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AN ANALYSIS OF SECONDARY SCHOOL TEACHER ATTITUDES TOWARDS
INSTRUCTIONAL TECHNOLOGY USE IN THE CONTEXT OF MOTIVATION
THEORY

A DISSERTATION SUBMITTED TO

THE FACULTY OF THE GRADUATE SCHOOL

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BY

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I would like to thank my parents, James and Helen Ann Sassen, who have instilled in me an appreciation for investing in an education. I would like to thank my wife LeAnn and my son Trevor whose lives have simultaneously worked to support me and remind me of what is really important in life.

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CHAPTER 1

INTRODUCTION

Purpose and importance of this investigation

This study attempts to determine how instructional technology affects teachers' motivation to work. In so doing, it links together long-standing theories on motivation with relatively new capabilities in the educational workplace.

Technology, understood in a broad sense, has always existed in and contributed to educational settings. Even the simplest tools of chalk, slate, desks, and pencils and papers are materials of technology. Their respective advents changed the environment and procedures of education. Today, the microcomputer is making possible new environments and procedures. How will new capabilities and subsequent shifts in educational methodologies affect the attitudes of the teachers in the workplace? What professional growth situations and proficiencies with technology contribute to teachers' enjoyment of their work in teaching? Are computers and related technology resources changing the workplace of education, the work of education, or both? These are among the questions this study seeks to answer.

Specifically, there are three research questions to this paper:

1. To define usage levels by teachers in the area of instructional technology.
2. To investigate possible relationships between level of technology use and teacher motivation.
3. To suggest implications for supervisor action and staff development programs.

At present, over 98% of schools in the United States give students access to computers as learning devices. Incentives for further inclusion of the microcomputer exist at the federal, state, and local government levels. The power and versatility of the computer are only just beginning to be recognized and implemented in education.

Enormous though its potential is, the computer is but another innovation in the educational workplace. Such is the context in which it is viewed within this study. Acknowledging and using computers as learning tools requires adoption and change just as other innovations have. Thus, this research is important because it recognizes both the benefits of instructional technology and the human response factors in adopting it.

The setting for this investigation is a large public high school district in northwest suburban Chicagoland. District 214 is composed of six high schools. The district has undertaken an enormous investment into instructional technology since 1993. Millions of dollars of equipment have been acquired for the construction of networks, classroom media, and computer labs. In addition, a comprehensive staff development program now structures workshops for ongoing

training for faculty and staff in the district. Thus, it is an ideal setting in which to investigate human response to innovation.

Organization of this paper

There are five chapters to this paper. Chapter 1 provides an introduction to the purpose and scope of this investigation and the history and terminology of instructional technology, Herzberg's motivational theory, and the Concerns-Based Adoption Model. Chapter 2 is a review of research literature related to instructional technology, Herzberg's motivational theory, and the Concerns-Based Adoption Model. Chapter 3 provides a background to the methodology and population of the study and literature and materials from the context of the study. Chapter 4 is an analysis of the data collected from interviews and documents from the study. Chapter 5 provides implications and related suggestions based on the findings of this study.

As technology creates new learning possibilities, it also creates a lexicon of its own. From RAM to ROM, the number of terms and acronyms which technology has created is vast. Thus, to provide clarity and context, this introduction will provide some definitions and background of instructional technology. As there are many terms, the definitions of which may or may not be familiar to the reader, footnotes are supplied in this chapter to facilitate reading. Subsequent chapters will instead use end notes for references. Following the definition of terms, a review of instructional

technology will be given to set an historical perspective to this study.

Definition and Description of Terms

Instructional technology: The Second Edition of the Random House Unabridged Dictionary defines technology as "the branch of knowledge that deals with the creation and use of technical means and their interrelation with life, society, and the environment." In concert with *instructional*, this definition needs to be modified and sharpened. What constitutes the use of instructional technology? Within this paper, instructional technology will refer to the use of hardware and software to access, manipulate, and communicate information in settings where students are learning.

As will be further described in the historical review of technology within this chapter, technology's evolution in the past fifty years has brought with it a wealth of terminology. The use of some of this terminology is necessary within this paper and so it is essential to begin by defining key terms and acronyms. These definitions can be divided into those relating to hardware and those relating to software.

Hardware: Hardware refers to any mechanical, magnetic, or electrical device which comprises a computing system. For this study, two such systems will be included: the microcomputer and its related peripherals, and the graphing calculator.

Microcomputer: The microcomputer now typically includes

a keyboard, CPU[1] , monitor, floppy disk[2], CD ROM drive[3] , and

hard disk drive[4]. Along with the standard keyboard, the most

common input device for directing computer functions and

processes is a mouse[5] . Other peripheral devices, described

below, are often attached to the central computer unit.

Computers today are typically purchased in one of three .

varieties: servers, desktop models, and laptops. Servers are

high capacity, high speed computers which act to store and

distribute information within networks[6] . Servers may

function without attached keyboards or monitors and may only

be accessible remotely through a network. Desktop model

computers, so named because all of the needed parts can be

configured within limited workspace, are typically comprised

of the six basic components described above. Laptops are

non-modular devices which typically weigh fewer than ten

pounds. To conserve space, these computers often have

reduced-size keyboards and substitute trackballs, touchpads,

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[1] CPU is an abbreviation for Central Processing Unit. These units, also called chips, are semiconductive materials that direct computer processes through the storage and transfer of small amounts of electrical current.

[2] Floppy drives house floppy disks. These portable storage units were originally 5.25″ square and made of bendable (floppy) plastic which surrounded a thin magnetic disk. The successor of this floppy disk is the 3.5″ floppy disk. Current floppy disks can hold 1.5 megabytes of data.

[3] CD-ROM is an acronym for "Compact Disc Read-Only Memory. Information on this type of medium can be read but not edited or rewritten. Most computers today include an internal drive for reading this type of media.

[4] Hard drives are storage areas which record data. Data is stored on hard drives in the same fashion as with floppy disks. Hard drives in new computers today range in size from 250 Mb (megabytes) to over 2 Gb (gigabytes).

[5] A mouse is a control device which directs the location of the cursor on the computer screen.

[6] A network is any connected group of computers which share files and/or printers.

or small joysticks for mice.

Peripherals: While microcomputers are at the center of the hardware in instructional technology, there is a wide range of devices which can send information to or receive information from microcomputers. These devices are commonly called *peripherals*.

The oldest and most common peripheral associated with computers is the printer. Printers today are sold in one of three varieties: dot matrix, ink jet, and laser printers. Dot matrix printers use a technology similar to typewriters in stamping small metal prods onto ink ribbons, producing text on paper. These are the oldest variety of computer printers. Due to their relatively poor resolution and slow print speed, dot matrix printers are being used less and less. They continue to be purchased and used, however, for situations which require printing triplicate forms. Ink jet printers, in lieu of this stamping, spray microscopic bursts of ink onto the paper. These printers, while still slow, provide significantly better resolution and sharpness than dot matrix printers. Many ink jet printers are now capable of resolutions equal or greater than 600 dpi[7]. Some ink jet printers are capable of producing monochrome (black and white) or color documents. Laser printers use a technology similar to copier machines. Toner ink is heated and then electromagnetically applied and fastened to the paper. These printers are capable of producing high resolution output with speeds of eight pages per minute or more.

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[7] DPI is an acronym for dots per inch.

Laserdics[8] and CD-ROMs[9] are storage media which can be accessed and manipulated by computers. Laserdiscs contain still and video images that can be cataloged, sequenced, and played at controlled rates with computers. In some cases, images on the laserdisc are summoned with the use of bar code readers. The bar code reader is passed over the catalog number of a still image or movie and the laserdisc automatically scans to that image. CD-ROMs contain catalogs of images, movies, and text and also hold actual governing programs which direct the access of the media on the CD. Unlike laserdisc data, CD-ROM data is in computer data format and can be copied to and from floppy disks and hard drives. Many popular encyclopedias, almanacs, and atlases are now available in CD-ROM format.

Presentations can be made with computers using LCD[10] devices. These take the form of plates which rest atop overhead projectors or standalone backlit projection units. Computer video signals can be fed through these devices and viewed by large audiences. Audio speakers can be connected to the audio port of many computers so that sound is audible in larger rooms.

Scanners and digital cameras are used in obtaining graphics and saving them into computer data format. Scanners allow for pictures and text on paper to be digitized and

[8] Laserdics are high capacity media which can store hours of full motion video and sound in digital format. Laserdiscs are the same diameter as conventional phonograph records.

[9] CD-ROM is an acronym for "Compact Disc Read-Only Memory. Information on this type of medium can be read but not edited or rewritten. A CD-ROM can hold 630 megabytes of data.

[10] LCD is an acronym for Liquid Crystal Display. This technology is best recognized as the display type used in common commercial calculators.

saved in one of several picture file formats. Through the use of OCR[11] software, scanners can read text on paper and immediately incorporate it into word processing documents. Digital cameras take pictures in similar fashion to traditional cameras but save images to a microchip instead of film. In lieu of developing film, images are then downloaded from the camera directly into the computer.

There are other devices which can directly send data to computers. Various scientific probes can be used in coordination with microcomputers to directly record measurements. Using a computer interface device, measurements such as velocity, pH, mass, pressure, temperature, and force can be sent directly to a computer. In addition, through a special type of data signals known as MIDI[12], musical instruments can exchange information with computers. The pitch, duration, and loudness of musical notes are recorded directly off of a musical instrument and then can be sent back to the instrument for playback.

Telecommunications equipment such as modems[13] and fax machines are now used to provide computer users with opportunities to access and share data and information. The Internet, a worldwide database of information from educational, government, organizational, and commercial

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[11] OCR is an acronym for Optical Character Recognition. This is the standard protocol for interpreting text as actual text, as opposed to a picture, on a scanner.

[12] MIDI is an acronym for Musical Instrument Digital Interface. This is a universal signal protocol which allows musical instruments to send data signals that convey the duration, pitch, and intensity of musical notes.

[13] Modems are devices which allow computers to use telephone line communications to send and receive data.

sources, is accessible via telecommunications equipment. People with access to the Internet can view information in text, picture, and audio form. They can send electronic mail to one another and send computer files to one another.[14]

Graphing calculators: The second piece of hardware which is included in this study is the graphing calculator. This device can not be considered a computer peripheral and thus is described separately. Like standard text-numeric calculators, these devices are primarily used to input and manipulate numbers and solve mathematical equations. Beyond text-numeric calculators, however, graphing calculators are used to convert numerical equations and relationships into visual, graphical format. They have become common tools within high school mathematics classes. Newer varieties can be hooked to LCD plates such that their display can be shown in presentation format.

Software: Software is defined here as programs used to direct computer operations. All computers receive commands and organize their processes via software. Software can be divided into two distinct types: operating systems and applications.

There are currently six operating systems which are used with microcomputers within educational settings.

1. DOS: an acronym for Disk Operating System. This operating system was written by Microsoft Corporation

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[14] Among the protocols supported by the Internet are SMTP, HTTP, and FTP. SMTP or Simple Mail Transfer Protocol, is the signal form that provides e-mail communications between Internet users. HTTP or Hypertext Transfer Protocol is the set of commands that allows for the viewing of information on the Internet or World Wide Web. FTP or File Transfer Protocol, is the set of signals that allows for downloading and transferring computer files through the Internet.

and formerly was used as the basic operating system for all machines using Intel Corporation microprocessors[15] .

2. Mac OS: written by Apple Computer, Inc. as the operating system for its line of Macintosh computers.
3. OS/2: written by International Business Machines, this operating system works with Intel-based microprocessors.
4. PRO DOS: written by Microsoft Corporation, this operating system is used on Apple II and Apple IIgs computers. Neither of these computers is still being manufactured, though schools are still using both models.
5. Windows OS: written by Microsoft Corporation. The Windows operating system is the most popular operating system for computers with Intel processors. Windows95 is the current version of this software used to direct the operations of personal computers. Windows NT is a separate version of the Windows operating system designed to manage and secure networks.
6. UNIX: this operating system, which has versions written by different companies, works strictly as a network structuring and management tool.

Application software is available to work on all of the above operating systems. The brands and titles of application software for use in education are far too vast to be listed individually. However, application software can be categorized into the following functions, listed alphabetically:

1. CAD[16] : used for mechanical drawing and the rendering of three dimensional objects
2. CAI[17]: used to provide direct content instruction to students
3. Communications: used to coordinate, send, and receive telecommunications and/or network data
4. Databases: used to store, sort, and organize textual and numerical information
5. Desktop publishing: used to interpose text and

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[15] Intel Corporation created the first microprocessors in 1970. Since then the company produces most of the world's microchips. The Intel line of chips has evolved from the 286 chip up to the current 586 or Pentium chip.

[16] CAD is an acronym for Computer Assisted Design

[17] CAI is an acronym for Computer Assisted Instruction.

graphics for publications.
6. Grade keeping: specific database software customized for keeping records of student progress
7. Internet access: used to send and receive e-mail, access text and pictorial information on worldwide networks, and download software.
8. MBL[18]: used to interpret data being received from digital probes and sensors
9. MIDI: used to send and receive MIDI signals from a computer to a MIDI-capable musical instrument
10. Multimedia: used to interrelate text, pictures, sounds, video, and animations
11. Reference: used in the form of content-specific tutorials or general encyclopedias, atlases, and almanacs
12. Spreadsheets: used to enter, manipulate, and run calculations on numerical information. Spreadsheet software also can be used to generate graphs and charts
13. Word processing: used to enter and manipulate text

History of instructional technology

Having defined specific hardware and software items which fit the definition of instructional technology for this study, it is important to recognize the history of technology in education in a holistic manner. Technology has always existed in classroom instruction and management in some format. Microcomputers should be seen as just the next step in technological evolution. Chalk, clocks, copier machines, and grade books are all excellent examples of tools of instructional technology.

Within this study, however, the history of technology in education will be limited to that defined by the advent and growth of computing systems. The purpose of an historical review is to help provide context for the current study.

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[18] MBL is an acronym for Microcomputer Based Labs

Limiting the review of technology to computer systems in education will sufficiently provide that context.

The first digital computer, titled ENIAC, was built at the University of Pennsylvania in 1946.[19] With a price tag of $500,000 and a gross weight of over thirty tons, this data-storage device housed 18,500 vacuum tubes. Large, expensive data storage machines proliferated in research and government institutions.

