LEARNING TECHNOLOGIES USED BY CVTC ELECTROMECHANICAL GRADUATES IN MANUFACTURING

By

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ABSTRACT

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The purpose of this investigation was to collect data surrounding the learning technology readiness, individual learning practices, and use of various learning technologies by CVTC electromechanical graduates from the graduating years of 1992-2002.

This study identified learning opportunity access, learning technology access, learning technologies employed by manufacturing, frequency of self-directed learning by CVTC electromechanical graduates, capability of engaging in individual learning practices, capability of utilizing learning technologies in the workplace, ability to adapt to other technologies in the workplace, primary utilization of learning technologies, and combinations of delivery methods and learning technologies used.

The results confirmed that CVTC electromechanical graduates, from the graduating years 1992-2002, had access to learning opportunities available anytime,

anywhere, and at the discretion of the learner. This delivers on the characteristic of workers being able to interact with different levels of technology by way of self-directed learning. Data verified that the graduates are able to adapt to manufacturing environments where other technologies such as proprietary application programs, applications software, and systems and networks are used.

Results also established that CVTC electromechanical graduates were capable of taking part in self-directed learning efforts and are also capable of utilizing the learning technologies that are available in their workplace.

The study also verified the primary utilizations of learning technologies as well as the delivery methods in which they are used. Companies that hire CVTC electromechanical graduates utilize CAI/CBT for the following purposes in the following sequence, from the most to the least utilized: troubleshooting and diagnostic, review, testing, and equally, lecture/classroom and drill and practice. A few do not use CAI/CBT. Additionally, the intranet/Internet is used for the following purposes in the following sequence, from the most to the least utilized: troubleshooting and diagnostic, testing, review, lecture/classroom, and drill and practice. A few do not use an intranet or the Internet.

Along with the identification of the learning purposes, the delivery methods in which CAI/CBT and intranet/Internet are utilized were discovered. The study found that the manufacturing locations in which CVTC electromechanical graduates are employed, utilize CAI/CBT in the following delivery situations, in the following sequence, from the most to the least utilized: coaching or on-the-job, followed equally high in self-paced and lecture/classroom deliveries. The intranet/Internet technologies were used highly in self-

paced situations, followed by coaching or on-the-job, and with a smaller amount of lecture/classroom utilization.

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CHAPTER 1

Introduction

Background

The United States will not be competitive in the global economy of the 21st century without a technically trained work force (Preparing technical workers for the new industrial era…, 1993). To prepare the technically trained workforce, many organizations and individuals in Wisconsin work on the approaches of providing the best accesses to technical training. Wisconsin's attention towards technical training accesses can be summarized in a journal by Governor Tommy Thompson's Task Force on Technical Education called *Technical education and training: The future of Wisconsin's workforce,* which stated,

> Today, significantly more students in Wisconsin need access to high-quality technical preparation programs at the secondary level than ever before. As students receive better career awareness instruction and career guidance, they will begin identifying specific technical training needs as part of their career and education plan. Schools must be able to provide such opportunities along side [*sic*] core academic and technology courses and advanced placement courses in science, math, English and other areas. (Governor Tommy Thompson's Task Force on Technical Education, 1999, n.p.)

The importance of providing increased access to technical training is also supported by calls from studies and organizations for educational institutions to rethink

teaching methods, putting considerably more emphasis on preparing students for life-long learning using interactive teaching methods (McCollum, 1999).

Wisconsin industry and the Wisconsin Technical College System (WTCS) frequently work together to create the access to technical training required of our global and state economies. Collaborative partnerships develop when WTCS is hired by industry to create customized training. Industry also creates internships for some of WTCS's programs so that students can practice their forming knowledge, skills, and attitudes. Moreover, WTCS is producing graduates hired by industry and business. In some cases, industry pays for tuition reimbursement for their employees to attend vocational or technical college programs. However, in some cases, industry and the technical college, who produces graduates for industry, have no ties or partnerships.

Whether or not WTCS and industry are working collaboratively, one of the technical college objectives is to prepare workers for the workplace and the technologies they may use. This requires WTCS to do so in a computer-oriented manner since computers are ubiquitous in the workplace (Marquardt & Kearsley, 1999). When workers enter into the workplace, they may interact with technology on different levels, or equally as important, workers may use technology to interact with others (Marquardt & Kearsley, 1999). Moreover, small and emerging businesses, or business with employees from zero to 499, "expect the use of "technologically-driven training methods," such as CBT, Internet-, and intranet-based training, to increase in the future" (Continuous Learning Group, 2001, n.p.) To learn these technologies, in the state of their increased use, may require self-directed learning.

Self-directed learning, as defined by Malcolm Knowles (1975), "describes a process in which individuals take the initiative, with or without the help of others, in diagnosing their own learning needs, formulating their own learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes" (Knowles, 1975, p.18). Knowles (1975) also suggests that because of our rapid state of change, now and in the future, education must develop the skills of inquiry (Knowles, 1975). Education isn't framed in terms of skills or knowledge that is kept for life, but it "must now be defined as a lifelong process" (Knowles, 1975, p.16). Referring to a more recent definition of self-directed learning, Marquardt & Kearsley (1999) relate self-directed learning to technology through the self-directed learning definition, that which "refers to the skills, insights, knowledge, attitudes and values acquired by a person through self-study, technology-based instruction, and observation" (Marquardt & Kearsley, 1999, p36).

For the United States to be considered in the global economy, many workers will utilize the aforementioned self-directed learning combined with learning technologies to attain various levels of technical training or post-secondary vocational training for various reasons. The reasons for the technical training may vary from individual, business, and educational institution perspectives. From the eyes of the individual, it may be to attain high order skills to earn a sufficient income (Jesswein, Lichty, & Zanko, 2001). In other cases, industries with 'safety critical' requirements need staff with "specific education and training with generic theory and practice, general systems knowledge, and procedural knowledge" (Newman 2001). From an educational institution perspective, vocational educators at Chippewa Valley Technical College state their

mission as “to improve the lives of students, meet the workforce needs of the region, and strengthen the larger community” (http://www.chippewa.tec.wi.us.).

An increasingly more acceptable way of providing technical training is through the use of learning technologies (Goldsmith, 1988). Marquardt and Kearsley define a learning technology as “the use of electronic technologies to deliver information and facilitate the development of skills and knowledge” (Marquardt & Kearsley, 1999, p58). These learning technologies could be in the form of computer-based training, computer-assisted instruction, computer-presented instruction, multimedia instruction, or web-based training. The list however doesn’t end here. There are many other choices discussed later in this study.

“Researchers have established the utility and effectiveness of a coordinated presentation of explanatory words and pictures in the learning process, particularly in novel or complex situations” (Osborn, 2001, n.p.). Statements such as this provide evidence that learning technologies are a prime way of presenting the novel or complex situations that occur in technical training. In presenting complex situations, computer-based training (CBT) frequently occurs as a type of learning technology used in technical training. Although there is much to be done if learning technologies such as CBT are to achieve the status they could in technical training, some good materials have been used in the electricity/electronics field (Goldsmith, 1988), which this study explores. Moreover, the use of learning technologies in technical training allows some great advantages that are also brought forth later such as hands-on interactiveness and learner style flexibility (Marquardt & Kearsley, 1999).

The use of learning technologies in training and education brings to the surface advantageous features called meta-learning, or "learning about learning" (Groneman & Kaser, 1995, p40) and lifelong learning. Following this meta-learning principle, students play a directive role in choosing their learning activities and make choices based on their experiences (Groneman & Kaser, 1995). Employees who follow this process emulate a model for lifelong, continuous learning (Groneman & Kaser, 1995), which seems to have a positive impact on healthy learning organizations and the success of our state and national economies. It seems that if CVTC electromechanical graduates are to engage in individual learning, take hold of meta-learning, and work in places that utilize various technologies, they need to be able to learn flexibly and in advanced manners by utilizing various learning technologies.

The concepts of technical skills training, learning technologies, meta-learning, and lifelong learning seem to be intricately related. One relationship is that a technical skill training, which ultimately involves technology, "should be a process of creating an environment in which students learn and practice lifelong learning strategies" (Groneman & Kaser, 1995, p. 48). That is, they are able to relate and function within various learning technologies. Another relationship is that by engaging in various learning technologies, meta-learning and individual learning naturally occur. To provide learning opportunities in a learning technology format such as web-based training or computer-based training presents a forum that encourages practices and characteristics of a lifelong learner such as initiating own learning, achieving high standards of literacy, managing information, and demonstrating aesthetic awareness (Dumas, 1997).

