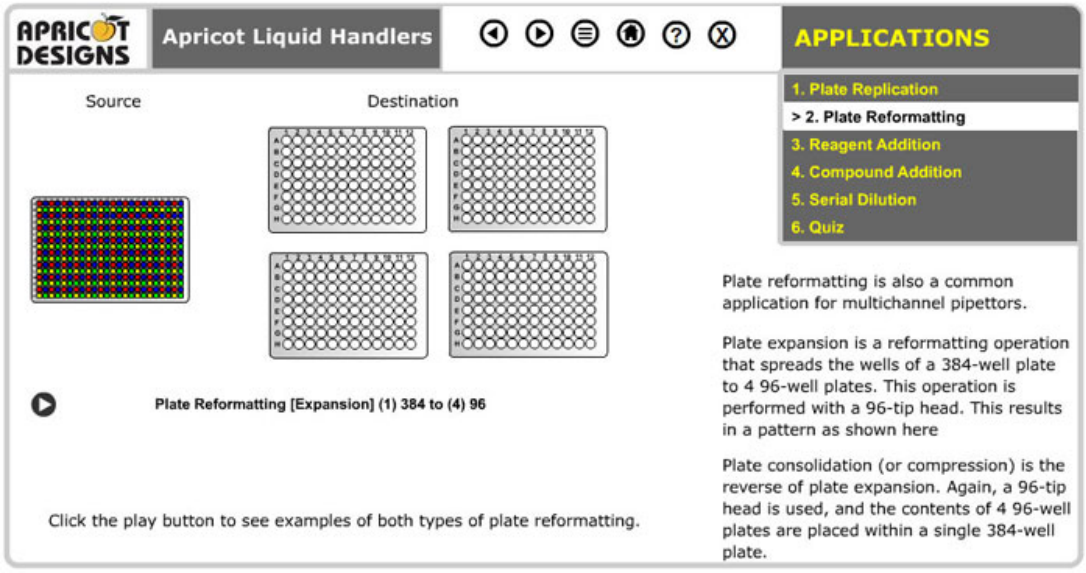

Figure B5. Sample content page showing the submenu on the upper right and an example of an interactive animation.

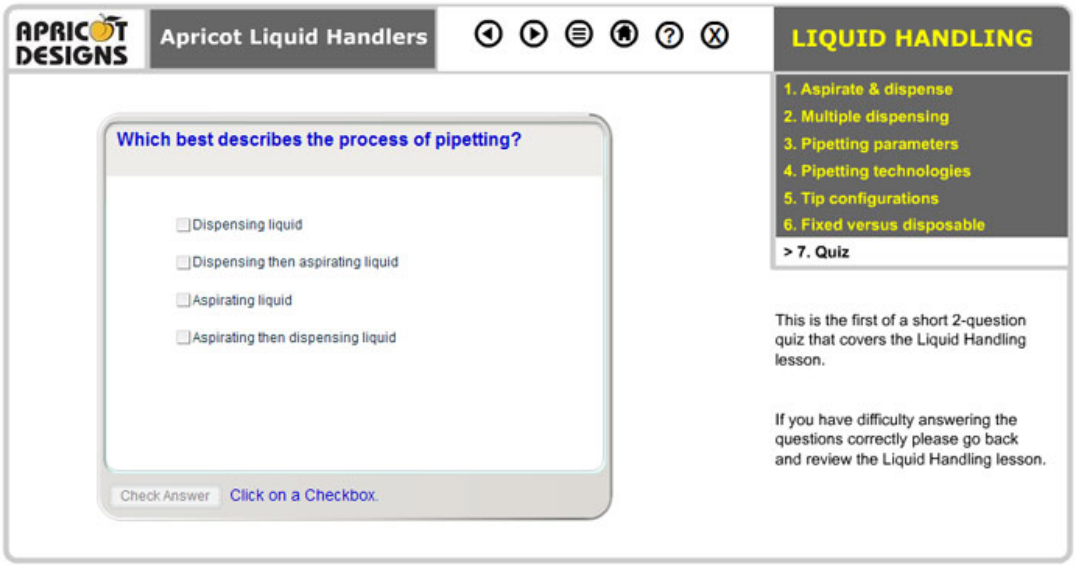

Figure B6. Sample quiz page showing a multiple-choice question.

APPENDIX C:

INSTRUCTIONAL PRODUCT FLOW CHART