Through the 1950's the television was introduced into instruction, an early electronic learning device. In 1954 the first computer was purchased for purposes other than government research by General Electric[20]. Four years later, the National Defense Education Act responded to the continuing Cold War by increasing funds for technology in education. Most of the affected schools were vocational schools. Five years later, the Vocational Education Act was passed to further the allotted monies for vocational skill training. Still, all computers at the time were large mainframe style computers that required hole-punched cards to be fed into them as data input.

In 1965, following President Johnson's Elementary and Secondary Education Act, the first minicomputers were brought to schools. These served the purpose of keeping student records and thus were used primarily by administrators and guidance counselors. Minicomputers, while not of the same scale as mainframes, were still considerably larger than

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[19] Robert Moody, *The First Book of Microcomputers* (Rochelle Park, N.J.:Hayden, 1978) pp. 3, 4.
[20] Murdock, Everett. *History, History of Computers, and Education.* <http://www.csulb.edu/~murdock/histofcs.html> March 1997

current-day microcomputers. By the late 1960's COBOL, BASIC, and Fortran were all established programming languages. Some universities were creating degree programs in computer science based on these languages. Vocational schools were providing computer maintenance and repair degree opportunities.

In 1969, the Department of Defense funded a pioneering project to connect its engineers with outside research contractors. Among these were commercial companies and research universities. An extensive network was constructed to link these institutions and was entitled the Advanced Research Projects Administration Network (ARPAnet). This network was the beginning of what today is the Internet.

Concurrent with the establishment of this network was a shift in the accessing and processing of information in higher education. At the time, all data was stored in large, centrally-located mainframe computers. Students and faculty would access these storage areas via "dummy terminals.". These terminals consisted of only a keyboard and monitor and thus were unable to store or process any information. As access traffic to mainframe data grew more congested, it became necessary to house processing capabilities within the terminals themselves, thereby creating desktop computers. To support this decentralization of data storage and processing, a new operating system entitled UNIX was created. This operating system allowed for distributed access to data across many storage devices and thereby linked university networks with ARPAnet.

In 1971 Intel Corporation of Santa Clara, California built the first "microcomputer". The microcomputer was so named in that it was built on a microchip, a small piece of silicon that houses the equivalent of hundreds of thousands of vacuum tubes. While this new technology was explored, existing software companies began to design instructional software for schools, though only for mainframe use. Three years later, Apple Computer of Cupertino, California released the Apple I microcomputer which required assembly by the owner. Within a year, the Apple I moved into schools and started a debate between microcomputer and mainframe supporters. The microcomputers primary functions were data storage and word processing.

Through the 70's other computer companies, including Tandy and Texas Instruments, began developing microcomputers. By the end of the decade, fifteen million personal computers (PCs[21]) had been purchased by schools and businesses. In 1979, the first spreadsheet application, used for inputting and manipulating numbers and calculations, was introduced. In addition, software companies began to form and write software for specific content areas in education.

By 1983, the Apple IIe had become the most popular computer in schools. This PC used Microsoft Corporations PRODOS operating system. Teachers and administrators were shifting from the mainframe concept of computing to microcomputer desktop systems. In 1984, borrowing technology from the Xerox Corporation, Apple Computer released the first

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[21] PC is used within this context to generically represent "personal computer," instead of the more particular definition of an Intel-based computer

personal computer with a graphical interface. This new
computer, called Macintosh, allowed for visual manipulation
of both text and pictures and introduced the mouse as an
input device. This computer ran on a new operating system
written by Apple itself. Microsoft authored its DOS
operating system which became the software basis for all
other lines of personal computers. By 1988, over twenty-five
percent of high schools were using PCs to support college and
career guidance. Aldus Inc. created PageMaker, the first
software program for interrelating pictures and text. This
new software began the new field of desktop publishing.

Meanwhile, the network of universities and government
agencies connected via ARPAnet were suffering from excessive
traffic. At the end of the 1980's the National Science
Foundation created NSFNet to alleviate these traffic
problems. Providing easier and more reliable access, NSFNet
slowly began to replace ARPAnet as the means of connection to
this worldwide network. In 1990, ARPAnet, due to lack of
use, closed down completely and NSFNet became the single
provider of access to the Internet.

As computing technology moved into the 1990's the focus
moved past word processing and paper-producing software and
into multimedia. Computer monitors became available in color
and CD-ROM and laserdiscs became accessible by computer.
Sound playback and recording was introduced. Color images,
simulations, and direct multisensory instruction became
available on computers. By 1992, schools were beginning to

access Gopher[22] servers remotely for research information. Two years later, the technologies of virtual reality, digital video, and three dimensional rendering brought the next level of multimedia and experience to the PC. By this time, most U.S. classrooms had a PC available for classroom use.

In the past five years, the proliferation of the Internet has been the central development in technology, both commercially and educationally. As desktop computer capabilities grew, commercial companies began providing access to the Internet. Along with educational (.edu)[23] and government (.gov) information, organization (.org) and commercial (.com) information became available. Over 300,000 commercial sites are now accessible on the Internet.[24]

In 1992, Netscape Communications Corporation created its *Navigator* software program as a tool to browse the Internet. This software enabled users to view both text and pictures on the Internet and thus became the basis for the World Wide Web, the graphical interface to the Internet.

Today Internet Service Providers provide access to the Internet in the same manner that cable companies provide access to cable television. Online services like CompuServe, America Online, Prodigy and Microsoft Network provide national and international access to the Internet.

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[22] Gopher is a worldwide network of computers which originated at the University of Minnesota. Gopher servers are accessible through telecommunications equipment.

[23] The Internet is subdivided into several discrete domains. Every site on the Internet resides in one of these domains. The domain is recognizable within a site's address as the suffix of the address. Thus, the Internet address www.luc.edu, by virtue of its ".edu" suffix, resides on an educational server.

[24] Bard Williams, *The Internet for Teachers* (Foster City, CA:IDG Books, 1996) p. 50

Additionally, local companies provide phone line access to the Internet. Along with displaying pictures and text, web browsers now allow for sound playback, movie and animation viewing, and interactive communications.

The Internet is no longer indigenous to higher education. By the middle of 1996, more than seventy-five percent of schools in the United States, from kindergarten through college, had access to the Internet. Over 3000 of these schools had created and published their own Web sites.[25] Students and teachers now use this network to access information and send electronic mail.

Viewing this history from a distance, one can see several distinct periods of development for the microcomputer. Its predecessor, the mainframe, had as its single purpose data storage. The emergence of word processing enabled the computer to replace the typewriter as a tool for writing. Graphical, picture-based operating systems then allowed for the evolution into page layout and personal publishing. CD-ROM and laserdisc technology, coupled with more powerful computer processing, brought new media and levels of interaction with computers. And, most recently, the Internet and World Wide Web have given the personal computer the coupled capabilities of both the television and telecommunications.

One result of this "personalization" of the computer is a continuing and growing imperative to incorporate computer capabilities into educational settings. Like the filmstrip, the overhead projector, and the calculator before it, the

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[25] Ibid, pp. 10 - 12

microcomputer is a technological innovation in education.
The effects and implications of microcomputer use in
education, however, will be much more far-reaching than in
the cases of these other technological innovations. Its
processing power and levels of adaptability and interactivity
surpass any other item of technology before it. Describing
these implications and defining "instructional technology"
and the computer's central role within it are key matters in
communicating the importance of this paper.

Detailed descriptions of hardware and software, however,
are not the focus of this paper. Rather, technology is
viewed as an innovation, a tool. How teachers use this tool
and to what extent that use has changed their feelings about
their work are the true foci of this paper. To assess these
two issues, the author has chosen two existing bodies of
work: the Concerns-Based Adoption Model and Herzberg's theory
of motivation.

Concerns-Based Adoption Model

The Concerns-Based Adoption Model is a tool for
determining the extent to which a person has made use of an
innovation in the workplace. An innovation could be
anything from new equipment to new strategies for
communication within the workplace. For this study,
"innovation" will refer to instructional technology. The
model is subdivided into three components: the Level of Use
(LoU) scale, the Stages of Concern (SoC) scale, and the
Innovation Configuration Map (ICM). One section of the

interviews in this study attempts to determine how teachers are using instructional technology. Their answers will be categorized hierarchically according to the LoU scale. This scale will be described further in Chapter 2.

Herzberg's Motivation/Hygiene Theory

Finally, Frederick Herzberg's motivation/hygiene theory will be used to determine the extent to which instructional technology has changed teachers' outlooks on their work. This theory, described in detail in Chapter 2, distinguishes between factors which, when present, motivate workers and those which, when absent, cause dissatisfaction. The former, called hygienic factors, relate to the working environment while the latter, called motivators, relate to the work itself. Questions from the third part of teacher interviews contain the exact sequence and wording from Herzberg's own interview research.

Technology in education is changing rapidly. New products and new capabilities arrive in computing every week. In 1998, the spectrum of uses for technology in secondary education has been largely set forth in this introduction. Shortly, new computer functions will make these descriptions obsolete.

However technology, no matter what the capacity in which it is used, will always be a tool, an innovation. With that as its nature, the CBAM LoU scale should continue to serve as a measuring tool for adoption. So too, with technology affecting the work environment and reshaping the work of teaching itself, Herzberg's research may continue to serve as a means of determining how technology's use has affected teachers' motivation to work.

CHAPTER 2

REVIEW OF RELATED LITERATURE

Literature related to instructional technology

The total body of research related to "instructional technology" is broad in scope and only a narrow portion is essential to this study. While research on the impacts of technology integration on pupil learning is indeed valuable, its focus is outside that of this study. A more related area of technology research is that of the studies which investigate teacher use of and attitudes toward instructional technology. A great deal of published and unpublished literature exists in this area.

The most abundant category of research within this general area of teacher use and attitudes is that which seeks to determine factors which affect teacher attitudes towards instructional technology. Herein still, there is a bounty of work that can be further subdivided into:

1. Extrinsic resource factors: monies, space, time
2. Intrinsic teacher factors: teaching style, age, content area

External factors: External factors are those which exist in the workplace such as resources, management and policies. With respect to research into extrinsic factors, Rozenweig

(1992)[26] found that among teachers in five districts in Southern California, the amount of teacher training time was the single most influential factor affecting teacher attitude. This factor was followed in influence by the availability of classroom computers and the perceived support from principals.

Bolton (1994)[27] found that the number of available computers was the single biggest resource factor affecting teacher behavior. Wilson (1996)[28] found that training, equipment, and software were the three biggest factors affecting teacher adoption. These factors, when absent, inhibited teacher acquisition of technology skills.

This work supports that of Cook (1989)[29] which also determined extrinsic resource factors to be of significant effect in teacher technology adoption. Further, Cook found that teachers reacted more positively to computers in their classrooms than to the creation of separate computer labs. Perceived support from other teachers and the ability to affect decision-making related to computer use were also associated with high levels of instructional technology use.

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[26] S.P. Rozenweig, "The Relationship of Grade-Level, Teacher Interest, Level of Training and Perceived Principal Support to Instructional Computer Use in the Elementary Grades" (unpublished Ph.D. dissertation, University of Southern California, 1992)

[27] W.R. Bolton, "Factors That May Influence the Use of Computer Technology in the Teaching and Learning Process", (unpublished Ph.D. dissertation, State University of New York at Buffalo, 1994)

[28] C.T. Wilson, Teachers' Perceptions Toward 21st Century Technology Implementation in the Shelby County Schools, Tennessee", (unpublished Ed.D. dissertation, University of Memphis, 1996)

[29] C.T. Cook, "Factors Associated with High Levels of Microcomputer Use in Fourth Grade Classrooms", (unpublished Masters thesis, Central Michigan University, 1989)

These findings are supported in the work of Warner (1993)[30] who found that political and cultural conditions which involve teachers in decisions about instructional technology significantly affects teacher adoption rate. Lecuyer (1997)[31] found that teacher access to computers at home translated into greater comfort with computer integration in the classroom.

Stemming from Fullan's (1982)[32] work on change in education, Ely (1990)[33] described eight unique environmental factors affecting the integration of technology in education. These factors are

1. dissatisfaction with the status quo
2. existence of knowledge and skill levels
3. availability of resources
4. availability of time
5. existence of rewards for participants
6. expectation and encouragement of participation
7. commitment of those involved
8. evidence of leadership

Indeed, the leadership which creates the climate for instructional technology growth is itself an extrinsic factor. Cory (1990)[34] found that the critical component to technology leadership is the ability to develop and

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[30] D. Warner, "An Assessment of Committed Teachers in Implementing Microcomputers into the Teaching/Learning Environment: A Descriptive Case Analysis", (unpublished Ed.D. dissertation, 1993)

[31] K.F. Lecuyer, "Changes in Teacher Thinking and Instructional Methods When Inegrating Computers into the Curriculum", (unpublished Ph.D. dissertation, George Mason University, 1997)

[32] M. Fullan, *The Meaning of Educational Change* (New York: Teachers College Press)

[33] Donald P. Ely, "Conditions That Facilitate the Implementation of Educational Technology Innovations," *Journal of Reasearch on Computing in Education*, 23 (Winter 1990), pp.298-305

[34] S. Cory, "Can Your District Become an Instructional Technology Leader?," *The School Adminstrator* (Special Issue on Technology), (1990) pp. 17-19.

articulate a vision of how technology could produce changes. Kearsley and Lynch (1992)[35] argue that this leadership component is missing in today's administrators, with many principals relying on teachers and computer vendors for guidance.

Internal factors: Internal factors affecting technology adoption are those which teachers hold within themselves as physical or attitudinal characteristics. Harrison (1992)[36] and Conery (1993)[37] investigated teaching styles and their relationship to readiness to adopt technology. In the case studies of the latter, evidence existed that teachers' teaching styles were preexistent and non-changing as technology was introduced. In contrast, Harrison's findings indicate that teachers who used technology most significantly were those willing to change their role from that of lecturer to that of classroom facilitator. Intrinsic factors of teaching style and recognition of technology's possibilities in learning outweighed extrinsic factors like training and equipment.

This work supported that of Novak (1991)[38] who also found that teachers' personal beliefs in the importance of computer use was the most motivating factor in technology

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[35] Greg Kearsley and William Lynch, Educational Leadership in the Age of Technology: The New Skills," *Journal of Reasearch on Computing in Education*, 25 (Fall 1992), pp. 50-61.