Regardless of the inevitable connection between technical skills training, learning technologies, and lifelong learning, technology-based training doesn't exist without its share of issues, which are discussed in this study. Some of these include the myriad of delivery method advantages and disadvantages. Also, there becomes a varied learning technology delivery format such as self-paced, instructor-led classroom, or on-the-job coaching. Its primary utilization may differ from entity to entity such as practice, simulation, lecture, and other reasons for its use. In addition, there are varied reasons for the selection and the need to fulfill the obligations for the initial selection reason. Moreover, there are benefits and drawbacks to technology use.

Graduates of the CVTC electromechanical program possess such titles as electromechanical technician, systems technician, and automated manufacturing technician. Other titles utilized in the workplace are explored in this study. Graduates of the electromechanical associate degree program "work on equipment and automation that makes everything from CDs to food products to computers" (http://www.chippewa.tec.wi.us).

Many more details about the CVTC electromechanical graduates, self-directed learning practices, and employer learning technology access, utilizations, and delivery methods are brought forward in the following chapters as the graduates' use of learning technologies in their employed manufacturing environments are described.

Statement of the Problem

The problem in this study can be seen from the following perspectives: No regional study has been conducted that describes how CVTC electromechanical graduates are learning after graduating and whether the way they are learning at CVTC is

supporting their employed positions after graduation. Learning technologies are becoming more widely used and accepted and some conclusions may be able to be drawn about how prepared workers are for learning in the workplace and lifelong learning. And because of the vast amount of resources, software, labor, and computer hardware needed when taking on a learning technology initiative, the two entities, business and education, may be able to formulate best practices for the region and capitalize on certain economies of scale.

Purpose of the Study

The purpose of this study is to describe the learning technology readiness and use of various learning technologies by CVTC's electromechnical program graduates who graduated from 1996 - 2001 in their current employed manufacturing environment. Data will be collected from those most knowledgeable with learning technology language and its utilization at the organizations in which CVTC electromechanical graduates are employed through a mailed survey during the Fall of 2002.

Research Questions

This research will address the following questions:

1. To what degree do CVTC Electromechanical graduates have access to learning opportunities through the means of the organization that are available anytime, anywhere, and at the discretion of the learner?
2. What learning technologies are employed at manufacturing locations?
3. To what degree of frequency do CVTC Electromechanical graduates engage in self-directed learning efforts or individual learning practices?

4. What is the perceived aptitude of CVTC Electromechanical graduates engaging in individual learning practices?

5. What is the perceived aptitude of CVTC Electromechanical graduates to engage in individual learning practices that are technology-based?

6. To what degree are the CVTC electromechanical graduates able to adapt in a manufacturing environment corresponding to different levels of technology interaction?

   a. Proprietary application programs

   b. Applications software

   c. Systems and networks

7. What is the primary utilization of learning technologies of manufacturing firms where CVTC electromechanical graduates are employed?

8. What combinations of learning technologies and delivery methods are used at manufacturing locations that employ CVTC electromechanical graduates?

Significance of the Study

This research is important to the community and CVTC in attaining vital information about their electromechanical graduates that will help the technical college, graduates, and employers in several ways:

1. This study attempts to identify a presence or lack of a pattern within manufacturing employers of CVTC electromechanical graduates so that information will be available to aid in making future decisions in the use of technology-based learning within CVTC's electromechanical program.

2. It is important because it describes learning technology uses so that technical colleges can prepare their students for life-long learning that is equal to or greater than

industry's technology-based learning efforts. It will do this in a manner that will help community members attain life-long learning skills which requires the community, including business and education, to create learning opportunities that are relevant to community contexts (The National Organisation for Adult Learning, 2002).

3. By providing technology-driven teaching methods, CVTC can live up to their mission of delivering superior, progressive technical education (http://www.chippewa.tec.wi.us).

4. If the research demonstrates that learning technology uses in electronic occupations and programs are prevalent, this may be a way for our Wisconsin region to show that our workforce is motivated, skilled, and adaptable paving the way for competitive positioning when new economic development opportunities emerge (Jesswein, Lichty, & Zanko, 2001).

5. By implementing learning technologies where students and employees can self-direct, CVTC can provide technical training that responds to the findings of the Governor's Task Force on Technical Education, in which the findings show that greater access to quality technical training is key to our economic success (Governor Tommy G. Thompson's Task Force on Technical Education, 1999).

6. By preparing workers to provide training by way of learning technologies can enable workers to "learn faster, more accurately recall what they learned over a longer period of time, and they are better able to transfer what they learned to actual performance" (American Society of Training and Development [ASTD] & National Governors Association [NGA], 2001, p.11).

Limitations of the Study

The following represent limitations on the research:

1. This study does not analyze the quality of learning technologies, its effectiveness, or attitudes by instructors or students of learning technologies.

2. This research does not try to prove that any learning technology is better than others.

3. This study only describes technology-based learning technologies within manufacturing environments of CVTC electromechanical graduates.

4. The study questions do not include collecting data to quantify the amount of time learning technologies are used in technical training.

Assumptions of the Study

1. The results of this study are assuming that those completing the surveys are knowledgeable of learning technologies used by CVTC electromechanical graduates from the graduating class years of 1992 – 2002.

2. Employers of CVTC electromechanical graduates were in a leadership position of attaining information concerning the use of learning technologies of CVTC electromechanical graduates.

Definition of Terms

Learning technologies can take on many forms when applied to teaching knowledge, skills, and attitudes. The following defined terms may be a variation in the way in which computers may be used to present concepts, principles, procedures, and/or cognitive knowledge and are discussed in this study.

1. Computer-based training (CBT)– "a type of education in which the student learns by executing special training programs on a computer" Also called computer-assisted instruction (CAI) (Webopedia, 2002).

2. Computer-managed instruction – another subject area related to computer-based instruction.

3. Educational technology - Devices and systems used to deliver education; generally communication technology equipment and the associated processes (Governor Tommy G. Thompson's Task Force on Technical Education, 1999).

4. E-learning – "instructional content or learning experiences delivered or enabled by learning technology" (ASTD & NGA, 2001, p.7).

5. Multimedia - The use of computers to present text, graphics, video, animation, and sound in an integrated way (Webopedia, 2002).

6. Technical education –"Instruction and educational experiences that result in knowledge about or skills in using a given technology" (Governor Tommy G. Thompson's Task Force on Technical Education, 1999, n.p.).

7. Web-based training (WBT) – the integration of instructional practices and Internet capabilities to direct a learner toward a specified level of proficiency in a specific competency (Conrad & TrainingLinks, 2000).

CHAPTER 2

Review of Literature

Introduction

This study looked at the learning technology readiness of CVTC electromechanical graduates allowing them to perform their technology-based jobs effectively. This chapter focuses on topics surrounding learning technologies and a technically trained workforce.

Technology in the Workplace

Technology in the workplace plays a major role in our global economy and can position organizations to concurrently succeed and thrive. Marquardt and Kearsley, in their book *Technology-based learning,* explored the relationships between learning technologies, learning, and working. They noted that technology has the power to bring organizations into the global economy, and those who can't or won't utilize technology will face widening economic and social gaps (Marquardt & Kearsley, 1999). From this perception, it can be seen that Wisconsin organizations need to embrace technology in many regards so that when the global economy in the form of new economic development opportunities emerge, we can show that our workforce is motivated, skilled, and adaptable, which would pave the way for competitive positioning (Jesswein, Lichty, & Zanko, 2001). Additionally, the Commission on Technology and Adult Learning believes that learning technologies, such as e-learning, will play a vital role in equipping workers with the skills they need to succeed in the 21st century, in turn boosting economic competitiveness and growth (ASTD & NGA, 2001).

Marquardt and Kearsley (1999) also noted that an increasing number of organizations across the world are beginning to recognize that in addition to integrating technology into work, they must also integrate technology into the growing need for learning (Marquardt & Kearsley, 1999).

With the advances of technology and the growing need for learning, learning technologies inarguably surfaces. As brought forth earlier in Chapter 1, Marquardt and Kearsley defined a learning technology as "the use of electronic technologies to deliver information and facilitate the development of skills and knowledge" (Marquardt & Kearsley, 1999, p. 58).

Workers and Technology

Since technology is ever present in the workplace, workers are bound to interact with technology on one or more levels. According to Marquardt and Kearsley (1999), workers may work with technology on four different levels. At a base level, workers may utilize the hardware, but not the software, requiring them to only understand the steps needed to operate equipment such as electronic devices and/or tools (Marquardt & Kearsley, 1999). At a second level, workers could use one or more proprietary applications to process transactions, complete or check records in a database, or use for specialized decision-making, with this proprietary software ranging from simple to complex. By the third level, workers may find themselves interacting with technology by using off-the-shelf software such as word processing, spreadsheets, databases, project management, or telecommunications programs, and in some cases, using it in specialized or unique ways. By the fourth level, engineers, technicians, programmers, and the like may operate with systems and networks. Those interacting at this level will be learning

according to their self-directed efforts in order to keep pace with technology changes. All of these levels will require workers to operate at different levels of self-directed learning (Marquardt & Kearsley, 1999).