[36] B.A. Harrison, "Factors Affecting Teacher Use of Computers in Secondary Social Studies Classrooms," (unpublished Ed.D. dissertation, Gonzaga University, 1992)

[37] L.G. Conery, "Teacher Beliefs About Computers in the Classroom: Three Case Studies", (unpublished Ph.D. dissertation, University of Oregon, 1993)

[38] D.I. Novak, An Explanation of Computer Use By Beginning Teachers, (unpublished Ed.D. dissertation, University of Michigan, 1991)

adoption. Her research further suggested that technology implementation by teachers evolves with level of teaching confidence.

Okinaka (1991)[39] and Agnir (1989)[40] investigated respectively the influence of teacher gender and years of service on technology adoption. In Okinaka's findings, little difference was seen in adoption rates between males and females. This supported the work of Loyd and Gressard (1984)[41]. In addition, a positive correlation was found between level of technology use and job satisfaction. Agnir's survey's and open interviews led to a correlation between attitude towards technology adoption and years of teaching.

Research which has investigated the effects of age on attitudes toward technology has seen mixed results. White[42] found that teachers in their twenties showed a greater level of classroom computer use than older teachers. Hagey's[43] results on age affects on technology use were similar, with younger faculty employing computers more frequently and providing students with more access to computers. In regards to longevity, however, she found no relationship between

[39] R.T. Okinaka, "Computer Teachers: A Study of Background Characteristics, Preparation in Educational Technology, and Attitudes", (unpublished Ph.D. dissertation, Claremont Graduate School, 1991)
[40] F.I. Agnir, "A Study of Attitudes About Computers Among Faculty of Three Community Colleges", (unpublished Ed.D. dissertation, University of Massachusetts, 1989)
[41] Loyd, B.H., & Gressard, C. "The Effects of Sex, Age, and Computer Experience on Computer Attitudes," *AEDS Journal*, 18(2), pp. 67-77.
[42] R.H. White, "A Study of the Relationship Between Teachers' Learning Style Preferences and Their Use of the Microcomputer at Home and At School in Medfield, Massachusetts" (unpublished DED dissertation, Boston College, 1993)
[43] M.S. Hagey, "The Computer: An Assessment of Teacher Training, Teacher Attitudes, and Computer Inventory (Hardware and Software) in Grades K-8 in the Metropolitan Public Schools of Nashville-Davidson County" (unpublished E.D.D dissertation, Tennessee State University (1985)

years of teaching and positive attitudes towards computer use.

DeCharms' (1968)[44] work on human behavior led him to conclude that people seek the capacity to change their own environment. The research of Baack, Brown, and Brown (1991)[45] used DeCharm's work to investigate attitudes towards technology in young and older adults. Statistical analysis of twenty Likert scale questions revealed that older adults, who had not grown up with computers, felt computers threatened their ability to control their environments. Extended into the workplace of education, related research has been done to compare teachers who had had pre-teaching experience with computers with those who had not. Koohang (1987)[46] found a direct relationship between amount of pre-service computer instruction and positive attitudes towards computers.

Mackowiak (1991)[47] studied the demographics of teachers who required and did not require computers in their teaching. Age, as well as gender, within her research, did not show any effect on teacher integration of computers. However, great differences existed between teachers of different departments. Science teachers more often used computers for a variety of purposes, including data analysis,

[44] DeCharms, R.(1968). *Personal Causation: The internal affective determinants of behavior:* New York: Academic Press
[45] Sharon A. Baack, Thomas S. Brown, and James T. Brown, "Attitudes Towards Computers: Views of Older Adults Compared With Those of Young Adults," *Journal of Reasearch on Computing in Education*, 23 (Spring 1991), pp.422-33.
[46] Alex Koohang, "A Study of Attitudes of Pre-Service Teachers Toward the Use of the Computers," *Educational Communication and Technology Journal*, 35(3), pp. 145-49.
[47] Kate Mackowiak, "The Effects of Faculty Characteristics on Computer Applications in Instruction," *Journal of Reasearch on Computing in Education*, 23 (Spring 1991), pp. 396-408.

organizational management, and computer assisted instruction. Other departments, particulary those in the humanities, showed significantly less comprehensive use of computers.

Frase (1996)[48] investigated both internal and external factors and their relationship to changes in use of instructional technology by teachers. External factors included computer availability, the compatibility of teacher-chosen software with district curriculum, the restrictions of the school computer network, and time demands and the structure of the school day. Internal factors included teachers' feelings of inadequacy about computer interfaces and their typing skills, and teacher attitudes towards student ability and student needs.

Apple Classrooms of Tomorrow Program: The last block of literature review on instructional technology comes from an ongoing intensive study of changes in teacher behavior and role with the adoption of computers as learning tools. Apple Computer, Inc. has done an extensive longitudinal study on the effects of classroom technology integration on teacher roles and attitudes. This study, the Apple Classrooms of Tomorrow (ACOT) project, began in 1986. The study focused on teachers at five sites over a four-year period, from 1986-89. Each of the sites began with one grade level in the fall of 1986, adding classrooms, staff, and students in subsequent 2years.

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[48] S.G. Frase "Internal and External Factors That Affect Elementary Classroom Teachers' Decisions About the Use of Microcomputers as Instructional Tools", (unpublished Ph.D. dissertation, State University of New York at Buffalo, 1996)

By 1989, the project included 32 teachers and 650 students in four elementary and one high school whose demographics range from inner-city to rural, and low to high socioeconomic status. Together the schools represented the diverse populations and conditions currently found in the nation's public schools. ACOT classrooms in each of these settings offered students constant access to interactive technologies. The elementary classes were equipped with Apple® IIe, IIGS®, and Macintosh® computers. The high school was an all Macintosh installation. In addition to computers, each class was equipped with printers, scanners, laserdisc and videotape players, modems, CD-ROM drives, and hundreds of software titles. The technology was used as a tool to support learning across the curriculum. No attempt was made to replace existing instructional technologies with computers. By design, the classrooms were true multimedia environments where students and teachers used textbooks, workbooks, manipulatives, white boards, crayons, glue, overhead projectors, televisions, musical instruments, etc., as well as computers. The operating principle was to use the media that best supports the learning goal. (Report 8 pp 2-3)

Once classrooms were configured, teachers were taught how to use the technology. Then, from 1986 to 1989, a qualitative investigation was made into the change in teacher actions and attitudes in the classroom. The methodologies included monthly audio tape journals from teachers, weekly reports, and on-site observation. In the case of the first two methodologies, all information was sent directly to Apple

computer where graduate students coded responses and created categories.

Five such categories subsequently evolved: entry, adoption, adaptation, appropriation, and invention. These categories are quite similar to those in the CBAM Levels of Use Scale. In the entry stage, teacher responses indicated discomfort with the physical interruption which the equipment brought to classrooms and difficulty in learning how to use the computers. In the adoption phase, teachers began to use their learned technology skills to supplement existing text materials for instruction. Teacher-centered lecture format instruction still predominated. The key distinction within the adaptation phase was a noticeable increase in teacher and student productivity. Students were completing assignments and curriculum sections in 60% of the time it had traditionally taken.

The appropriation phase began for a small number of the participating teachers in the middle of the second year of the study, 1987. In this phase, student work became completely project-driven. Students worked in teams, teachers team-taught classes, and class schedules were even reorganized to allow for optimum student work time. The final phase, invention, was reflected in teacher comments about waiting for new capabilities in technology which would allow for even more collaborative, problem-based work. Teachers had grown so familiar with technology and its possibilities that they had behaviorally moved from change-resistant to change-anticipatory.

Motivation theory literature

The theory of motivation on which this study is based is
that of Frederick Herzberg. All categorization of worker
motivation will be taken from Herzberg's motivation/hygiene
theory. In addition, his critical incident line of
questioning will be used in part two of the interviews.
Since this study relies so greatly on Herzberg's work, a
review of his work is appropriate within the review of
related literature..

Herzberg's work in the area of motivation led to the
publication of three books: *Job Attitudes: Review of Research
and Opinion, The Motivation to Work, and Work and the Nature
of Man.* The last of these is a summative work which reprises
and analyzes the work in the preceding two. It is this third
book, *Work and the Nature of Man,* which is so pivotal to this
study.

Herzberg's investigations came after the influential
work of Taylor and Mayo in the area of scientific management.
With his contemporary, Abraham Maslow, Herzberg adopted a
more human-centered approach to his work and subsequent
theory. Read in its entirety, *Work and the Nature of Man* is
not as much a training manual for aspiring business managers
as it is a cultural and psychological inquiry into human
needs. Herzberg himself was a psychologist. The context of
this paper is not psychology, but Herzberg's descriptions of
human psychology form the basis for his motivation/hygiene
theory and thus merit a brief description.

Herzberg's underlying assumption to his
motivation/hygiene theory is that man has two distinct
natures, animal and human. These natures emerge from evolving
cultural myths:

> Two millenia of teaching have convinced many
> men that when Adam was cast out of the Garden,
> mankind was doomed, warped, and bound to a
> lifetime of pain. This notion of man's
> sinfulness conceives of the whole purpose of
> existence as a sentence of suffering for Adam's
> fall. Therefore, man's overriding need is to
> avoid the multitude of pain-provoking events
> that are found in his new alienated environmen,
> outside the gates of Paradise. But man in this
> condition is akin to all animals, and his basic
> motivation is thus the avoidance of pain. The
> function of this myth, then, is to give meaning
> to the meaningless; positive form to the
> amorphous pain of life.[49]

This first nature, which Herzberg labels the Animal-Adam
nature, forms the psychological basis for the hygiene half of
the two factor theory. Emerging from lower level needs such
as the avoidance of loss of life, sexual deprivation, hunger,
and pain are certain elements of work which, when absent,
lead to job dissatisfaction.

The second, higher order nature of man, is his own self-
driven desire to realize his potential and ongoing
psychological growth. It is the existence of this higher
nature of man which distinguishes us from other species of
animals:

> In considering the difference between animal
> and man, one should note another inexorable
> biological law that is pertinent to the
> argument - growth. By biological growth is
> meant the unfolding of basic genetic substance
> until the organism is capable of maintaining
> itself. As an animal grows to biological

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[49] Frederick Herzberg, *Work and the Nature of Man* (New York, N.Y.:Thomas
Y. Crowell,1966) p. 16

> maturity, new substrates unfold and enable new
> behaviors to emerge. But when biological
> maturity is reached, this is the approximate
> end of the animal's ability to increase its
> repertory of behavior.
>
> At this point, man separates himself from the
> rest of the animal kingdom. Even as the human
> body senesces, man is able to grow and increase
> his psychological abilities.[50]

Even as biological decay begins for humans, life still provides the opportunity for continued psychological growth. People mature cognitively and psychologically by knowing more, forming new relations between things which are known, becoming more creative, more effectively managing ambiguity, and individuating (finding individual response to life's stimuli).[51]

Thus man has, along with an animal nature, a human nature. There are factors within work which contribute to human growth in these psychological areas. These factors are Herzberg's satisfiers, also known as motivators.

Based on two hundred critical incident interviews with engineers and accountants in Pittsburgh, Herzberg isolated nine dissatisfiers and five satisfiers. Dissatisfiers, or hygienic factors, are elements to work environments which, when absent, cause workers to be dissatisfied with their work. These nine hygienic factors are:[52]

1. company policy
2. administration
3. supervision
4. interpersonal relations
5. salary
6. possibility for growth

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[50] Ibid, p. 53
[51] Ibid, pp. 59-70
[52] Ibid, pp. 72-74

7. working conditions
8. job security
9. personal life

None of these nine dissatisfiers are related in any way to motivation. When present, all five contribute to job satisfaction. Each is relatable to man's needs for avoidance of pain. All describe a worker's relationship with the context or environment in which he or she works. These are not, however, factors which contribute to psychological growth and, therefore, job motivation.

Also isolated were five distinct motivational factors:[53]

1. achievement
2. recognition
3. nature of the work itself
4. responsibility
5. advancement

When absent, these factors do not contribute to job dissatisfaction. These factors are relatable to the growth needs of man, recognized in his human nature. Thus, when present, they present opportunity for true motivation. Unlike the dissatisfiers, which describe a worker's relationship to his or her work environment, satisfiers desribe a relationship to the nature of the work itself. That is, in order for a worker to be happy in her work, more than a pleasant work environment must be present. She must have something to do and enjoy doing it!

While there are two natures to man, Herzberg's subsequent motivation/hygiene theory is *not* bipolar. Hygiene factors relate to the avoidance of pain while motivators relate to a need for growth. Motivators and hygiene factors

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[53] Ibid

can not be stretched along a continuum. Factors which prevent job dissatisfaction are not the same as factors which create job motivation and lead to superior job performance.

Beyond the identification of unique dissatisfiers and satisfiers, Herzberg applied his theory to suggest how employees who were hygienicly-oriented and those who were motivationally-oriented would contribute to their workplace. These extrapolations of the dual nature theory were observable during the course of data collecting and therefore helped shape the contents of the final chapter of this research in which implications and suggestions are identified.

Along with the motivation/hygiene theory itself, the methodology Herzberg used to establish the categories of motivators and hygienic factors is important to this study. Two hundred interviews were held with engineers and accountants. These interviews were semi-structured and focused on critical incidents which led to either positive or negative shifts in workers' feelings about their work. The second part of the interviews in this study will be conducted using the series of questions used in Herzberg's interviews. These questions appear in the appendix of this study.

The general flow of the interviews begins with workers isolating a time at which they felt exceptionally good or bad about their work. With this critical incident established, the interview then continues by investigating reasons why workers felt the way they did at the specified time. The interviews then conclude by assembling a chronology of events

which returned workers' attitudes to normal.

The critical incidents themselves needed to meet several criteria:[54]

1. The sequence of events must revolve around an event or series of events. There must be some objective happening.
2. The sequence of events must be bound by time, with a beginning, middle, and end. The end does not necessarily need to be abrupt.
3. The sequence of events must have taken place during a period in which feelings about the job were exceptionally bad or good.
4. The story related in the events must be centered on a period in the respondents's life when he held a position that fell within the limits of the sample.
5. The incidents must cause a change in attitude related to work, not another aspect of the respondent's life.

In focusing interviewees' responses, the researcher will apply these criteria in arriving at true critical incidents. Thus, Herzberg will provide both a theoretical and methodological blueprint for this study.

CBAM literature

While Herzberg's work will provide a basis for detmining the extent to which teachers' attitudes have changed, assessing the extent to which teschers use instructional technology will require a separate tool. There are many such tools which help organize responses into a hierarchy. For this study, the Concerns-Based Adoption Model will be used.