A Method of Delivery

Learning technologies are only one way of delivering new knowledge, skills, and attitudes. Since 1982, *Training* magazine has produced an annual industry report on various aspects of employer-sponsored training. In 2001, they broke their reporting into four categories: instructor-led (classroom), instructor-led (from remote location), by computer with no instructor, and other. The other category included structured, on-the-job training and self-study programs using videos, manuals, and workbooks (Galvin, 2001).

Types of Learning Technologies

Learning technologies can take on many forms and are grouped differently according to the source.

The Commission on Technology and Adult Education identified learning technologies as e-learning, or "instructional content or learning experiences delivered or enabled by electronic technology" (ASTD & NGA, 2001, p.7). The realm of e-learning in this case includes distance learning, CD-ROMs, videoconferencing, computer-based instruction, satellite downlinks, interactive TV lectures, computerized diagnostic assessment and evaluation, competency certification, electronic portfolios, virtual educational networks, corporate universities, and much more (ASTD & NGA, 2001).

Marquardt and Kearsley (1999) categorized learning technologies as those that are presentation technologies "(how information is presented to learners)" or distribution

technologies "(how information is delivered to learners)" (Marquardt & Kearsley, 1999, p. 59). Marquardt and Kearsley communicated that in the areas of presenting, industries or organizations may choose, among others, to present technical information in the following ways, as categorized and defined by the American Society for Training and Development (Marquardt & Kearsley, 1999, p. 58):

"1. Electronic text or publishing – the dissemination of text via electronic means" (Marquardt & Kearsley, 1999, p. 59). Many times the electronic text or publishing is accompanied by graphics: illustrations, diagrams, schematics, photographs, graphs, and/or charts (Marquardt & Kearsley, 1999).

"2. Computer-Based Training (CBT) – "learning that uses computers to deliver training" (Marquardt & Kearsley, 1999, p. 59).

"3. Multimedia – computer application that uses text, audio, animation, and/or video" (Marquardt & Kearsley, 1999, p. 59).

"4. Teleconferencing – the instantaneous exchange of audio, video, or text between two or more individuals or groups at two or more locations" (Marquardt & Kearsley, 1999, p. 59).

When addressing the need to distribute or deliver information to learners, education and industry may choose to use the following distribution technologies, of which are only a partial listing:

"1. CD-ROM – a format and system for recording, storing, and retrieving electronic information on a compact disk that is read using an optical drive" (Marquardt & Kearsley, 1999, p. 59).

"2. Electronic mail – the exchange of messages through computers" (Marquardt & Kearsley, 1999, p. 59).

"3. Internet – a loose confederation of computer networks around the world that are connected through several primary networks" (Marquardt & Kearsley, 1999, p. 59).

"4. Intranet – Internets within an organization" (Marquardt & Kearsley, 1999, p. 59).

Varied Uses

In hand with the various types of learning technologies are their varied uses. They may include the distribution and retrieval of information such as course notes and web searches (Abrami, 2001). Concurrently or in lieu of this form may be a communication use such as computer conferencing within a course or between classes. The learning technology might also be used to provide drill and practice, guided discovery, and/or simulations (Abrami, 2001).

Learning Technology Advantages

By utilizing these learning technologies, many advantages occur. Marquardt and Kearsley (1999) listed and explained advantages, such as just-in-time training, learner-controlled, cost-effective, self-paced and user-friendly, accessible over wide geographical areas, and uniform in content and delivery.

Just-in-time training or the ability for individuals to access learning information when they need it (Marquardt & Kearsley, 1999), offers a method that is better than waiting for a class to be scheduled. The advantage of being learner-controlled gives users the ability to take their time, peruse the topics in a manner that matches their learning styles, and extract or visit only what is needed. Along with the previous

advantages, learning technologies can be cost-effective, eliminating or reducing the need for travel, multiple instructors, and can reach more participants. Learning technologies can be self-paced and user-friendly (Marquardt & Kearsley, 1999). By providing a simple, point-click navigation, learners can easily click their way through training units and at a pace that matches their absorption and processing abilities. Some of the learning technologies can be accessible over a wide geographic area. An individual or group can engage in distance-learning technology at home or in the office, being in a location other than the training source. Learning technologies can provide the added benefit of being uniform in content and delivery (Marquardt & Kearsley, 1999). In this form, multiple people can access the same consistent training and education and everyone is seeing and/or hearing similar content.

Another advantage identified by the 2001 Commission on Technology and Adult Learning is how learning technologies such as e-learning allow learning to become a continuous process of inquiry and improvement that keeps pace with the speed of change in business (ASTD & NGA, 2001).

Learning Technology Disadvantages

Because there is no perfect solution, there inevitably arrives disadvantages or drawbacks in the use of learning technologies in business or education. Learning technologies are not a perfect solution and are still emerging in many organizations. Like many other facets of our human condition, many are abruptly stopped by the changes technology brings and unable to function in a technological environment (Why hasn't technology…, 2001). The question of whether organizations use a PC or MAC can be an obstacle in implementing learning technologies, followed by upgrades and the expense of

upgrading (Why hasn't technology…, 2001). Maintenance of hardware to provide learning technologies is important, as well as the skills needed to do so.

The technological disadvantages that learning technologies bring are accompanied by the disadvantages of the human element. Marquardt and Kearsley (1999) noted that there are always individuals who cannot or will not accept technology. They may be willing, but cannot quite tackle the concept of using technology for learning. Technology may be avoided because individuals are not adequately trained or motivated (Marquardt & Kearsley, 1999). Also, using learning technologies requires staff development, which in some cases does not occur, as it should in business and education. Moreover, teachers may not be familiar with technology, making it hard to make an initial learning technology plunge. In light of these and many other reasons, it is important to recognize these issues because ultimately an essential skill of every worker is the ability to work with technology to find information and convert it to knowledge (Marquardt & Kearsley, 1999).

High Points

In spite of disadvantages that need to be dealt with concerning education and training via learning technologies, there are many high points. Learning technologies, used in some cases are student-centered, which is regarded as the more effective approach to learning (Guest, 2001). Furthermore, both non-academic and academic students achieve high quality learning outcomes under active teaching methods, such as web-based delivery, rather than passive methods, like the traditional lecture or classroom (Guest, 2001).

Learning Technologies in Business

E-learning today is rapidly growing with many supporting statistics. "Corporate e-learning in the United States is a $1.2 billion market and is expected to grow to a $7 billion market by 2003" (ASTD & NGA, 2001, p. 10). Moreover, firms participating in ASTD's State of the Industry Report 2001, projected an average 117% increase in the use of learning technologies between 1999 and 2002. Supporting this is the 900% increase in web-based training between 1999 and 2003 (ASTD & NGA, 2001). From these statistics, it is apparent that learning technologies in business are widely used, with expected increases for the future.

Self-Directed Learning and Learning Technology Readiness

Self-directed learning and its popular focus isn't unmarked territory from a business perspective. According to a study by the organization called RISEbusiness, small and emerging businesses (SEB's), or those having zero to 499 employees, cite self-directed learning as one of their most popular training methods (Continuous Learning Group, 2001).

Keeping in mind this popularity and our ubiquitous computer world, it's not surprising that these two concepts might have a relationship. Self-directed learning and learning technologies have many things in common and can be mutually supporting. Self-directed learning is "a process in which individuals take the initiative, with or without the help of others, to diagnose their learning needs, formulate learning goals, identify resources for learning, select and implement learning strategies, and evaluate learning outcomes" (Lowry, 1989, n.p.).

In order to make a connection between self-directed learning and learning technologies, it's important to consider tools that employees may use to diagnose their own learning needs, identify resources for learning, and select and implement learning strategies. While engaging in self-directed learning process, a learner may use the Internet, a CD-ROM, or participate in an on-line course, taking advantage of its "self-serve" characteristics. It is in this light that self-directed learning naturally fits with learning technologies and the connection can be made between those who will be self-directed learners and those that are able to use various learning technologies in the workplace.

Furthermore, self-directed learning, when utilizing various technologies can reshape our traditional learning transforming it into a learner-focused activity. According to the Commission on Technology and Adult Learning, "technology can personalize content, and anticipate learners' future information and learning needs by recognizing patterns in how people learn. It can also match content with each individual's learning style, experience and skills" (ASTD & NGA, 2001, p. 9). Many learning technologies such as the Internet, which can provide published text, multimedia, and on-line courses, have a common advantage above other delivery methods in that they are learner-controlled and learner-focused. In these various e-learning forms, learning opportunities are available anytime and anywhere, and at the discretion of the learner who wishes to participate, allowing learning to "take place at the worksite and in the context of an individual's job responsibilities" (ASTD & NGA, 2001, p. 9).

In this era, self-directed learning, learning technologies, and lifelong learning are all related when it comes to the learning process. Brockett and Hiemstra (1991, n.p.) demonstrated these relationships when making the statement,

The field of adult education has long embraced such ideas as autonomy, independence, and personal development of adult learners. These ideas are implicit in such terms as lifelong learning, self-directed learning, self-planned learning, independent study, distance education, learning projects, andragogy, and self-directed learning readiness. All of these in some way stress the role of individual learners in the learning process.

Because self-learning and learning technologies are so related, this may mean that in our technologically advanced society, workers need to be prepared and ready to learn with various learning technologies so they may independently integrate learning with work.

Summary

When reviewing the literature, it is evident that learning technologies and self-directed learning play a vital role in technical skills training. Self-learning presents lifelong learning skills. The manner in which self-learning will probably occur will be in the form of various learning technologies. In this respect, "technical skills training should be a process of creating an environment in which students learn and practice lifelong learning strategies" (Groneman & Kaser, 1995, p. 48). From the literature, it can be inferred that in order for CVTC electromechanical graduates to perform their technology-based jobs effectively, it will be important for them to know about the use of learning technologies in their place of work so that CVTC can adapt their delivery

methods, if needed, to a form that prepares workers for learning technologies in the workplace. They will need to be introduced to learning technologies because invariably they will be exposed to learning technologies to attain new skills, knowledge, and attitudes after their formal schooling.

CHAPTER 3

Methodology

Introduction

The information presented in this chapter includes survey development, survey design, pilot study, selection of subjects, implementation, data analysis, and limitations.

The quantitative methodology used was a survey. This method was selected because it was a way for respondents to study the questions and also give time, if needed, for organizational inquiry into the learning technologies used by CVTC Electromechanical graduates and the graduates' primary learning technology utilizations.

Survey Development

This survey was developed using the information discovered in the review of literature surrounding learning technologies, workers interacting with technology, and lifelong learning. The survey construction was based on the research questions. The research questions as they relate to the survey questions are as follows:

Research Question	Survey Item
1. Access for CVTC Electromechanical graduates to engage in learning opportunities through the means of the organization anytime, anywhere, and at the discretion of the learner	5-7
2. Learning technologies employed at manufacturing locations	8
3. The frequency in which CVTC Electromechanical graduates engage in self-directed learning efforts or individual learning practices	9

4. Aptitude of CVTC Electromechanical graduates to engage in individual learning practices	10-11
5. Aptitude of CVTC Electromechanical graduates to engage in individual learning practices that are technology-based	12
6. Graduates' abilities to adapt to four levels of technology	13
7. Primary utilization of learning technologies	14
8. Combinations of learning technologies and delivery methods	15

The survey was developed to maintain respondent confidentiality. The initial survey questions were designed to solicit demographics about CVTC Electromechanical graduates, the employer, and type of manufacturing business.

Survey Design

The survey questions derived information surrounding employer demographics, individual learning practices of CVTC Electromechanical graduates at their place of hire, individual learning practices using learning technologies, graduate ability to adapt to technology levels, organizational learning technology access and utilization, and combinations of learning technologies and delivery methods used. The survey questions were arranged according to a broad inquiry of CVTC Electromechanical graduate learning and technology adaptation and expanded to questions that addressed the organization's use of learning technologies. The manner in which the response options were arranged helped the respondent focus from general to specific questioning. The

number of questions was a result of creating enough questions to conclude information for the research questions.

Pilot Study

Occasionally researchers will distribute a pilot survey to determine validity. Prior to attending an Electromechanical Advisory Committee, this survey was e-mailed to committee members in order to prepare them to give feedback and suggestions. This study and survey was then presented to the CVTC Electromechanical Advisory Committee consisting of instructors, graduates, and employers of electromechanical graduates. It was important to determine if the questions were feasible and understandable and whether the survey was directed at the right population; that being the direct supervisors of CVTC Electromechanical graduates. The feedback received was they appreciated the questions with respect to learning technologies, but were also interested in the topics and the internal and external distribution of training that CVTC electromechanical graduates receiving in the workplace. The committee was able to point out questions where more descriptions would be helpful and narrowing of learning technology utilization choices would prevent the overlapping of options.

Selection of Subjects

Surveys were sent to employers as a result of gathered information about employers of CVTC Electromechanical 1992-2002graduates. The specific graduate years selected were chosen by considering the shelf life of hardware and software with a maximum of seven years and rounding up to ten. All employers who hired 1992-2002 electromechanical graduates were potential survey recipients.

Implementation

Participants were selected by collecting CVTC Electromechanical graduate information from the Chippewa Valley Technical College placement office. A phone call was made to each of the manufacturing firms to determine those most knowledgeable of learning technologies in the organization and knowledgeable about direct supervisors of CVTC Electromechanical graduates and also to identify whether CVTC Electromechanical graduates were still employed by their firm. A letter was sent to the supervisors to improve response rates and provide information about the drawing giveaway for returned surveys to emit an initial response motivation. The survey was mailed to the direct supervisors of CVTC Electromechanical graduates, along with a stamped, addressed postcard to enter into a drawing giveaway, which would be mailed back by respondents at the time of mailing back the survey in a return stamped, addressed envelope.

Data Analysis

The data was analyzed using a computerized statistics packaged called SPSS-X. The data is nominal and ordinal in nature and all appropriate descriptive statistics were utilized.

Limitations

The study has several limitations. Although the survey was tested by submitting it to the CVTC Electromechanical Advisory Committee, it remains without documented measures of validity or reliability. Additionally, employers, who have knowledge of the learning technology readiness and self-directed learning practices of CVTC Electromechanical graduates, could have recently changed and have little knowledge

concerning their new employees' technical skills training, learning technologies utilized, or self-directed learning efforts and abilities. Similarly, with a national economic downturn, the employers of the CVTC Electromechanical graduates could be in transition and ultimately have no person available who possesses that knowledge. Finally, the employer list of CVTC electromechanical graduates from the graduating years of 1992-2002 might not be updated for reasons such as CVTC graduates not returning current employer information or not being straightforward about the business in which they are employed. Therefore, the response results could produce limited data and not allow a generalization to the population.

CHAPTER 4

Results and Discussion

Introduction

This chapter will include the results of this study. Information regarding manufacturing companies who were asked to participate, survey returns, demographic information, and item analysis as it relates to the research questions under investigation are presented.

Manufacturing Companies Asked to Participate

CVTC's electromechanical program was contacted and asked to share electromechanical graduate employer information from graduates of the 1992-2002 graduating classes. From that list, there were 42 manufacturing companies that were contacted by phone to participate in the study and receive a survey.

Survey Returns

Of the 42 manufacturing companies that were initially contacted by phone and sent a survey, 23 communicated a response, producing a response rate of 55%. Of the 23 communicating a response, 10 participants completed the survey that was useable with 13 of the 23 responses being employers who either didn't employ CVTC Electromechanical graduates or didn't maintain records on employee education. This therefore represented an effective response rate of 34%.

Demographic Information

The first four questions addressed demographic information such as the type of manufacturing the employer provides, the number of employees located at the manufacturing location, the number of CVTC electromechanical graduates employed at

the manufacturing location, and the job titles of CVTC electromechanical graduates employed within the organization. Of the 10 participants completing the surveys, the following represents the areas of manufacturing as they relate to the first survey question, "What type of manufacturing does your business provide?": web and coating line processes, glass, electronics, finishing equipment, food, small recreational vehicles, and one service company. Employers were also asked to respond to the question, "How many employees are located at your manufacturing location?". Below, Table 1 summarizes the responses:

Table 1

Number of Employees at Manufacturing Locations

Response Categories	Number	Percent
Less than 20 employees	0	0.0
20-100 employees	1	10.0
101-200 employees	2	20.0
201-300 employees	2	20.0
301-400 employees	2	20.0
401-500 employees	1	10.0
More than 500	2	20.0
Total	10	100.0

The third demographic question asked employers to respond to, "How many CVTC electromechanical graduates are employed at your manufacturing location?".

Businesses employing six or more comprised 30% of the responses; five CVTC electromechanical graduates 0 or 0%; four CVTC electromechanical graduates 1 or 10%; three CVTC electromechanical graduates 2 or 20%; two CVTC electromechanical graduates 2 or 20%; and employers with one CVTC electromechanical graduate, 2 or 20%. Table 2 summarizes the responses.

Table 2

Number of CVTC Electromechanical Graduates

Response Categories	Number	Percent
One	2	20.0
Two	2	20.0
Three	2	20.0
Four	1	10.0
Five	0	0.0
Six or more	3	30.0
Total	10	100.0

Lastly, employers were asked to check all the job titles of CVTC electromechanical graduates employed within their organization. The following list represents the job titles of CVTC electromechanical graduates employed at the respondents' manufacturing locations: systems technician, automated manufacturing technician, electromechanical technician, technical support staff, field service technician,

manufacturing technician, metrology technician, maintenance superintendent, debug technician, equipment service technician, and manufacturing engineering technician.