The components of the Concerns-Based Adoption Model (CBAM) were designed by Gary Hall and his colleagues at the

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[54] Ibid, p. 72

University of Texas[55] . The diagnostic components of CBAM are designed to facilitate the change and adoption process. Change not only encompasses technical problems associated with the adoption of an innovation, but also the personal needs of the potential adopter. The CBAM model includes three diagnostic dimensions: (a) Stages of Concern (SoC), (b) Levels of Use (LoU), and (c) Innovation Configuration Map (ICM).

Stages of Concern address the intensity of the feelings and perceptions that the individual adopting the technology is expressing. Concerns are identified in seven different areas. Levels of Use address the behavior related to how the individual uses the technology, with eight distinct levels identified. Specific behaviors are associated with each Level of Use. Finally, Innovation Configuration Maps involve the development of word maps that describe the operational components of an innovation and how each can be adapted, or in some cases mutated.

For this study, only one of these components, the LoU will be used. Levels of Use provides a key ingredient for understanding and describing implementation of an innovation, in this case computing devices for learning. Data collected from LoU interviews can provide useful insights about staff development, evaluation, planning and facilitation for leaders and change facilitators. Levels of Use gives the leadership and change facilitator a yardstick to monitor the rate of change. By understanding Levels of Use in systemic

[55] G.E. Hall, A. George, and W. Rutherford, "Development and Validation of a Concerns Questionnaire," (paper presented at the Annual meeting of the American Educational Research Association, New York, 1979).

change, leaders and facilitators can provide appropriate
interventions for each user based on the user's LoU category.

According to Hall and Hord (1987) Levels of Use focuses
on the behaviors that are or are not taking place in relation
to the innovation. The Levels of Use definitions include
three "nonuser" descriptions and five "user" descriptions.
When Hall and associates defined the levels, heavy emphasis
was placed on developing definitions of what could be
observed with each level representing different behavioral
approaches. For example, a person at Level of Use 0, Nonuse,
is not looking at, reading about, using, or discussing the
innovation. The clarity of each of these levels is of great
assistance in coding responses to interview questions.

The seven levels of use are described below, using the
original terminology of the model. Within this study, the
term "user", as used in these descriptions, refers to
teachers. The term "client" therefore refers to students.

Table 2-1: CBAM Levels of Use

1. VI RENEWAL: State in which the user reevaluates the
   quality of use of the innovation, seeks major
   modifications of or alternatives to present
   innovation to achieve increased impact on clients,
   examines new developments in the field, and explores
   new goals for self and the system.
2. V INTEGRATION: State in which the user is combining
   own efforts to use the innovation with related
   activities of colleagues to achieve a collective
   impact on clients within their common sphere of
   influence.
3. IVB REFINEMENT: State in which the user varies the
   use of the innovation to increase the impact on
   clients within immediate sphere of influence.
   Variations are based on knowledge of both shortand
   long term consequences for clients.
4. IVA ROUTINE: Use of the innovation is stabilized. Few

if any changes are being made in ongoing use. Little
preparation or thought is being given to improving
innovation use or its consequences.
5. III MECHANICAL USE: State in which the user focuses
most effort on the short term, day to day use of the
innovation with little time for reflection. Changes
in use are made more to meet user needs than client
needs. The user is primarily engaged in a stepwise
attempt to master the tasks required to use the
innovation, often resulting in disjointed and
superficial use.
6. II PREPARATION: State in which the user is preparing
for first use of the innovation.
7. I ORIENTATION: State in which the user has recently
acquired or is acquiring information about the
innovation and/or has recently explored or is
exploring its value orientation and its demands upon
user and user system.
8. 0 NONUSE: State in which the user has little or no
knowledge of the innovation, no involvement with the
innovation, and is doing nothing toward becoming
involved.

Typically a person will move in sequence from Level of
Use 0, Nonuse, to Level of Use IVA, Routine, assuming that
the innovation is appropriate, the leader and other change
facilitators fulfill their roles, and time is provided.
Activities associated with the "nonuser" range from doing
nothing to gathering information in preparation to use the
innovation.

Once the user has reached Level II and is prepared to
adopt the innovation, they are prepared to move to the "user"
categories. The first use of an innovation tends to be
disjointed and erratic. Most new users cling to the users
guide and concentrate on the day-to-day uses more than
considering long term uses. Individuals typically remain at
this mechanical level for an extended period of time. As the
user becomes quite experienced, they move into Level of Use

IVA, Routine. Once a user reaches a Routine Level of Use they typically fall into a comfortable pattern for using the innovation. As users move toward the higher Levels of Use IVB, Refinement; V, Integration; and VI, Renewal, adaptations are intended to improve the effectiveness and positive outcomes from using the innovation. The focus is now on increasing effects with students.

This description of CBAM demonstrates its usefulness in categorizing the responses from teacher interviews. Questions in part one of the interviews will direct teachers to respond as to their level within this hierarchy, based on their current use of instructional technology.

While the Concerns-Based Adoption Model generically refers to any change to the workplace as an innovation, computers certainly factor as one primary innovation. Thus, it is not surprising that research has been done to determine computer usage levels via CBAM. Jardine (1992)[56] found supporting evidence that the Levels of Use tool does describe real differences in teachers interest in and use of computer applications in the classroom. Hope (1995)[57] used both the SoC and LoU tools in investigating the process of technology adoption within a single school. Stamos (1996)[58] used a case study approach in determining that the most common level of

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[56] P.G. Jardine, "Computer Integration Into the Curriculum: A Concerns-Based Adoption Model Perspective," (unpublished Masters Thesis, University of Calgary, 1992)

[57] W.C. Hope, "Microcopmuter Technology: Its Impact on Teachers in an Elementary School," (unpublished Ed.D. dissertation, Florida State University, 1995)

[58] G.G. Stamos, "Computer Use at Grossmont High School in the Grossmont High School District (California)," (unpublished Ed.D dissertation, Northern Arizona University, 1996)

teacher use within the CBAM LoU scale was Level IVA, at which teachers were using computers in a routine, stabilized fashion.

CBAM's usefulness is in sorting out patterns of behavior among participants in a study. In all three cases above, conclusions about faculty adoption patterns allowed the authors to suggest advantageous staff development options for improved integration of technology. Among the suggested improvements were:

1. implement strategies that empower teachers and work within their unique points of view
2. provide a variety of activities to promote adoption
3. configure large, complex innovations into component parts

In doing qualitative research, there is a heavy reliance on interpreting and coding descriptions. The LoU scale will provide benchmark language against which teacher responses can be compared. In this way, it will greatly assist in the coding of responses.

CHAPTER 3

DESCRIPTION OF THE RESEARCH

Methodology

Rationale: The means of gathering data in this study was
through semi-structured interviews. The researcher
interviewed thirty teachers between January and April of
1997. The choice of interviewing as a strategy for data
collection was based on the importance of hearing direct
teacher descriptions of their work. Furthermore, this
methodology mirrors that of Herzberg, to whose research this
study is closely tied.

The ultimate question to this study is, "How has the use
of instructional technology affected teachers' attitudes
towards their work?" As teachers integrate new technology
options into their curriculum, do they feel any better about
the work they do? Initially, the structure of this key
question suggested a need to quantify values for both
technology use and attitudes. Within a quantitative
analysis, a survey could be distributed requesting
participant response to Likert scale questions in both areas.
Correlations could then statistically determine the existence
and strength of the relationship between the level of
instructional technology use and teacher job attitudes.

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Such an approach would make it difficult, however, to determine reasons behind any such relationships or lack thereof. Descriptions would be limited to the language contained within the surveys. The researcher felt it important to obtain a wider range of descriptive language than could be gathered from this form of data collection.

In pursuit of a broader set of descriptions, interviewing was selected as the means of collecting data. While this diminished the sample population, it expanded the set of responses and possible categories and therefore provided for more in-depth analysis of data. The research therefore adopted a qualitative approach and was characterized by the following descriptors of qualitative research[59]:

1. Data was collected in the natural setting of the workers and, in lieu of surveys or other tools, the researcher was the key instrument of data collection. Opportunity was made in the interview settings to learn about the culture and climate in which participating interviewees worked.
2. During interviews, the researcher made efforts to reduce the "observer effect," which might alter the natural behaviors of interviewees.
3. The interviews sought to elicit language which could be coded and categorized such that the study's key question might be descriptively answered. In place of statistics, subsequent data analysis grew from the coding of responses, as structured by the interview questions.
4. The goal of the research was to understand and describe multiple relationships between teacher use of technology and attitudes about work.

Description of setting : Interviews were conducted on site at the six high schools in Illinois High School District

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[59] Robert C. Bogdan and Sari K. Biklen, *Qualitative Research in Education* (Boston, Mass.: Allyn and Bacon, Inc., 1982) pp. 39-49

214. The composition and location of this district are further described later in this chapter. Most interviews took place between 12:00 p.m. and 4:00 p.m. in coordination with teachers' lunch periods or prep time. Typically, the researcher and teacher met in an unused classroom or resource room in the departmental area. Whenever possible, interviews were held in the classroom in which the teacher taught. Interviewees received a copy of the interview questions in advance of meeting with the researcher and were encouraged to compose answer sketches in advance of their actual interview.

All the interviews were completed in a single sitting, with most being completed in thirty to forty five minutes. Interviews were timed, but no limit was set as to the allowable length for an interview. Complete written transcripts of the interviews were recorded. In deference to the comfort of the interviewees, no audio recordings were made.

Purpose and sequence of questions: **Figure 3-1** is the exact sequence of questions which were asked of each teacher. Within this sequence are three distinct parts. All parts were structured with preestablished questions which were read verbatim, both in content and in sequence. Follow-up questions were asked of respondents depending on the clarity of their initial response.

Figure 3-1: Interview Questions

Part 1: Background

1-1 What is your name?
1-2 What is your age?
1-3 For how many years have you been a teacher?
1-4 How many of those years have you been employed in this present high school?
1-5 How many years have you been in the capacity in which you currently teach?

Part 2: Use of Technology

2-1 How long have you been using technology in your work?
2-2 In what capacities are you currently using technology as it relates to your work?
2-3 In what sequence have you learned these skills?
2-4 Describe your skill level in each of these areas.
2-5 What resources are available to you that facilitate your use of technology?
2-6 How have students and other teachers been impacted by your use of technology?

Part 3: Attitudes About Work

3-1 Think of a time when your work with or learning of instructional technology made you feel exceptionally good or exceptionally bad about the work you do for District 214. Tell me what happened.

3-2 How long did this feeling last?
3-3 Can you describe what specifically made the change in feelings begin? Was what happened typical of what was going on at the time?
3-4 Why did you feel the way you did at the time? What did these events mean to you?
3-5 Did these feelings affect the way you did your job? If so, how?
3-6 Can you provide specifics examples of how your job performance was affected?
3-7 Did what happened affect you personally in any way?
3-8 How did the consequences of your feelings at this time affect your career in the long run?
3-9 How did your feeling about your profession change?
3-10 On a scale of 1 to 10 (1 being the least and 10 being the most) how greatly was your attitude toward your work affected by these feelings?

There was a specific purpose to each of the questions within the three parts of the interview. The first portion of the interview determined some basic biographical information about the interviewee. Question 1-1 was asked in order to identify the interviewee. At the time this question was asked, interviewees were assured of privacy in their responses. All names within this study have been replaced by coded initials to help assure that respondents' identification could not be known.

A recognized challenge in the interview and coding processes was the need for the interviewer to remain neutral. Within the course of the interviews, the interviewer served to guide answers towards clarity, but avoided influencing answers in any way. Second, through the course of the coding process, the researcher was the only person to codify the data and, to assist in the calibration of this process, reviewed interview codings at three different sittings so as to minimize bias.

Questions 1-2, 1-3, and 1-4 were asked to allow for the creation of age and longevity categories in coding responses. Previous research in relating age and years of teaching with technology adoption have produced mixed results, as described in chapter two.

Question 1-5 was asked to determine the amount of curricular change which the interviewee had recently undergone. Teachers who were teaching new classes would likely be faced with lesson plan demands beyond those who were teaching courses subsequent times. This question

allowed for investigation into possible relationships between computer use and amount of required course preparation time.

In Question 1-5 interviewees were further asked to describe the titles and track levels of their current course loads. In this way, the interviewer was able to determine the age and ability levels of the students taught by the interviewees.

Added to the responses of these first five questions were field notes on the interviewee's demeanor, the setting in which the interview was held, and any observable patterns of behavior or responses. These notes, along with the participant's responses to the questions in part one, combined to form the sketch of the teacher as a worker. Typically, this first portion of the interview lasted less than ten minutes.

The second part of the interview was structured to ascertain a teacher's level of use of technology. This set of questions was worded specifically to help generate teacher responses that could be matched with response categories in the CBAM LoU hierarchy. In this way, the sequence of questions as a whole acted like a response scale. A rationale for each of the questions is described below.

The purpose of question 2-1 was to establish the breadth of knowledge in instructional technology. In asking this question, the researcher specified the definition of instructional technology as described in Chapter II of this study. Teachers, for example, were informed that incorporating overhead projectors, filmstrips, and video

cassette players did not constitute the use of instructional technology as defined for this research.

Specifically, teachers were guided to list the hardware and software which they used and which their students used under their supervision. Responses which described the use of microcomputers and software for purposes outside of teaching and extracurricular work were included but noted separately.

While there were restrictions on what constituted *instructional* use, use itself was not defined by any particular level of incorporation. Teachers were allowed and encouraged to describe technology tools with which they had only recently become acquainted or of which they had just read or heard. Including these descriptions acknowledged the introductory levels (0-II) of the LoU Scale.

Question 2-2 sought to determine the origin of a respondent's use of instructional technology and the length of time through which the respondent had worked in order to have the current breadth of use. Important to this question was the determination of whether a respondent's current familiarity with computers was learned entirely as a teacher or if he or she had existing computer skills prior to teaching. This question thus became linked to questions 1-2, 1-3, and 1-5.

Questions 2-3 and 2-4 called for a review of the responses thus far in section two of the interview. These two questions were asked simultaneously and the researcher reviewed the descriptions already given.

For question 2-3 interviewees were asked to describe the chronological sequence in which they had learned the use of hardware devices or software programs which they currently used. Important to this question was the establishment of the context in which each tool was learned and the length of time for which the respondent had known and used that tool. This question also sought to provide an opportunity to determine if teachers' sequence of learning was influenced by personal interest, school emphasis, or both.