Learning Opportunity Access

One set of the research questions sought to answer the question, "To what degree do CVTC electromechanical graduates have access to learning opportunities that are available anytime, anywhere, and at the discretion of the learner?" Three separate survey questions were used to collect this information. One of the survey questions that addressed this was phrased, "Do the CVTC electromechanical graduate(s), which you employ, have access to learning opportunities that are available anytime?" 80% or 8 of the employers answered "Yes", while 20% or 2 responded by checking "No." Additionally, the next question expanded on this by asking, "Do the CVTC electromechanical graduate(s), which you employ, have access to learning opportunities that are available anywhere?". The results indicated that 60% or 6 answered "Yes", while 40% or 4 answered "No." The third question asked, "Do the CVTC electromechanical graduate(s), which you employ, have access to learning opportunities that are available at the discretion of the learner who wishes to participate?" The responses resulted in 9 or 90% replied by marking "Yes", while 1 or 10% marked "No." Table 3 summarizes these findings.

Table 3

Learning Opportunity Access

Responses	Yes	Percent	No	Percent	Total Percent
Anytime	8	80.0	2	20.0	100.0
Anywhere	6	60.0	4	40.0	100.0
At Discretion of Learner	9	90.0	1	10.0	100.0

Learning Technologies Available in Manufacturing

The following survey question directed an answer to the research question, "What learning technologies are employed at manufacturing locations?", who employ CVTC electromechanical graduates from the graduating years 1992-2002. The survey question addressing the type of learning technologies utilized within manufacturing was divided into two parts. Both parts could potentially and characteristically describe the learning technologies used by employers. One part, in which they could check, asked if they employed learning technologies that record individual knowledge or skill practice and testing information. Employers would check the other part if they utilized learning technologies that didn't record individual knowledge or skill practice and testing information. The responses are summarized in Table 4 below.

Table 4

Learning Technologies Available

Response Categories	Number	Percent
Record individual performance	7	39.0
Don't record individual performance	9	50.0
Other	2	11.0
Total	18	100.0

Frequency of Self-Directed Learning Efforts

Following, the next survey question addressed the research question, "To what degree of frequency do CVTC Electromechanical graduates engage in self-directed learning efforts or individual learning practices?". This was answered by frequency responses to the survey statement, "Individuals from the CVTC Electromechanical program can take part in self-directed learning efforts or individual learning practices." Nine or 90% of the employers responded in the "sometimes" category, while 1 or 10% responded in the "frequently" category. None of the employers responded by checking the "seldom", "never", or "unknown" categories.

Perceived Aptitude in Individual Learning Practices

Survey questions ten and eleven focused on the research question, "What is the perceived aptitude of CVTC Electromechanical graduates engaging in individual learning practices?". Employers were asked to what degree are CVTC electromechanical graduates able to diagnose their own learning needs, formulate their own learning goals,

identify resources for learning, select learning strategies, implement learning strategies, and evaluate learning outcomes based on a scale of "below organizational expectations" to "above organizational expectations." Employer frequencies and their percentages of responses are presented in Tables 5, 6, 7, 8, 9, and 10 that follow:

Table 5

Ability to Diagnose Learning Needs

Response Categories	Number	Percent
Unknown	1	10.0
Below organizational expectations	0	0.0
At organizational expectations	8	80.0
Above organizational expectations	1	10.0
Total	10	100.0

Table 6

Ability to Formulate Learning Goals

Response Categories	Number	Percent
Unknown	0	0.0
Below organizational expectations	1	10.0
At organizational expectations	8	80.0
Above organizational expectations	1	10.0
Total	10	100.0

Table 7

Ability to Identify Resources for Learning

Response Categories	Number	Percent
Unknown	0	0.0
Below organizational expectations	1	10.0
At organizational expectations	7	70.0
Above organizational expectations	2	20.0
Total	10	100.0

Table 8

Ability to Select Learning Strategies

Response Categories	Number	Percent
Unknown	0	0.0
Below organizational expectations	1	10.0
At organizational expectations	8	80.0
Above organizational expectations	1	10.0
Total	10	100.0

Table 9

Ability to Implement Learning Strategies

Response Categories	Number	Percent
Unknown	0	0.0
Below organizational expectations	2	20.0
At organizational expectations	7	70.0
Above organizational expectations	1	10.0
Total	10	100.0

Table 10

Ability to Evaluate Learning Outcomes

Response Categories	Number	Percent
Unknown	1	10.0
Below organizational expectations	2	20.0
At organizational expectations	7	70.0
Above organizational expectations	0	0.0
Total	10	100.0

Means and standard deviations were calculated based on the employers' perceptions of the graduates' ability to engage in the six individual learning practice areas of diagnosing learning needs, formulating learning goals, identifying resources for learning, selecting learning strategies, implementing learning strategies, and evaluating learning outcomes. Assigning a number to each degree response, 1="below organizational expectations", 2="at organizational expectations", and 3="above organizational expectations", these statistics are presented in Table 11:

Table 11

Means and Standard Deviations of Meeting Organizational Expectations in Six Individual Learning Practices

Response Categories	Mean	Standard Deviation
Diagnosing learning needs	2.11	.33
Formulating learning goals	2.00	.47
Identifying resources for learning	2.10	.57
Selecting learning strategies	2.00	.47
Implementing learning strategies	1.90	.57
Evaluating learning outcomes	1.78	.44

Employers were also asked about their observations overall in the capability of individuals from the CVTC Electromechanical program to engage in individual learning practices. The mean for graduates taking part in self-directed learning efforts was 3.10 (between "sometimes" and "frequently") with a standard deviation of .32. Their responses overall follow in Table 12:

Table 12

Overall – Capable of Engaging in Individual Learning Practices

Response Categories	Number	Percent
Strongly agree	1	10.0
Agree	8	80.0
Neutral	1	10.0
Disagree	0	0.0
Strongly disagree	0	0.0
Total	10	100.0

Perceived Aptitude in Technology-Based Individual Learning Practices

Survey question twelve addressed the research question, "What is the perceived aptitude of CVTC Electromechanical graduates to engage in individual learning practices that are technology-based?". This question was divided into two parts where employers provided a response to the ability of CVTC electromechanical graduates to utilize learning technologies that were over an intranet or the Internet and also their ability in utilizing those that weren't over an intranet or the Internet. Employers scaled their responses in the categories of "cannot utilize" to "utilizes without assistance." With respect to being able to utilize training not on an intranet or the Internet, their reactions were 1 or 10% could utilize with assistance, 9 or 90% could utilize without assistance. In referring to the aptitude of graduates to utilize learning technologies that involved an intranet or the Internet, 2 or 20% can utilize with assistance and 8 or 80% can utilize

without assistance. In the "Other" learning technology category, only one respondent indicated a graduate(s) could utilize other technologies without assistance.

Ability to Adapt to Technology Levels in Manufacturing

Not only were employers asked about the individual learning practices as they related to technology but were also asked to respond to a survey question that focused on their ability to adapt to four levels of technology interaction: . Employers' responses targeted towards the research question, "To what degree are the CVTC electromechanical graduates able to adapt in a manufacturing environment corresponding to the four different levels of technology interaction?" Employers were asked to respond to a statement divided into three parts. The first part employers scaled their responses to the ability of CVTC electromechanical graduates to adapt to proprietary application programs. These proprietary applications were described as applications made or customized for the organization's needs to process transactions, complete or check records in a database, or use for specialized decision-making. The second part of the question addressed the degree to which CVTC electromechanical graduates could utilize applications software such as word processing, spreadsheets, databases, project management, or telecommunications programs, and in some cases, using it in specialized or unique ways. The final and third part of the question investigated the degree to which CVTC electromechanical graduates could adapt to systems and networks. Tables 13, 14, and 15 below summarizes the findings:

Table 13

Ability to Adapt to Technology Level - Proprietary Application Programs

Response Categories	Number	Percent
Cannot utilize	1	10.0
Utilize with assistance	2	20.0
Utilize without assistance	7	70.0
Unknown	0	0.0
Total	10	100.0

Table 14

Ability to Adapt to Technology Level - Applications Software

Response Categories	Number	Percent
Cannot utilize	0	0.0
Utilize with assistance	4	40.0
Utilize without assistance	6	60.0
Unknown	0	0.0
Total	10	100.0

Table 15

Ability to Adapt to Technology Level - Systems and Networks

Response Categories	Number	Percent
Cannot utilize	1	10.0
Utilize with assistance	5	50.0
Utilize without assistance	4	40.0
Unknown	0	0.0
Total	10	100.0

Primary Utilization of Learning Technologies

The second to last survey question elicited findings to the research question, "What is the primary utilization of learning technologies of manufacturing firms where CVTC electromechanical graduates are employed?". This survey question was arranged so that employers could check all the purposes that applied for three separate learning categories. The learning technology purposes were divided into category purposes of drill and practice, troubleshooting and diagnostic, testing, review, lecture/classroom, and not used. Employers could respond to learning technology categories of CBT or CAI, Internet or intranet-based training, or another category that could be self-labeled.

CAI/CBT is used for multiple purposes. The results indicated that for the CAI/CBT and drill and practice combination, 30% (3) responded to using for drill and practice, while 70% (7) don't use this method. For the CAI/CBT and troubleshooting and diagnostic combination, 80% (8) responded to using for this purpose, while 20% (2)

don't use CAI/CBT for this purpose. In the CAI/CBT and testing combination, 40% (4) responded to using CAI/CBT for the purposes of testing, while 60% (6) don't. For the CAI/CBT and review combination, 50% (5) responded to using this learning technology for this purpose, while 50% (5) don't use for this purpose. In the CAI/CBT and lecture/classroom category, 30% (3) use this learning technology for this purpose, while 70% (7) do not. Only one employer reported not using CAI or CBT for any purpose. Table 16 summarizes these findings:

Table 16

CAI/CBT Learning Technology and Primary Utilizations

Response Categories	Percent used/checked	Percent not used/not checked	Total Percent
Drill and practice	30.0	70.0	100.0
Troubleshooting and diagnostic	80.0	20.0	100.0
Testing	40.0	60.0	100.0
Review	50.0	50.0	100.0
Lecture/Classroom	30.0	70.0	100.0
Not used	10.0	90.0	100.0

Similarly, intranet or Internet based training is used for multiple purposes. In the intranet/Internet and drill and practice grouping, 20% (2) of the respondents use for this purpose, and 80% (8) don't use for this purpose. For the intranet/Internet and troubleshooting and diagnostic grouping, 70% (7) of the respondents use for this purpose,

while 30% (3) do not. In the testing and intranet/Internet grouping, 50% (5) use for this purpose while 50% (5) do not. Closely matched is the intranet/Internet and review grouping, where 40% (4) use for the purposes of review, while 60% (6) do not. For the intranet/Internet and lecture/classroom grouping, 30% (3) of the respondents indicated they use this learning technology for this purpose, while 70% (7) don't use for this purpose. Only two employers reported not using this learning technology for any purpose at all. Table 17 summarizes these findings:

Table 17

Intranet/Internet Learning Technology and Primary Utilizations

Response Categories	Percent used/checked	Percent not used/not checked	Total Percent
Drill and practice	20.0	80.0	100.0
Troubleshooting and diagnostic	70.0	30.0	100.0
Testing	50.0	50.0	100.0
Review	40.0	60.0	100.0
Lecture/Classroom	30.0	70.0	100.0
Not used	20.0	80.0	100.0

The last category, "other", was marked by only one employer who listed a learning technology of a technical network that is used for troubleshooting and diagnostic, review, and lecture/classroom purposes.

Learning Technology and Delivery Method Combinations

The final survey question sought to provide findings for the research question, "What combinations of learning technologies and delivery methods are used at manufacturing locations that employ CVTC electromechanical graduates?" Employers could check all delivery methods that applied in the categories of CBT or CAI, intranet or Internet-based training, and a category identified as "other" that could be self-labeled. The delivery methods within these categories available to be checked were lecture/classroom, self-paced, coaching or on-the-job, and other.

The results show that CAI/CBT is used in multiple delivery methods. The CAI/CBT grouping showed that 60% (6) employers use it in the classroom, while 40% (4) do not. Following, the CAI/CBT grouping showed that 60% (6) use CAI/CBT as a self-paced method of delivery, while 40%(4) do not. For the CAI/CBT and coaching/on-the-job grouping, 70% (7) use it in this delivery method, as 30% (3) do not. There weren't any employers who indicated they used CAI/CBT in any other delivery situation. Table 18 provides the aforementioned information below:

Table 18

CAI/CBT Learning Technology and Delivery Method Utilizations

Response Categories	Percent used/checked	Percent not used/not checked	Total Percent
Lecture/Classroom	60.0	40.0	100.0
Self-paced	60.0	40.0	100.0
Coaching or on-the-job	70.0	30.0	100.0
Other	0.0	100.0	100.0

Intranets and the Internet are also used in a variety of delivery methods. In a lecture/classroom situation, 30% (3) use an intranet or the Internet while 70% (7) don't use this technology for this delivery method. In the intranet/Internet and self-paced combination, 70% use this learning technology in this situation, while 30% (3) don't use in this situation. When in a coaching or on-the-job situation, 50% (5) use an intranet/Internet while 50% (5) do not. There weren't any other delivery methods identified where the intranet/Internet is used. Table 19 summarizes these results:

Table 19

Intranet/Internet Learning Technology and Delivery Method Utilizations

Response Categories	Percent used/checked	Percent not used/not checked	Total Percent
Lecture/Classroom	30.0	70.0	100.0
Self-paced	70.0	30.0	100.0
Coaching or on-the-job	50.0	50.0	100.0
Other	0.0	100.0	100.0

In the last category of "other", only one employer responded with another technology used in the "other" delivery methods set forth in the survey. This delivery method was labeled as a forum, with a provided description of a group of technical scientists, engineers, and technicians that discuss various issues and technical papers are reviewed.

Discussion

Various statements can be made that ties together the findings and the review of literature. More often than not, the respondents are offering learning opportunities by the way of various learning technologies in a manner where they are available anytime, anywhere, and at the discretion of the learner. By doing so, it is providing a common advantage above other delivery methods in many respects. E-learning is allowing learning to be "learner-controlled and learner-focused", "to take place at the worksite", and "in the context of an individual's job responsibilities" (ASTD & NGA, 2001, p.9).

The respondents to this survey, who are mostly manufacturing firms, are in a position to experience the advantages of the learning technologies mentioned by Marquardt and Kearsley (1999) such as just-in-time training, learner-controlled, cost-effective, self-paced and user-friendly, accessible over wide geographical areas, and uniform in content and delivery. By manufacturing firms choosing to offer these learning technologies, they are building in a type of self-directed learning that has allowed CVTC electromechanical graduates to make successful transfers to other technology uses, mostly without assistance, such as proprietary application programs, applications software, and systems and networks. These same learners have been able to adopt individual learning practices such as diagnosing their own learning needs, identify resources for learning, and implement learning strategies.

Summary

Various data and findings have been brought forth in this chapter. Learning technology information as it relates to the majority of manufacturing respondents has been presented along with CVTC electromechanical graduate characteristics such as evidence of being self-directed learners as well as their learning technology and self-directed learning habits to other technology tasks used in the manufacturing locations. All three of the main areas are represented by these respondents in that there is clear evidence of the following three components being present at the same time for the CVTC electromechanical graduate workgroup: learning technologies, learning technology readiness, and self-directed learning and desirable individual learning practices.

CHAPTER 5

Summary, Conclusions and Recommendations

Introduction

In this chapter, the study will be summarized and conclusions based on the results will be discussed. Finally, recommendations related to this study will be presented.

Summary

The purpose of this investigation was to collect data surrounding the learning technology readiness, individual learning practices, and use of various learning technologies by CVTC electromechanical graduates from the graduating years of 1992-2002. After a review of literature, a survey was constructed and presented to a CVTC Electromechanical Advisory Committee. Following their input, modifications were made. Surveys were sent to manufacturing employers of 1992-2002 CVTC electromechanical graduates who were contacted by phone in order to identify survey participants who were willing to participate and/or the names to which the survey mailings should be addressed. Survey respondents included those who completed the surveys and also those who either didn't employ CVTC electromechanical graduates or didn't keep records on the education of those employed.

Survey data was analyzed using SPSS software. Descriptive statistics such as frequency counts, percentages, means, and standard deviations were reported from the survey responses.

Conclusions

There were eight research questions addressed by this investigation. Following, each question is restated and the conclusions brought forth for each.

Research Question Number One: To what degree do CVTC Electromechanical graduates have access to learning opportunities through the means of the organization that are available anytime, anywhere, and at the discretion of the learner?

The study found that the respondents were offering learning opportunities anytime (80%), anywhere (60%), and at the discretion of the learner (90%). By following this approach, these respondents are creating a self-directed learning environment, which creates individual and organizational benefits.

Research Question Number Two: What learning technologies are employed at manufacturing locations?

The study found that the manufacturing locations in which CVTC electromechanical graduates are employed utilize learning technologies that both record and don't record individual performance. Some of these technologies are CAI/CBT, Intranet/Internet, and Forums.

Research Question Number Three: To what degree of frequency do CVTC Electromechanical graduates engage in self-directed learning efforts or individual learning practices?