An assumption to this question was that sequences would be naturally determined to an extent by the evolution of hardware and software tools. That is, a teacher's use of word processing prior to her use of laserdiscs might largely be due to the later development of laserdiscs. Even though this imposed sequence of technology developments did influence teacher responses, question 2-3 still sought to determine if there was a typical order or hierarchy to teachers' learning of instructional technology.

In question 2-4, the interviewees were then asked to rate their level of familiarity with each aforementioned hardware device or software program on a scale of 1 to 10. The researcher provided examples of what constituted low, middle, and high level scores for each device or program so that respondents could have a context in which to respond. Respondents were discouraged from rating themselves until they had qualitatively described their uses.

Collectively, the first four questions of this series provided respondent descriptions which could translate into

Levels 0 to III on the CBAM LoU Scale. The focus of the interviews to this point was on the knowledge of the technology tools, not the necessarily the contexts in which the tools were used.

With the first four questions establishing knowledge levels, the purpose of question 2-5 was to determine the extent to which teachers applied their knowledge of each tool. Beginning with Level III, the LoU scale increasingly refers to the impacts which innovation use has on "clients." In the context of these interviews, clients are defined as both the students taught by the teachers and colleagues with whom the teachers worked. Question 2-5 explored the extent to which students benefited by teachers' use of each technology tool for which there was a knowledge base.

The descriptions given by teachers then allowed for possible relationships with levels IV - VI in the LoU scale. The researcher sought to coax specific examples of how a teacher used a particular hardware or software tool to allow students to access, manipulate, or share class information. Did the teacher provide direct instruction on the use of a software program for students? Did the teacher provide class time for students to directly use a technology tool? Were there examples of how the use of a particular tool had been cause for a new system of assessment of students? Had the teacher used a tool to generate new course resources and materials? In sum, this question was pivotal in evoking descriptors of higher CBAM levels of use. It provided an opportunity to learn the extent to which a teacher's

knowledge was integrated into her or his teaching.

Question 2-6 extended this line of questioning by examining the sphere of influence that a teacher's use of a technology tool had had. Responses to this question gave further evidence of higher order technology use as indicated by new levels of collaboration and mentoring amongst colleagues. Level V of the LoU scale would be recognized in responses which described complete curricular overhauls, new syllabi, and new levels of communication between teachers as made possible by use of technology. Level VI would be indicated by descriptions of major modifications to specific hardware or software uses.

While questions 2-5 and 2-6 gave teachers an opportunity to articulate higher levels of use on the CBAM scale, they simultaneously served a purpose closely related to the other research related to this study; that of Herzberg. As the use of an innovation climbs the LoU scale, the nature of the work being done becomes increasingly affected. Therefore, teacher responses also began to include motivator and hygiene descriptors from Herzberg's work. Herzberg's dual theory, as described in Chapter II, summatively describes satisfiers as elements related to the work environment. Unlike satisfiers, motivators are instead shaped by the nature of the work itself. During interviewee responses to questions 2-5 and 2-6, the researcher made note of when reference to technology was in the context of work environment and when it referred to the work itself.

The third and final series of questions was taken

directly from the sequence of questions asked by Frederick Herzberg in his research which led to his motivation/hygiene theory. Due to the different tone and substance of this portion of the interview, the interviewer encouraged participants to pause before continuing with the final series of questions.

The entire sequence surrounds the identification of a period in time when the interviewees feelings about work changed for the better or for the worse. Herzberg describes the rationale behind the language and sequencing of these questions within his own research:

> The rationale of the "sequence of events method" is to assure the investigator that a real attitude exists by studying the change in attitudes. Selecting periods of time when the respondent felt exceptionally good or bad suggests that he was feeling different from the way he had felt before. If he is feeling different, there is more likelihood that an attitude or feeling is being tapped. Focusing on specific events also gives greater assurance that the respondent was personally involved. In this way the investigator, by analyzing the nature of the events themselves, can avoid much of the rationalizations and other beclouders of the respondent's explanations.[60]

As defined by Herzberg, the period of time described in question 3-1 needed to have a definable beginning as well as a discrete end so as to be an identifiable amount of time. The researcher provided examples of what constituted definable time periods and events, but gave no preference for them to be of positive or negative effect. Respondents were asked to choose a single such time period, though some

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[60] Frederick Herzberg, *Work and the Nature of Man* (New York, N.Y.:Thomas Y. Crowell,1966) p. 95

requested an opportunity to describe more than one.

Question 3-1 was slightly modified from Herzberg's original phrasing, requiring that the identified period of time be within the context of instructional technology. All interviewees had had experience with learning instructional technology and therefore had anecdotes to tell from those contexts. Within question 3-1, the interviewee defined the starting and ending points of the time period and indicated if the event-triggered period was one of positive influence or negative influence. A complete description of the period, structured chronologically, was recorded.

All subsequent questions in the third series related to the time period described in question 3-1. Question 3-2 sought to elicit for the first time specific feelings which resulted from the event or events within the time period. The duration of these feelings helped demarcate the length of the time period and the extent of the attitude change.

The two parts of question 3-3 looked at the core cause for the feelings of the time period. These questions, along with further identifying the onset of the period, began to identify whether the causal event was related to hygienic or motivational factors. Question 3-4 supplemented this information by describing the nature and intensity of the feelings which were triggered by the causal event or events.

The qualitative descriptions of feelings which composed most of questions 3-3 and 3-4 were sharpened by specific descriptions of the impacts of the feelings in questions 3-5 and 3-6. These two questions gave respondents a chance to

reprise their feelings and clarify them. In the same manner
that a discrete causal event was requested in question 3-1, a
discrete example or set of example responses was requested in
3-6.

Question 3-7 sought to determine how distributed the
specific feelings were within the respondent's life.
Herzberg's view of his research was not that people were
workers, but rather that workers were people, whose feelings
permeated in and out of the work place. There is continuity
to people's feelings in pursuit of common psychological
needs.

Questions 3-8 and 3-9 refocused the attention on the
work place and attempted to determine the long-term
professional implications of the respondent's feelings. The
latter question gave interview participants a chance to
define what they saw the teaching profession to be. This
penultimate question therefore brought the specific incident
described in 3-1 to the points of its most global and
thematic perspective.

The final interview question, like question 3-1, was
modified slightly from Herzberg's actual phrasing. Herzberg
requested participants to rank the importance of their
feelings within the time period on a scale of 1 to 21. In
this study, the same request was made, but respondents were
asked to use a 1 to 10 scale instead.

Thus the final series of questions focused on personal
feelings and honed responses by attaching them to discrete
events and allowing respondents multiple opportunities to

describe their feelings. Following the completion of the
third and final series of questions, the time duration of the
interview was noted and the interview was concluded.

Population

Overview of the school district: The setting and
population of this research was Township High School District
214. This public school district is comprised of six high
schools in the northwest suburbs of Chicagoland. The six
high schools are Elk Grove High School, Rolling Meadows High
School, John Hersey High School, Prospect High School,
Wheeling High School, and Buffalo Grove High School. In
addition to these six high schools are several alternative
schools; Vanguard, Forest View Alternative School, and
Nipper.

Both the employees and students of the district
represent a wide range of cultural, ethnic, and socioeconomic
backgrounds. The geographic range of the district spans from
Arlington Heights and Mount Prospect in the south to Buffalo
Grove in the north. The district stretches as far west as
Rolling Meadows and back east as far as Wheeling and Des
Plaines.

While its population is diverse, District 214's goals
have been very directed. Among the highest priorities for
improved instruction within the past three years is the goal
of greater technology integration within teaching and
learning. In the second semester of the 1994-95 academic
year, the school district undertook an enormous technology

integration project. Having secured twenty-five million dollars in technology grant monies, all six high schools were to be configured for video and Internet access, new computer labs were to be built, and each classroom was to have at least one computer and video monitor within it. Thus, a significant level of attention has been focused on instructional technology within District 214 in the past three years.

In addition to the hardware expenses, the District created the Voluntary Technology Staff Development Program (VTSDP). The goal of the VTSDP is described in this literature as:

> The Staff Support Program is committed to providing opportunities for staff to learn how to use technology that will directly impact student learning and improve services. The technology training will include activities to promote professional collaborative relationships.

All faculty and staff were invited to participate in this program. Under the terms of the program the district would compensate faculty and staff towards the purchase of personal computers. In exchange for $1500 in compensation, all participants would agree to enroll in no less than sixty hours of program training within a three year period. An entire curriculum of workshops was created with topics ranging from basic computer use to desktop publishing and advanced computer applications.

The central administration builder at the Forest View Educational Center housed three administrative personnel whose roles were to oversee the growth of the district

network and faculty and stafff learning. To support staff and faculty in their investigation and use of computers and software, each building created a Technology Coordinator position. Teachers, during the course of many interviews, referred to the hardware, software, and personnel resources which were made available by this large grant.

Bobb Darnell, Ed.D., the Director of Staff Development for the district, spearheaded the development of the VTSDP curriculum and employee participation within it. The program officially began in the Winter semester of 1995. Through the first year, hundreds of faculty and staff members agreed to participate. There were 1913 workshop enrollments in 138 workshops during that semester. **Figure 3-2** depicts the levels of participation in the VTSDP through the Spring semester of 1997.

Figure 3-2: VTSDP Participation Levels 1995-1997
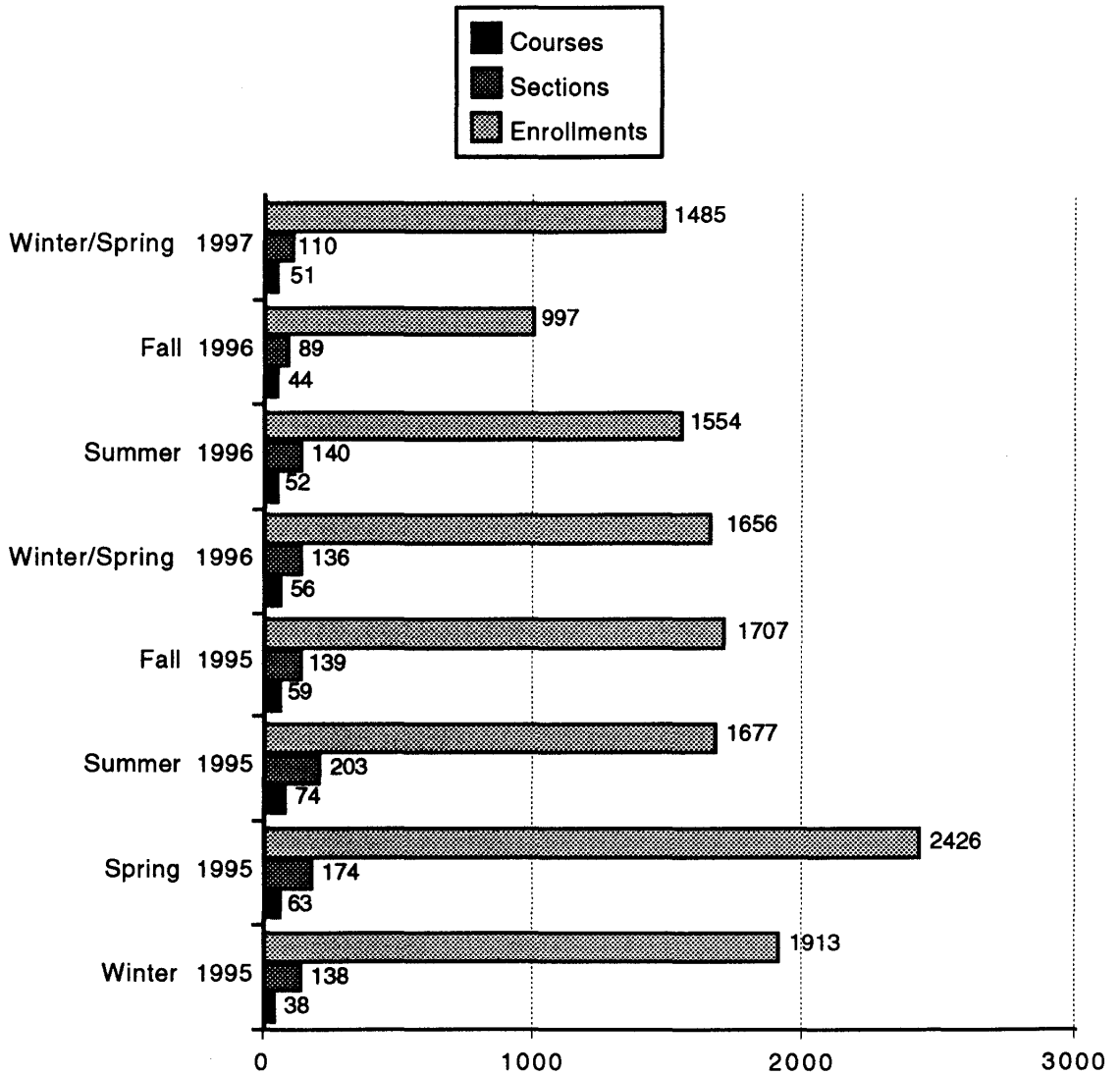
With this level of attention on instructional technology, District 214 was an ideal place for the research within this study. In September of 1996, the researcher contacted Bobb Darnell and began discussions on how interviews could be structured. The follow section details how interview candidates were chosen and contacted.

Acquisition and selection of interviewees: The VTSDP is structured and run by the Staff Development Office in District 214. All advertisements, workshop sign up sheets, and attendance records are managed from within this office.

In establishing criteria for the type of interviewee that would fit this study, it was decided that all interviewees needed to have some familiarity with basic computer use. This decision meant that no respondent should exist at the 0 level of the LoU scale, nonuse. While that consequence narrowed the range of possible categories in coding the data, it was important for the respondent to have some knowledge of instructional technology in order to have some answer to provide in section three of the interview. That is, without the context of instructional technology, no appropriate positive or negative event could be identified.

The Staff Development Office provided a comprehensive list of all participants in the VTSDP. Along with names and school locations, data was provided on the number of hours of completed workshop time for each person in the program. All non-teaching participants were eliminated as candidates; this study was strictly concerned with teachers. Administrators

and staff members who taught part time were included in the population of interviewees.

With the criteria of teaching and some familiarity with technology established, the next objective was to send invitations to as diverse a population as possible. Doing so required a balance of faculty from each of the six high schools and a range of skill levels with technology. Since data from the staff development office linked teachers with their respective high schools, the former of these was easily managed and ultimately an equal number of interview requests was sent to each high school.