Employers mostly agree that CVTC electromechanical graduates sometimes take part in self-directed learning efforts, as opposed to frequently, seldom, never, or unknown.

Research Question Number Four: What is the perceived aptitude of CVTC Electromechanical graduates engaging in individual learning practices?

The study found that employers mostly agree CVTC electromechanical graduates from this population are capable of engaging in individual learning practices such as

diagnosing their own learning needs, formulating their own learning goals, identifying resources for learning, selecting learning strategies, implementing learning strategies, and evaluating learning outcomes. CVTC electromechanical graduates weakest aptitude was implementing learning strategies and evaluating learning outcomes.

Research Question Number Five: What is the perceived aptitude of CVTC Electromechanical graduates to engage in individual learning practices that are technology-based?

The findings were that CVTC electromechanical graduates could engage in CBT/CAI and intranet/Internet technology-based learning practices most of the time without assistance.

Research Question Number Six: To what degree are the CVTC electromechanical graduates able to adapt in a manufacturing environment corresponding to different levels of technology interaction in terms of proprietary application programs, applications software, or systems and networks?

CVTC electromechanical graduates of this population can utilize proprietary application programs, applications software, and systems and network without and without assistance. In only one response were CVTC electromechanical graduates unable to correspond to different levels of technology; In this case it was systems and networks technology level where the CVTC electromechanical graduates(s) were unable to utilize.

Research Question Number Seven: What is the primary utilization of learning technologies of manufacturing firms where CVTC electromechanical graduates are employed?

The study found that the manufacturing locations in which CVTC electromechanical graduates are employed, utilize CAI/CBT for the following purposes in the following sequence, from the most to the least utilized: troubleshooting and diagnostic, review, testing, and equally, lecture/classroom and drill and practice. A few do not use CAI/CBT. Additionally, the intranet/Internet is used for the following purposes in the following sequence, from the most to the least utilized: troubleshooting and diagnostic, testing, review, lecture/classroom, and drill and practice. A few do not use an intranet or the Internet.

Research Question Number Eight: What combinations of learning technologies and delivery methods are used at manufacturing locations that employ CVTC electromechanical graduates?

Along with the identification of the learning purposes, the delivery methods in which CAI/CBT and intranet/Internet are utilized were discovered. The study found that the manufacturing locations in which CVTC electromechanical graduates are employed, utilize CAI/CBT in the following delivery situations, in the following sequence, from the most to the least utilized: coaching or on-the-job, followed equally high in self-paced and lecture/classroom deliveries. The intranet/Internet technologies were used highly in self-paced situations, followed by coaching or on-the-job, and with a smaller amount of lecture/classroom utilization.

Overall, the conclusions as they refer to the statement of problem are that CVTC electromechanical graduate are learning at CVTC in a manner that is supportive or consistent with the workplace.

Recommendations

Some recommendations are brought forth to those who are stakeholders in the education and training of CVTC electromechanical graduates.

For CVTC Electromechanical Graduates and Students. CVTC electromechanical graduates and students should seek out learning technologies that encourage and are inherent of self-directed learning characteristics. The results of the study showed that when learning technologies were involved, characteristics of self-directed learning were also present as well as the ability to adapt to other workplace technologies. Through the use of interactive CD-ROM's, web-based training, and even technical forums, users are able to adapt and be leaders in utilizing employer technologies that are conducive to learning organizations. By choosing to learn in advanced manners, electromechanical students and graduates play a directive role in choosing their learning activities and make choices based on their experiences (Groneman & Kaser, 1995). Additionally, these practices ensure a path of integrating learning with work. Employees who follow this process emulate a model for lifelong, continuous learning (Groneman & Kaser, 1995), which seems to have a positive impact on healthy learning organizations and the success of our state and national economies.

For Businesses and Educators. For businesses and educators involved in the training and education of CVTC electromechanical graduates and students, employing learning technologies has multi-fold benefits. Employees and students will be more self-directed towards their learning goals and will be able to identify resources to keep up with fast-paced change in a way that meets employer and employee needs. Learning technologies will also foster a characteristic of employees integrating learning with work

in a self-directed manner. Educators and businesses should consider an evaluation mechanism to purposefully collaborate on the use of learning technologies in preparation programs and in the workplace so that students are learning in a manner that is consistent or above the workplace needs. This collaboration would be above the activities that arise when CVTC is providing customized training for industry. Additionally, the CVTC electromechanical program can use this as a program marketing point in that students are prepared with learning technologies that are consistent with the workplace. Not only will the organization benefit from integrating technology into work tasks but will also benefit from integrating technology into learning such as fostering the dissemination of information.

For Future Studies. Reflecting on the outcomes of this study, future studies may want to consider various changes and improvements.

It was beneficial to have the CVTC Electromechanical Advisory Committee. In order to ensure that specific program matches to the workplace can be identified, it may be helpful to identify the specific tasks where CVTC electromechanical students and graduates are utilizing learning technologies and where learning progress is made, although this could be time consuming on the part of the respondent since it may involve a deeper level of knowledge about the learning technology use.

Another probing improvement would be a deeper level of investigation into the types of learning technologies used so that the CVTC electromechanical program could identify specific learning technologies to consider for their program. For example, having knowledge of PowerPoint that have hyperlinks to an intranet or the Internet,

would help educators in knowing technology competencies to consider in the CVTC electromechanical program.

Another consideration would be to match the learning technologies identified in question #8 with those in question #12, #14, and #15.

Another item to consider is the wording of the survey questions. Some of the survey questions could have been construed in a different manner such as survey question #9 where "can take part" was used. It's possible that respondents could have interpreted this as an ability from the individual perspective or as an access question from the employer perspective.

A final reflection would be concerning the formatting of bullets. It would be favorable to avoid open bullets such as those used in survey question #8. Open bullet points in question #8 potentially caused confusion where some respondents considered those as characteristics they were to identify.

Summary

Many reasons for seeking and providing learning technologies exist. The constant of change now requires education to not transmit what is known, but to develop the skills of inquiry (Knowles, 1975). In addition, learning technologies that are available anytime, anywhere, and at the discretion of the learner, are a large and increasing method of providing self-directed learning. Furthermore, sections of business are expecting the use of technological training methods to increase in the future. Vitally important, is the role that learning technologies can help us in keeping pace to meet our national growth needs.

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APPENDIX A

Survey Letter

October 28, 2002

Dear:
I am a UW-Stout graduate student in the M.S. Career and Technical Education program. In an effort to help CVTC deliver superior, progressive technical education, I am asking your help in completing the enclosed voluntary survey.

I am contacting you to answer survey questions to the best of your knowledge concerning the areas of Chippewa Valley Technical Electromechanical Graduates' individual learning practices with various learning technologies, their ability to adapt to technologies at various levels, your organization's learning technology utilization and access, and combinations of learning technologies and delivery methods used.

Please return the survey in the enclosed envelope by Friday, 11/22/02. Your individual answers will not be identified. Identifying numbers on the survey are merely used to indicate who has responded so that follow-up activities can be completed.

As a way of saying thanks for your help, I've enclosed a self-addressed, stamped postcard to return when you have completed the survey that will be entered into a drawing to win a prize of (2) movies passes, a Packer or Viking t-shirt, or free car wash tokens nearest your location.

The results of the survey will identify a presence or lack of a pattern within manufacturing employers of CVTC Electromechanical Graduates so that information will be available to aid in making future decisions in the use of technology-based learning within CVTC's Electromechanical program. It will do this in a manner that will help community members attain life-long learning skills which requires the community, including business and education, to create learning opportunities that are relevant to community contexts By providing technology-driven teaching methods, CVTC can live up to their mission of delivering superior, progressive technical education If the research demonstrates that learning technology uses in electronic occupations and programs are prevalent, this may be a way for our Wisconsin region to show that our workforce is motivated, skilled, and adaptable, paving the way for competitive positioning when new economic development opportunities emerge. By implementing learning technologies where students and employees can self-direct, CVTC can provide technical training that responds to the findings of the Governor's Task Force on Technical Education, in which the findings show that greater access to quality technical training is key to our economic success

Thank you very much for helping with this study. If you would like to be notified of the survey results, please send an email to martineaub@uwstout.edu with the email subject: Survey Results Request. If you should have any questions regarding the survey, please contact Brenda Martineau, the primary researcher at 715-726-1654.