The latter criterion, however, was more difficult to measure. Since the interviews had instructional technology as part of their core content, respondents with higher levels of familiarity with technology might be more likely to agree to participate in an interview. If such were to ensue, then little or no representation would be had at the lower end of the LoU scale. Some data needed to be known which could act as an index of familiarity with technology.

The data chosen for this purpose was the number of hours of cumulative participation in VTSDP workshops. As part of the agreement in being furnished with discounted computer equipment, all VTSDP registrants need to participate in at least sixty hours of workshops. Enrollment beyond sixty hours was encouraged. Participation could include work in both student and teacher roles. Faculty and staff who were deemed sufficiently knowledgeable in a particular area could act as instructors for workshops offered in that area.

Participants who enrolled as students or teachers in more than sixty hours of workshop time were paid from district staff development monies for doing so.

The staff development department furnished data which indicated the hours of technology workshop time in which each potential interviewee had participated. The number of accumulated hours of participation ranged from 0 to 120. In an effort to have all parts of this spectrum represented in interviews, an equal number of interview requests were made from each of the following groups:

> 0 - 20 hours
> 21 - 40 hours
> 41 - 60 hours
> 61 - 80 hours
> over 80 hours

On Wednesday, December 4, 1996, the entire list of 950 current VTSDP participants was downloaded from the staff development database. Some of these VTSDP participants were administrators and staff members. These names were removed from the list of possible invites since the research was targeted at teachers. From the remaining list, 276 teacher names, with equal representation from each of the above participation categories, were chosen as a focus population of interviewees.

On Thursday, December 12, invitations to interviews were then sent via intra-district "gray" mail to these 276 teachers. **Appendix A** contains the actual invitation materials sent. Included in these materials are:

1. A cover letter which describes the context and

purpose of the interviews, assures participants of
privacy in their responses, and offers a curricular
software program, written by the researcher, as a
gift of thanks for participating.[61]
2. A blank sign-up form for respondents to indicate
available dates and times for meeting. Respondents
were asked to return this to the Forest View
Educational Center district headquarters to the
attention of the researcher.
3. A list of the interview questions which the
respondents were asked to keep.

These invitations were distributed in advance of the

holiday vacation in the hopes that teachers could respond

prior to the upcoming break. In addition, interview

schedules were designed to make early second semester time

available to teachers, beginning with Monday, January 6,

1997. This time customarily sees fewer grading demands and

more opportunities for meeting during planning periods. The

interview schedule continued till the final week of March.

So as to allow teachers to fit the interviews into the

span of their work day, interview times were made available

from 11:00 a.m. to 4:00 p.m. Interviews were designed to

last between thirty and forty-five minutes such that teachers

could meet between teaching periods.

Between December 16, 1996 and January 20, 1997, thirty-

two teachers responded that they would be willing to

participate in interviews. Of these thirty-two, all but two

were successfully scheduled and interviewed between January

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[61] This piece of software, entitled *Memory Builder*, was written in the
summer of 1996 to assist students and teachers with vocabulary building
in all subject matters. The author holds all the rights to the software
and was under no restriction in offering and distributing this software.
District 214's Director of Staff Development, who encouraged this
software as an incentive for teacher participation, furnished the
researcher with blank floppy disks and made copies of the software for
all final interview participants.

7, 1997 and March 5, 1997. **Figure 3-3** displays the dates, time, and locations of the thirty interviews.

Figure 3-3: Interview Schedule

1	RMHS	1/7/97	12:00	PM
2	WHS	1/8/97	1:15	PM
3	WHS	1/8/97	12:15	PM
4	WHS	1/8/97	3:00	PM
5	RMHS	1/15/97	3:00	PM
6	RMHS	1/15/97	1:00	PM
7	BGHS	1/16/97	12:15	PM
8	JHHS	1/16/97	2:30	PM
9	JHHS	1/16/97	3:00	PM
10	BGHS	1/16/97	11:30	AM
11	EGHS	1/17/97	12:00	PM
12	BGHS	1/22/97	12:15	PM
13	BGHS	1/22/97	1:00	PM
14	PHS	1/22/97	2:15	PM
15	WHS	1/23/97	11:00	AM
16	JHHS	1/29/97	2:15	PM
17	JHHS	1/29/97	1:15	PM
18	RMHS	2/3/97	1:00	PM
19	RMHS	2/3/97	3:00	PM
20	RMHS	2/3/97	2:00	PM
21	RMHS	2/5/97	12:00	PM
22	RMHS	2/5/97	1:15	PM
23	EGHS	2/6/97	12:15	PM
24	BGHS	2/12/97	1:15	PM
25	BGHS	2/12/97	12:30	PM
26	WHS	2/12/97	11:15	AM
27	BGHS	2/12/97	3:00	PM
28	PHS	2/19/97	12:15	PM
29	BGHS	2/19/97	3:00	PM
30	WHS	3/5/97	12:10	PM

The critical question within this research is, "How does the use of technology affect teachers' feelings about their work?" The qualitative approach described above makes possible the answering of a "how" question. The structure of the interviews, coupled with the sample of teacher participants made possible a fruitful investigation into this question.

CHAPTER 4

PRESENTATION AND ANALYSIS OF THE DATA

Introduction

Organization of this chapter: The presentation and
analysis of data from this research naturally organizes
itself along the sequence of questions asked within the
thirty teacher interviews. This sequence, divided into three
sections, begins with the simplest demographic information
and continues into more analytical descriptions of
participant levels of technology use and the presence of
motivational and hygienic factors stemming from that
technology use. Thus, the presentation and analysis of the
data will be structured according to the numerical sequence
of questions within the interviews.

Explanation of abbreviations: Through the course of the
interviews and subsequent codings, numerous abbreviations
were used to keep the data concise. **Table 4-1** below
provides an interpretation of the various abbreviations used
in these processes. In some cases, abbreviations of software
were used for specific programs. These abbreviations are
explained in more detail within the footnotes of this
chapter.

Table 4-1: Coding abbreviations

Abbreviations related to high schools and departments

Abbreviation	Meaning
BD	Behavior Disordered
BGHS	Buffalo Grove High School
EGHS	Elk Grove High School
ESL	English as a Second Language
JHHS	John Hersey High School
LD	Learning Disability
PHS	Prospect High School
RMHS	Rolling Meadows High School
VTSDP	Voluntary Technology Staff Development Program
WHS	Wheeling High School

Abbreviations related to software and hardware

CA	clip art
CAI	computer based instruction
CBL	computer based labs
CD	compact disc
CP	computer programming
CW	ClarisWorks[62]
DB	database
DP	digital photography
DTP	desktop publishing
GB	electronic grade book
GC	graphing calculator
GM	Grade Machine[63]
GS	Geometer's Sketchpad[64]
HS	HyperStudio[65]

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[62] ClarisWorks is an integrated software program which contains word processing, spreadsheet, database, drawing, painting, and communications modules. District 214 has adopted this software as its principle word processing software.

[63] Grade Machine is a comprehensive grade keeping program. It is the preferred grade keeping software program in District 214.

[64] Geometer's Sketchpad allows students to draw, manipulate, and measure the angles of polygons. It is used in several of the high schools in District 214 as a hands on instructional tool for geometry classes.

[65] HyperStudio is a multimedia program which lets teachers and students create presentations and tutorials. The software allows for the intermingling of text, pictures, movies, animations, sound, and interactive buttons.

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IN.......................Inspiration⁶⁶
INT......................Internet
LD.......................laserdisc
MIDI.....................musical instrument
                        digital interface
SL.......................computerized slide shows
SS.......................spreadsheet
TB.......................test bank
WP.......................word processing
```

Presentation of the data

Interview codings: For the sake of space, the complete interview transcripts have been withheld from the contents of this paper. In lieu of these transcripts, a database was constructed to hold key points of each interview and demonstrate the coding of responses. These summative interview codings compose **Appendix A** of this paper. The codings are structured in accordance with the interviews themselves, beginning with background information on participants and continuing though LoU and Herzberg codings. Also included are key quotes from participants which help to highlight their interviews.

Overall demographics: The first part of each interview consisted of introductory questions which helped describe the general characteristics and descriptors of the teachers. Tables 4-2 through 4-5 below summarizes the demographic information on the teachers and the interviews.

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⁶⁶ Inspiration is a program which allows students to interrelate concept maps and flow charts with standard outlines. It is primarily used as a visual organizer.

Table 4-2: Interview participation by school

Buffalo Grove........................8

Elk Grove...........................2

John Hersey.........................4

Prospect............................4

Rolling Meadows.....................7

Wheeling............................5

Total..............................30

Table 4-3: Interview participation by teaching department

Computer Science....................2

English.............................4

ESL.................................3

Fine Arts/Music.....................2

Languages...........................2

Mathematics........................6[67]

Reading.............................1

Science.............................7

Social Studies......................3

Special Education...................3

Table 4-4: Participation by number of completed VTSDP hours

0 - 20 hours........................3

21 - 40 hours.......................8

41 - 60 hours......................10

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[67] Three teachers taught in both the science and math departments and have been listed in this table as both math and science teachers.

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61 - 80 hours.......................5
over 80 hours.......................4
Average VTSDP hours................53.1
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Table 4-5: Other teacher demographics

Female:Male participation ratio: 17:13

Average age of participants: 42.5 years

Average years of teaching: 15.4 years

Average interview length: 44.5 minutes

In reviewing the interview sample as it was described in section one of the interviews, the group was reasonably diverse, given the manner in which the total population was selected. Teachers from all six high schools participated, with every school having multiple participants, as shown in Table 4-2. Buffalo Grove High School supplied the most number of interviewees with eight.

There was also good representation across departments in the interviews, as shown in Table 4-3. Every curricular department was represented, including a significant level of participation from ESL and special education teachers. Science teachers participated seven times with four of those seven coming from Buffalo Grove High School.

Interestingly, the number of VTSDP workshop hours for each participant varied widely, as shown in Table 4-4. It was originally a concern that a disproportionate number of teachers with participation levels beyond sixty hours would agree to be interviewed. In reality, an almost perfect bell

curve distribution of workshop hours were represented, with the average number of participation hours being 53.1. Twenty one of the thirty participants had not completed their sixty hour quota at the time of their interview. By comparison, the average number of completed workshop hours for the entire population of VTSDP teachers was 38.8 hours and 65 percent of that whole population had not completed their workshop quota. Thus the interview sample, while its average hours of participation was higher than the entire population, was not excessively skewed toward the high participation end of the spectrum.

Slightly more females (17) participated in interviews than did males (13). All of the special education, ESL, reading and language teachers were female. All of the math teachers and computer teachers were male, though one female science teacher also taught math.

The teachers ranged in age from 25 to 59, with the average age being 42.5 years. In sequencing participants from youngest to oldest, a time span of thirty-four years, there was not a gap of more than four years between any two participants. The distribution of years of service was understandably similar to the age distribution, with numbers ranging from two to thirty-six years of service.

In conclusion, part one of the interviews depicts a diverse sample of teacher participants. In demographic categories including age, gender, and department, there was representation from a variety of people. A sample of thirty does not allow for generalization about the results of data

analysis, but the distribution of participation provides for
a balanced investigation into levels of use and teacher
motivation.

Analysis of LoU

Frequency of LoU levels throughout sample: The process
of determining the CBAM Level of Use at which each
interviewee was performing with technology depended on the
language which they used in part two of the interviews. This
second sequence of questions gave respondents an opportunity
to chronicle and itemize their use of instructional
technology and describe the effects this use had on students
and colleagues. As stated in chapter one of this paper,
instructional technology herein is defined as the use of
hardware and software to access, manipulate, and communicate
information in settings where students are learning.

The order of the questions was itself hierarchically
arranged so that teachers could describe a natural
progression from the learning of technology skills, to uses
of technology which assisted only themselves, to uses which
affected students and colleagues as well. During the
interviews, answers were elicited and clarified so that
respondents clearly described the types of uses of technology
and their spheres of influences with the technology. In
answering question 2-6, interviewees were asked to provide
specific examples of how their knowledge and use of
technology had affected students and colleagues. The
presence or absence of these examples helped distinguish the

true level of use of the technology.

The resulting teacher descriptions then had to be compared to the descriptors used in the original CBAM literature from the Center for Research and Development at the University of Texas at Austin. Chapter two of this research provides the descriptors for each level of use as originally determined by Hall. Each level of use contains verbs which depict the extent to which, in the context of this research, a teacher is implementing technology in teaching.

As the answers to section two of the interviews were reviewed and coded, three important patterns emerged which focused the analysis of LoU in this paper. First, given the established definition for instructional technology and the descriptors for each level of use within CBAM, no respondent was coded with a LoU value of 0, I, or II. All interview participants, by virtue of their enrollment and involvement with the VTSDP, had moved past these three anticipatory stages and had begun actively using computer hardware and software. The combined availability of computers at school and at home, along with the ongoing support from colleagues and the VTSDP workshops, set the baseline level of use at IVA, mechanical use. Thus, the research noted in chapter two on the influence of external factors on technology adoption could not be supported or contradicted within this study because of the relative homogeneity of hardware, software, and training resources for all interviewees. This research does, to some extent, support LeCuyer's findings that

computer access at home (in this case due to participation in the VTSDP) improves integration levels at school.

Second, as the coding of responses ensued it became apparent that technology was too broad a term to use in determining LoU descriptors for respondents. A wide variety of technology uses were described with some uses being appropriate only to certain settings and disciplines. Therefore, in order to accurately determine the LoU in technology for each interview participant, it was necessary to focus on one particular facet of technology and determine the extent to which the use of that facet had changed the teaching and learning.

In questions 2-1 through 2-5 of the interviews, teachers cataloged and chronicled their use of technology across a wide array of software programs and hardware devices. Each teacher described a familiarity with no fewer than three software programs. For some teachers, there was even familiarity across programs. Other teachers described themselves as being very adept in the use of some software programs but relatively unfamiliar with others.

The evolution of technology skills for almost all the participants began with the learning of word processing and keyboarding. All but four teachers, no matter what age or teaching discipline, began learning the use of a computer based on its usefulness in entering and manipulating text. Two teachers had first used computers within the context of computer programming and two others had first used computers for keeping grades.. Word processing was the single common

technology use among all participants. While many of the
hardware and software uses defined in chapter one were
evidenced within the interviews, only word processing use was
common to all teachers.

With the diversity of uses that emerged beyond word
processing, it became clear that teachers were performing on
various levels of use for different software programs.
Therefore it was necessary to categorize these unique program
uses and determine a LoU for each teacher based on one or two
of them. If a teacher had very little familiarity with a
grade keeping software program but had implemented new
curricular ideas based on her knowledge of creating software
slide shows for student presentations, then the determination
of an appropriate LoU for that teacher was focused on the
latter as an innovation.

The third pattern which emerged showed that, like the
CBAM LoU scale itself, technology uses needed to be
categorized and sequenced. Different uses of technology
require differing depths of knowledge and can affect teaching
and learning to varying degrees. Through the course of
section two of the interviews, teachers were asked to rate
their skill level with each software and hardware use they
itemized. It became apparent that high values for some uses,
such as multimedia presentations, required considerably more
depth of computer knowledge than uses such as word
processing. Therefore, technology uses were identified,
categorized, and then placed into one of three levels
according to the depth of knowledge required to learn and

show proficiency with each use.

In first identifying technology uses, the following were categories were developed and here are sequenced alphabetically:

Table 4-6: Categories of technology uses from interview codings

CAI uses:

1. Designs tutorials for direct computer-based student instruction
2. Purchased and integrated a commercial skills development software series
3. Has written exercises for use with software program that allows students to manipulate geometric shapes
4. Has given workshops to other teachers on the use of geometry program
5. Brings students to lab for viewing a simulation on legislative procedures

CBL uses:

1. Provides computers in science lab for direct collection and processing of data

Database uses:

1. Uses a database to store student names and records and send communications to students

Desktop publishing uses:

1. Assists students with the design of finished research projects
2. Designs program and event materials for distribution in the department and throughout the school

Grade keeping/test generating uses:

1. Keeps student grades and attendance records via computer

2. Prints progress reports at regular intervals from grade keeping software
3. Creates tests from a database of questions supplied with textbook

Graphing calculator uses:

1. Provides a calculator for each student during class time
2. Established program to allow students to take calculators home overnight

Internet uses:

1. Allows students to incorporate Internet materials into research assignments
2. Provides context and direct instruction for use of Internet for research
3. Has students maintain communications with people in other countries via e-mail

Multimedia uses:

1. Designs presentations using text and pictures for use in class lectures and discussions
2. Uses computers to control and sequence laserdisc images
3. Provides direct instruction to students on creating computer based presentations
4. Provides instruction on incorporating digital photographs, digital video, and scanned images into word processing documents
5. Uses game-like computer presentations to teach and review concepts
6. Provides instruction on concept mapping as an alternative to standard outlining
7. Has given departmental workshops on the use of multimedia software

Spreadsheet uses:

1. Uses spreadsheets in the analysis of data collected in science labs

Word Processing uses:

1. Prepares course materials using word processing program

2. Expects essays and research papers to be typed by students
3. Has rewritten department materials using word processing program
4. Dedicates class time to the instruction of keyboarding skills
5. Reserves computer lab and gives students class time to use a computer to write and revise papers.
6. Creates certificates and awards for students
7. Developed a template with which students create newsletters on current events

Next, with the aforementioned criterion of knowledge depth in mind, each of the ten technology uses was fitted into Table 4-7 below.

Table 4-7: Categories of technology uses

Category 1	Multimedia uses
	Desktop publishing uses
Category 2	Database uses
	Spreadsheet uses
	Graphing calculator uses
	Internet uses
	Word Processing uses
Category 3	CBL uses
	Grade keeping uses
	Test generating uses
	CAI uses

Some justification of these categories is required before they can be used to assist in the determination of LoU

values for teacher participants. The list should not be interpreted as a necessary sequence of technology uses. It is not necessary to begin with computer based instruction before learning the use of grade keeping software nor is it necessary to have a working knowledge of Internet uses before working with spreadsheets.

The categorizations in this list are based on the needed level of familiarity with computer or calculator interfaces and the complexity of the terminology which needs to be known in using them. Category 3 programs are software packages which have very limited uses and require a minimum understanding of opening, closing, saving, and printing processes on the computer. Unlike standard applications like word processing and databases, there is no application of these program uses beyond their intended, content-based use. They serve a limited purpose and therefore require the least amount of knowledge to use with proficiency. As shown in the Uses codings in Appendix A, majority of teacher participants used grade keeping software and all rated themselves with skill levels of six or higher. A minority of teachers employed some form of computer assisted instruction or computer based lab softare and hardware, but those who did reported high familiarity and confidence in using them.

Items in Categories 2 and 1 are distinct from those in Category 3 in that their use can be applied to a variety of contexts. With the exception of Internet use, all these programs are used for the *construction* of knowledge and ideas compared to Category 3 programs which are used for

instruction. The use of the Internet for accessing information is not, unlike Category 3 software programs, subject specific. Due to their diverse capabilities, Category 1 and 2 software programs require a knowledge of formatting and program specific language and symbols. Category 1 programs further require a knowledge of multiple media types and their compatibilities with each other.

Twenty five of the thirty interviewed teachers indicated that word processing was the first application they learned for the computer with many having learned multiple software programs for word processing use. All thirty participants used computers for word processing and reported an average proficiency level of 8.4 on a scale of 1 to 10.

Beyond word processing, however, the instances of use for the remaining Category 1 and 2 programs diminished significantly. While database and spreadsheet applications have been present for almost as long as word processing applications[68], their usage was much more limited within the sample of interviewees. Nine participants responded that they used databases or spreadsheets to store and manipulate data. This minority reported an average proficiency level of 8.3. Thus, the proficiency stayed relatively consistent, but the proportion of people who used these applications diminished. The four who responded that they used spreadsheets were either computer or science teachers.

Not surprisingly, the use of graphing calculators was limited to math teachers. Of the six teachers who taught

[68] The very first use of computers, as described in chapter one, was for database purposes. However, database applications for desktop computers arrived after word processing applications.

math, four indicated that they regularly made use of this tool in class. These four reported an average proficiency of 8.6 with the use of graphing calculators.

Reports and descriptions of Internet use were affected by the uncompleted wiring of some schools in the district at the time of the interviews. Thirteen participants reported that they used the Internet for accessing information, providing research opportunities for students, and sending and receiving e-mail. Of these, all but two indicated that Internet use had been their most recent use of technology. The average proficiency report for Internet use was 6.1, further underscoring the newness and relative inexperience which the teachers had with this tool.

As for Category 1 software uses, ten teachers responded that they used desktop publishing or multimedia software to intermingle pictures, text, sounds, and animations. Teachers who reported using desktop publishing software programs such as PageMaker™ and Quark XPress™ described their use of these software programs for improving the appearance of teaching and cocurricular materials. Teachers who incorporated multimedia did so in the preparation for in-class presentations or for the structuring of assignments in which students would do the presenting. The incorporation of laserdiscs, with playback controlled via computer, was described by two science teachers and represented multimedia use as well. Those who responded as incorporating desktop publishing or multimedia uses of the computer reported an average proficiency of 7.3.

With the exception of one, every teacher reported multiple uses of technology. Given the range of responses and the aforementioned differences in required knowledge for employing different software programs and hardware devices, it was necessary to focus on one or two highlighted technology uses in order to determine a CBAM LoU. In the coding of each participant's responses, one or two described uses then became the focal use(s) of technology for which an appropriate LoU could be assessed. Priority selection was put on Category 1 and 2 uses which required significant learning time and which, by virtue of their more universal application, had the potential to more widely affect the teacher's job.

Following this selection of key technology uses for the participants, a composite LoU was established for each teacher. Table 4-8 below shows the distribution of levels of use throughout the interview sample.

Table 4-8: Levels of Use (LoU) of Interviewees

Renewal...................................0
Integration..............................12
Refinement...............................11
Routine...................................6
Mechanical................................1
Preparation...............................0
Orientation...............................0
Non use...................................0

B. descriptions related to each LoU

As described earlier in this chapter, no teacher was

coded with a LoU below Level III, mechanical use. The first three levels of use describe employees who are just beginning to hear of and understand the value of an innovation. All interviewees were beyond these early stages.

There was one interview participant whose responses to section two of the interview described a Level III mechanical use of technology. At this stage in the CBAM LoU hierarchy, the user[69] is actively using an innovation but that use is characterized by a focus on the user's needs as opposed to the clients'. The participant coded at this level itemized five different computer uses but gave no evidence of employing the technology beyond sporadic, short term use. Critical to her answers were the following quotes:

> I really don't see any change in the way I teach. We have a lot of stuff here and I know it's important. I've got a new computer in my classroom... I took the 60 hours right away. But that was just to get out of debt with the computer... For what I teach, the computer is not a major interest to me. (RL)[70]

For this participant, there was no single use which gave indication of impacting students or colleagues. She had, through the course of her workshops in the VTSDP, chosen to investigate many different topics in technology instead of focusing on one or several. Her use subsequently had no extended purpose or plans for growth and was largely superficial. Her greatest familiarity was with word

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[69] As described in chapter two, the CBAM use of the term "user" in this study refers to teachers. The use of the word "client" subsequently refers to students and colleagues who are affected by the teachers' use of technology.

[70] To assist in correlating quotes with the codings in Appendix A, the initials of the interviewee are included at the end of each quote throughout this chapter.

processing and she spoke of using that primarily for writing correspondence with friends and relatives. She furthermore candidly acknowledged that she planned to retire within three years and did not feel sufficiently interested in technology to begin incorporating it in her teaching.

While there was only one participant whose composite LoU of technology was mechanical, many interviewees described this level of use for emerging technologies such as e-mail and Internet access. District 214 had, through 1995 and 1996, placed a priority on getting computer labs and faculty offices connected to the Internet. At the time of the interviews, only two of the six campuses had Internet wiring completely in place. Nonetheless, via workshops, thirteen participants had at least some early experience with Internet access and e-mail.

The routine (IVA) LoU was denoted for six of the thirty participants. These teachers' participations in the VTSDP averaged 26.0 hours up to the point of their interviews. Several types of teacher responses made this coding appropriate for them. Two of the six reported feeling unsure about their skill level with all of the technology uses they reported. While their teaching had changed from their knowledge and use of their technology skills, their proficiency was too limited to allow for long range planned use of the technology. Among the telltale quotes from these three interviewees is:

> I know how to use ClarisWorks and I use it
> to make certificates and send mailings. But
> I'm still shaky on setting margins... I just
> do the survival things. Just basic stuff. (GR)

Other teachers whose descriptions evidenced routine use were employing uses of technology which colleagues had previously established. Teachers reported using CAI software which others in their department had purchased and investigated. No further use or investigation of the software was being made by the teachers at this level of use. Some focused their responses on word processing uses, but described only an expectation that students complete assignments using word processors. Three teachers stated directly that while they do not provide any instruction in or class time for the use of word processing, they expected all papers to be typed by their students. This type of response was most common among teachers who taught upper level or advanced placement courses.

A key descriptor to the routine level of use is "stabilized." There were indications by several of the teachers coded at Level IVA of the LoU Scale that they had previously been more involved in finding new uses for themselves and their students but had, over time, settled into an unchanging use of their described software programs. In one such example, the teacher explained:

> When I taught the Intro. to Social Sciences course back in 1988, I weekly wrote a computer program to correspond to *Newsweek* magazine. Eventually, all the teachers of that course began using this program. But the district changed word processing programs and I don't teach that course any more. Now, no one uses it any more. (BC)

In sum, Level IVA respondents, while they were coded at this level for different reasons, shared common threads to

their descriptions of their overall technology use. Their
use of technology was impacting students and had grown beyond
self-serving purposes, but they gave no indication of
planning any expanded implementation of the current set of
tools which they were using. They were of varying levels of
confidence and proficiency in using software and hardware,
but all acknowledged the impact their current use was having
on their work. None, however, gave indication of evaluating
their current level of use and its consequences.

Distinguishing between levels IVA and IVB within the
CBAM LoU scale is difficult because their differences are
nuanced. Both sublevels allow teachers to use the innovation
without collaborating with colleagues. Thus within this
study, distinguishing between IVA and IVB was only possible
by listening for indication as to whether a teacher was
varying the use of the technology tool(s) and described
continued growth and redesign of that use for student
benefits. The presence of such descriptors would be cause
for coding a teacher at Level IVB instead of IVA.

Based on their descriptions of technology use, eleven
teachers were coded into this level of use on the CBAM scale.
A central goal of the VTSDP, as quoted in chapter two, was to
assist teachers in learning uses of technology that would
allow them to function at this level of use. With twenty
three of the thirty interviewees at or above this level, the
VTSDP seems to have had a significant level of success in
achieving this goal.

Teachers at Level IVB described a vast array of uses and

contexts with technology. Programs from all three categories
in Table 4-7 were described, with every respondent noting at
least four different software uses. Seven different
departments and five of the six high schools were represented
at this level. Thus, responses at this level do not appear
to have been affected by subject matters taught or high
school.

Teachers at this LoU had participated in an average of
61.3 hours of VTSDP workshops. This number is more than
double the average for teachers at Level IVA. This large gap
may speak to an important difference between levels IVA and
IVB. The core distinction between these two sublevels is
that the former is characterized by stability while the
latter is described by continued growth which affects
clients. With the VTSDP's goal being to educate teachers
such that they integrate technology in their teaching, it is
not surprising that a significant VTSDP participation
difference existed between teachers at these two levels.

The following quotes give examples of teachers using
technology at the level of refinement:

> In order for my teaching to be
> interesting, I have to change. The *Opening
> Night* software program has been a new way to
> bring in change for the students.(BM)

> When I give presentations in class, the
> kids think it's like a game. Some of the kids
> who are usually bored and detached are the ones
> who are the most excited and plugged in. (HH)

> I spend a lot more time teaching
> technology and research skills now that I'm
> confident with computers. That confidence

hasn't made me more comfortable with teaching, just with technology... My teaching has changed, but I think laterally, not vertically (SR)

Lower track kids like to see themselves using technology just like higher track kids... I don't push computers. I don't feel good about using technology, I feel good because the technology helps my students... The calculators allow the lower track kids to do things which might otherwise be over their heads. (SM)

All but one of the teachers at Level IVB made active use of technology equipment in their classrooms. The uses were diverse, but common to all of them was the ongoing effort to learn them and build time and attention into the course curricula in order to teach students their use. Examples included:

1. building of multimedia projects which incorporate digital photography and scanned images
2. building and using a word processing template for student use in creating book reports
3. using a computer-based screenplay program to enable students of different primary languages to collaborate and write plays
4. authoring presentations to focus and enhance class lectures for students with attention difficulties
5. creating a research skills unit which requires students to learn the use of online data access tools
6. providing regular in-class access to graphing calculators to allow students to visually and numerically manipulate equations
7. intermittently providing computer interfaces for data collection in science labs
8. structuring and guiding an Internet project for researching Christmas customs around the world
9. using computer-controlled laserdisc

presentations to show images of Hispanic
countries and cultures

The general description for a teacher functioning at
Level IVB is that of a person who had built a sufficient
knowledge base with a technology tool or set of tools and who
had invested curricular time and resources in incorporting
the tool(s). Most respondents at this level gave themselves
high marks for proficiency with the software programs they
described using.

There were, however, instances when teachers described a
greater enthusiasm for and awe of technology than their
corresponding knowledge of the technology. For some, their
knowledge of a particular tool had come not just from
preparatory workshops but from trying to use the tool and
learning its use from students and colleagues. This subset
of teachers described themselves as not needing complete
comfort with a software program before integrating it into
their teaching. Repeated accounts by participants between
the ages of forty and sixty depicted teachers who felt
challenged to be technologically literate and not be viewed
as "old school" teachers.

For many, the use and "on the fly" learning of the
technology provided an opportunity for building relationships
with colleagues and students. A trust in the technology's
benefits, coupled with a strong relationship component to
their style of teaching, made it possible for several
teachers to immerse themselves in the use of a tool and
refine its use based on a growing knowledge of the tool and

an extant knowledge of their students. Teachers who taught
in contexts such as special education where instruction was
learner-centered described this situation more often than
teachers whose classroom contexts were highly subject-
centered. Indicative of this are the following quotes:

> By no means am I an expert! I don't
> consider what I know how to do out of the
> ordinary. Tons of people are willing to give
> up their time to help me... Kids helped me
> learn how to do e-mail. (HH)

> I like to be shown, mess with a program,
> and then maybe read manuals if I get stuck.
> But I'd rather learn from people around here.
> I ask everyone who walks by... Teachers are
> good sharers; they're blabbermouths! (ME)

Another common indicator at Level IVB was teachers'
descriptions of feeling a pressure to respond to the
challenges and capabilities of technology. While they were,
as yet, not confident enough to teach colleagues or develop
program-wide changes with the technology, they acknowledged
the potential benefits of its use and felt compelled to be
knowledgeable with it. Many teachers, particularly those
whose subject matters were Language or ESL, felt that a
widening language barrier was forming between teachers who
were technologically literate and those who were not. Among
the key quotes in testament to these feelings are:

> I recognize the need for continual growth
> now. Without being receptive to this stuff,
> you're locked in the past... I hang out with
> computer people now and I'm real nice to
> computer coordinators! (ME)

> There are so many terms. When I first
> decided to participate in the (VTSDP) program,

> I remember taking notes and thinking, 'This is
> exactly like a foreign language.' Trouble is,
> now I'm the one who has to learn it, not teach
> it! (MD)

One teacher, a department chair in Fine Arts, did not directly use technology in class. His extensive use of and skill with desktop publishing and music notation software had allowed him to completely revise the manner in which musical scores and event programs were created. In this manner, he had significantly improved departmental documents and facilitated the printing of unique orchestral parts of musical scores. Coupled with these benefits was his current effort to integrate MIDI technology so as to allow students to interface musical instruments with computers. Thus, this interviewee was coded at the refinement level of use.

At Level V of the LoU scale, teachers had to describe more than ongoing use of the technology tools. At this level, teacher responses needed to contain descriptions of them assisting in program-wide growth and development of a technology tool or actively teaching colleagues about the use of the tool. Among the key quotes from the eleven teachers coded at the level of integration are:

> I am the first teacher in the school to
> have acquired Internet identification stickers
> (for access permission). The reason my
> students are first is because I took the time
> to teach them the proper use of it. I've
> shared my uses of it with teachers in my area
> as well. (OL)

> Because of my enthusiasm and desire to
> know, I'm seen by my department members as a
> go-to person. Heck, I learn a lot of what I
> know from the students. They're bright as hell

and they love showing me. They taught me how to use e-mail and I showed members of my department. (GL)

When I first brought Geometer's Sketchpad and Tesselmania, I had to drag colleagues into technology. But it's clear that you can do things, especially with Sketchpad, that you can't do with pen and paper. Now, people come to me for help! (RM)

Teaching an elective course, I felt a pressure to make sure my materials looked first rate. Boring electives get killed. So I completely revamped the reference binder for the (Computer Applications) course. (MK)

A lot of these people don't even know enough to ask the right questions about computers. I've given workshops on how to use HyperStudio to other (English) teachers and they were totally new to what the software could do. (JP)

I spend time teaching kids how to design their papers so that they can take more pride in their appearance... People get comfortable with things when they see me do it first.(BS)

As with respondents at Level IVB, a variety of software and hardware uses were described at Level V. Every teacher at this level noted at least three unique uses of software. This number is actually less than that provided by the group at the refinement level, but the two teachers who indicated only three technology uses described at least one of them as having department-wide impacts.

For the group of teachers at the integration level of use, the average hours of workshop participation in the VTSDP was 54.5 hours, compared to 61.3 hours for teachers at the previous refinement level. Behind this drop in participation hours were several causal factors. First, two respondents,

whose participation hours were eight and twelve respectively,
voiced dissenting opinions about the structure and purpose of
the VTSDP. One stated:

> We have hardware coming out of our ears
> here. Maybe we've taken on too much too fast.
> There are precious few people who really know
> the technology. The District seems to think of
> or view technology as an end in itself... My
> use of the Internet is being held hostage
> because I have to take six hours of
> workshops!... As fellow teachers and I have
> worked on integrating Sketchpad, we've always
> first asked, 'What do we want to be different
> about our students (from the use of Geometer's
> Sketchpad)?' (IK)

Second, a greater portion of the people at this LoU
described having a long history with using computers. Their
familiarity with computers far predated the origin of the
district's focus on technology integration. Many spoke of
using previous computer systems which were much more
intricate and less graphically oriented. For these people,
the evolution of computer interfaces towards a simpler
graphical user interface[71] assisted in building their
confidence in using computers. Two of the eleven began their
experiences with computers in computer programming and had
built upon that "grass roots" knowledge of computer
operations. Two other teachers had switched departments and,
in so doing, found that their levels of knowledge exceeded
those of their new colleagues. Thus, the research of Koohang
seems to be supported in that teachers who had computer
experience prior to teaching did show more confidence in

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[71] A graphical user interface or GUI refers to a computer system which
uses visual symbols and icons to represent locations and functions
within the computer. In place of textual prompts needing to be typed,
processes are driven by selecting from a continuous set of menu options.

using computers with their teaching. That confidence, however, was not necessarily coupled with an agreement with the school or district's priorities for technology growth.

Interestingly, though their length of experience with computers was greater, teachers in this group were, on average five years younger than teachers at Level IVB of the LoU scale. The three youngest, with three, four, and six years of teaching experience respectively, spoke of how important their uses of computers in college had been in building confidence in using technology in their teaching. For them, the presence of technology tools had been a constant and the switch from being students to being teachers was the point of change. Inversely, for veteran teachers, their jobs had been constant, but the presence of technology had been a change. Further descriptions of age and use relationships follows the conclusion of LoU analysis at each level.

Even if the two aforementioned teachers, with VTSDP hours of eight and twelve, were excluded, the average number of VTSDP hours for teachers at the integration LoU would be 64.4. This number still is not a significant increase from the 61.3 shown by the teachers at the refinement LoU. A third explanation for this is the increase in independence and initiative shown by teachers at Level V. The following quotes give examples of these character qualities:

> Coming in to Special Education from the Business Education Department, I was predisposed to using computers. Three years ago, I adopted the Skills Bank program, tested it, and encouraged the purchase of it. (HS)

> When I arrived, ESL wasn't using
> computers. We were in the dark ages. I just
> decided, 'We're doing it!' Suddenly, everyone
> was doing it! I'm simply in awe of what a
> computer can do. (GM)

It became apparent, in reviewing responses at levels IVB
and V of the LoU scale, that level of knowledge of technology
use(s) was only a moderate distinguishing factor. More
important was the teacher's ability to recognize possible
program-wide benefits to using technology and their readiness
to initiate the changes required to implement it. The
teachers at this level all had in common the capacity for
leadership. This trait was pivotal in distinguishing them
from previous levels of use. A sense of leadership had
enabled them to communicate technology uses and their
benefits to coworkers in their area of work. Interestingly,
while one of the eleven acted as a technology support staff
person within his school, none of the other ten had formal
leadership roles within their schools or departments. Thus,
their work and recognized leadership had indeed begun with
their own initiative.

As teachers levels escalated along the LoU scale, the
amount of time invested in technology naturally rose. Those
at Level V had often spent summer hours developing materials
to better integrate software programs. One teacher stated:

> Each new computer fans my excitement. I
> can do more in less time and with a higher
> quality, yet now it seems I just do more...
> People speak of wives being "sports widows". I
> think my wife is a computer widow. (SP)

In addition, there was a greater likelihood that

teachers who had reached the level of integration identified their technology skills as a significant portion of their teaching skills. Those at the level of integration had achieved the second goal of the VTSDP, which was to "promote professional collaborative relationships."

As indicated in Table 4-8, no interviewees were coded at the renewal (VI) level of use. This level of use did not conform well to this study for several reasons. In interpreting what a user needs to be doing to exemplify use at this level, both the work of teaching and the progress of technology stymied teachers from moving to this level.

As stated in chapter two, Level VI is evidenced by a reevaluation of the quality of use of the innovation coupled with efforts to make major modifications of or alternatives to present innovation. While some teachers had indeed evaluated their own use of technology, none had sought major modifications to a specific technology use. A majority of instructional time is application time for the tools of teaching. Teachers exhibited varying degrees of application and integration in levels III through V. Considerably less time is given to curricular or methodological evaluation within the course of a teaching day.

Furthermore, the process of finding new and improved software and hardware resources depends on available funds. Teachers gave varying accounts of their capacities to requisition technology monies. Most were dependent on department chairs or technology support staff to buy software. These limitations within teaching therefore made

it difficult for interviewees to demonstrate reevaluation and modification.

The natural evolution of software and hardware also made the reevaluation difficult. Teachers, as with all people who use technology, are dependent on the growth of hardware and software programs. The new capabilities made possible by each new version of software programs, each new processor and hardware devices within computers, depend on the research and development by technology companies. In this way, the nature of technology also limited the reevaluation component. Major modifications often have to wait until the technology itself evolves.

As previously stated, the external factors of computer, software, and training availability were relatively equalized throughout the interview sample. This prevented the support or contradiction to previous research which had investigated how those extrinsic variables affected the adoption and use of technology. The internal factors of age, gender, and subject matter did vary within the sample, however.

Table 4-9 shows, in ascending order, the ages and LoU codings for the thirty teachers interviewed. Very little evidenced emerged within these codings that age was a factor which affected level of use. Six of the eleven respondents coded at the integration level were thirty-fours years old or younger, suggesting that high level use might be facilitated in younger teachers. Teachers who were older than the median age of forty-three did not show any significant differences in the LoU codings. Thus, the intrinsic factor of age,

within this research, showed little effect on teacher adoption and use of technology.

Table 4-9: Age and Level of Use

Age	Level of Use
25	Refinement
26	Integration
27	Integration
29	Integration
29	Integration
30	Refinement
31	Integration
34	Integration
34	Routine
35	Refinement
36	Refinement
37	Routine
41	Refinement
42	Routine
43	Integration
45	Routine
45	Integration
45	Routine
46	Integration
48	Refinement
48	Integration
51	Integration
53	Routine
53	Integration
55	Mechanical
55	Refinement
57	Refinement
57	Refinement
58	Refinement
59	Refinement

Similarly, there was little difference between levels of use in males and females within the interview sample. Table 4-10 shows the distribution of levels of use in both genders.

Table 4-10: Gender and Level of Use