Sincerely,

Brenda L. Martineau
UW-Stout Graduate Student – M.S. Career and Technical Education

APPENDIX B

Drawing

Ticket #

Free Drawing

As gratitude for completing the UW-Stout graduate study survey, please complete the following information on this postcard and send in by 11/13/02 so that you may be entered in a drawing to take place on 11/15/02. You will be notified by 11/15/02 if you have won one of the following free drawing prizes:

Name _____
Address _____
City _____ State ____ Zip _____
Phone (_____)_____ Best Time to Reach _____

1st Prize: (2) Movies Passes
2nd Prize: T-shirt (Packer or Viking)
3rd Prize: Two car wash tokens

APPENDIX C

Survey Instrument

Employer Survey
Chippewa Valley Technical College (CVTC) Electromechanical Graduates Technical Skills Training, Learning Technologies, and Individual Learning Practices

Survey Purpose: The purpose of this survey is to identify the learning technology readiness and use of various learning technologies by a specific population. Particularly, we are collecting information from the training department, human resource department, or direct supervisors of graduates (whoever would be most familiar with learning technology language and its utilization at your organization) from the 1992-2002 CVTC Electromechanical associate degree program.

Survey Instructions: Please read, sign, and send back with this survey the enclosed consent form. Human Resource personnel, Training Department personnel, or direct supervisors of graduates (whoever would be most familiar with learning technology language and its utilization at your organization), please take a few minutes to fill out this survey on behalf of individuals who graduated from the CVTC Electromechanical program and mail back in the enclosed stamped, addressed envelope. Please answer completely as the results of the data will be important to the community and CVTC in attaining vital information about their electromechanical graduates and will help the technical college, graduates, and employers in several ways. If you have any questions, please contact Brenda Martineau, the primary researcher, at (715)726-1654.

1. What type of manufacturing does your business provide? (Please write a short description of product manufactured.)

_____

_____

_____

2. How many employees are located at your manufacturing location? (Please check only one.)

- ☐ A. Less than 20 employees
- ☐ B. 20-100 employees
- ☐ C. 101 to 200 employees
- ☐ D. 201 to 300 employees
- ☐ E. 301 to 400 employees
- ☐ F. 401 to 500 employees
- ☐ G. More than 500 employees

3. How many CVTC electromechanical graduates are employed at your manufacturing location? (Please check only one.)

- ☐ A. 1
- ☐ B. 2
- ☐ C. 3
- ☐ D. 4
- ☐ E. 5
- ☐ F. 6 or more

4. Please check all the job titles of CVTC electromechanical graduates employed within your organization. (Check all that apply.)

- ☐ A. Systems Technician
- ☐ B. Automated Manufacturing Technician
- ☐ C. Electromechanical Technician
- ☐ D. Technical Support Staff
- ☐ E. Field Service Technician
- ☐ F. Other_____

5. Do the CVTC electromechanical graduate(s), which you employ, have access to learning opportunities that are available anytime?

- ☐ A. Yes
- ☐ B. No

6. Do the CVTC electromechanical graduate(s), which you employ, have access to learning opportunities that are available anywhere?

- ☐ A. Yes
- ☐ B. No

7. Do the CVTC electromechanical graduate(s), which you employ, have access to learning opportunities that are available at the discretion of the learner who wishes to participate?

- ☐ A. Yes
- ☐ B. No

8. Check the applicable learning technologies employed at your facility.

☐ A. Learning technologies that record individual knowledge or skill practice and testing information. Other characteristics might include:
  - With or without sound, multimedia, and/or animation
  - Might provide testing
  - Could be a PowerPoint presentation
  - Could be an internet or intranet computer program
  - Could be a vendor supplied computer program
  - Could be a CD ROM/ Diskette

☐ B. Learning technologies that don't record individual knowledge or skill practice and testing information. Other characteristics might include:
  - With or without sound, multimedia, and/or animation
  - Doesn't provide any kind of testing
  - Could be a PowerPoint presentation
  - Could be an internet or intranet computer program
  - Could be a vendor supplied computer program
  - Could be a CD ROM/ Diskette

☐ C. Other _____

9. Individuals from the CVTC Electromechanical program can take part in self-directed learning efforts or individual learning practices.

- ☐ A. Frequently
- ☐ B. Sometimes
- ☐ C. Seldom
- ☐ D. Never
- ☐ E. Unknown

10. To what degree are CVTC electromechanical graduates able to…	Unknown	Below organizational expectations	At organizational expectations	Above organizational expectations
a. diagnose their own learning needs?	0	1	2	3
b. formulate their own learning goals?	0	1	2	3
c. identify resources for learning?	0	1	2	3
d. select learning strategies?	0	1	2	3
e. implement learning strategies?	0	1	2	3
f. evaluate learning outcomes?	0	1	2	3

11. Overall, the individuals from the CVTC Electromechanical program are capable of engaging in individual learning practices such as diagnosing their own learning needs, formulating their own learning goals, identifying resources for learning, etc.

- ☐ A. Strongly agree
- ☐ B. Agree
- ☐ C. Neutral
- ☐ D. Disagree
- ☐ E. Strongly disagree

12. To what degree are the CVTC electromechanical graduates able to utilize…	Unknown	Cannot Utilize	Utilizes With Assistance	Utilizes Without Assistance
a. computer-based training or computer-assisted instruction for learning (special training programs on a computer, not over an Intranet or the Internet)?	0	1	2	3
b. internet or intranet-based training with or without animation for learning?	0	1	2	3
c. Other _____?	0	1	2	3

13. To what degree are the CVTC electromechanical graduates able to adapt in a manufacturing environment corresponding to …	Unknown	Cannot Utilize	Utilizes With Assistance	Utilizes Without Assistance
a. proprietary application programs (applications made or customized for the organization's needs to process transactions, complete or check records in a database, or use for specialized decision-making)?	0	1	2	3
b. applications software (using off-the-shelf software such as word processing, spreadsheets, databases, project management, or telecommunications programs, and in some cases, using it in specialized or unique ways.)?	0	1	2	3
c. systems and networks (computer networks, etc.)?	0	1	2	3

14. What is the primary utilization of learning technologies by CVTC electromechanical graduates when using… (Please check all the purposes that apply for each learning technology category)

	Learning Technology Purpose					
Learning Technology Category	**Drill and Practice Purposes**	**Troubleshooting and Diagnostic**	**Testing**	**Review**	**Lecture /Classroom**	**Not Used**
a. computer-based training or computer-assisted instruction for learning, either provided by your organization or provided by a vendor?						
b. internet or intranet-based training for learning, either provided by your organization or provided by a vendor?						
c. Other_____?						

15. For each learning technology, please check all the delivery methods utilized by CVTC electromechanical graduates for learning.

Learning Technology Categories	Delivery Methods			
	Lecture/Classroom Place a (✓) for each learning technology category used in lecture/classroom.	**Self-Paced** Place a (✓) for each learning technology category used for self-paced training.	**Coaching or On-the-Job** Place a (✓) for each learning technology category used in a coaching or on-the-job training scenario.	**Other** Place a (✓) for each learning technology category used for other types of delivery methods. Please write the type of delivery method in the box along with the checkmark.
a. Learning technologies such as computer-based training or computer-assisted instruction • With or without sound, multimedia, and/or animation • Might provide testing • Could be a PowerPoint presentation • Could be a vendor supplied computer program • Could be provided on a CDROM/Diskette				
b. Learning technologies such as Internet or Intranet-based instruction. • With or without sound, multimedia, and/or animation • Might provide testing				
c. Other _____ _____ Description:				

☺Thank you for your assistance with this study!
Please return this completed survey in the enveloped provided by _____. Don't forget to complete the drawing giveaway postcard and send with the survey by _____. Drawing will occur on _____.

APPENDIX D

Follow-Up Letter Non-Respondents

November 18, 2002

Dear:

A couple of weeks ago I sent a questionnaire to you that asked about the learning technology readiness and use of various learning technologies by Chippewa Valley Technical College Electromechanical graduates that may be employed at your organization. To the best of my knowledge, it has not yet been returned.

I am writing again because of the importance that your questionnaire has for helping to get accurate and complete results. Although I've sent many questionnaires, it's only by hearing from nearly everyone in the sample that I can be sure that the results are truly representative.

The information gathered from those who have already responded includes an interesting variety of information regarding learning technologies used in manufacturing. The results of the survey will be useful to the Chippewa Valley Technical College in that it will address research questions such as to what degree are CVTC Electromechanical graduates capable of engaging in individual learning practices or self-directed learning efforts and to what degree are CVTC Electromechanical graduates capable of engaging in individual learning practices that are technology-based.

Please return the survey in the enclosed envelope by Wednesday, 11/27/02. Your individual answers will not be identified.

A few people have responded by saying they don't currently employ CVTC Electromechanical graduates in such positions as maintenance technicians, electromechanical technicians, etc. or that they prefer not to respond. If either of these concerns applies to you, please let me know by returning the blank questionnaire and indicating the reason for its return.

Thank you very much for helping with this study. If you would like to be notified of the survey results, please send an email to martineaub@uwstout.edu with the email subject: Survey Results Request. If you should have any questions regarding the survey, please contact Brenda Martineau, the primary researcher at 715-726-1654.

Sincerely,

Brenda L. Martineau
UW-Stout Graduate Student – M.S. Career and Technical Education