```
Female.......Integration
Female.......Integration
Female.......Integration
Female.......Integration
Female.......Integration
Female.......Integration
Female.......Mechanical
Female.......Refinement
Female.......Refinement
Female.......Refinement
Female.......Refinement
Female.......Refinement
Female.......Routine
Female.......Routine
Female.......Routine
Female.......Routine
Female.......Routine
Male........Integration
Male........Integration
Male........Integration
Male........Integration
Male........Integration
Male........Integration
Male........Refinement
Male........Refinement
Male........Refinement
Male........Refinement
Male........Refinement
Male........Refinement
Male........Routine
```

Subject matter did not affect teachers' level of use, but seemed to affect how technology was integrated into teaching. Teachers in science and math departments most frequently used technology to aid in viewing and manipulating data. This data was either numerical, as in the case of graphing calculator and CBL uses, or visual, as in the case of laserdisc images. The emphasis was on improved control over the pace and depth of the information.

Teachers in ESL and special education settings were more likely to describe technology uses in which students were

engaged in direct instruction or extended project construction via the computer. For these teachers, the technology served to more greatly motivate and focus students during class time. The emphasis was on greater control of student behavior and classroom atmosphere in these cases.

Thus there was limited support for the previous findings on the effects of internal factors in technology adoption. The work of Mackowiak, in which age was not seen as a factor but subject matter was, drew some support from these interviews and codings. In general, no patterns emerged showing relationships between extrinsic or internal factors and technology use. However, the analysis of levels of use did achive the first stated objective of this paper.

Analysis of motivation/hygiene factors

The third and final portion of teacher interviews attempted to provide evidence of worker satisfaction or dissatisfaction as described in Herzberg's theory of motivation. The language and sequence of the questions were drawn from Herzberg's research described in Chapter 2 of this paper. The questions encouraged teachers to identify a discrete event, related to their use of instructional technology, which had a significantly positive or negative effect on how they felt about their work. Descriptions of their subsequent feelings then became the language which was coded into motivator and hygienic categories.

Defining satisfactory job performance: As Herzberg

collected and categorized responses to his interviews, he generalized that the factors which, when absent, caused dissatisfaction were factors related to the workplace. That is, components of the work environment seemed to be cause for worker dissatisfaction. Conversely, the items identified as motivators were instead related to the work itself. Applying this dichotomy to the context of this study prompts the question of how technology has changed the workplace and how technology has changed the work itself.

While a great deal of attention has been given to Herzberg's identification of two sets of factors affecting job performance, a strength of his interview tactic is its ability to elicit concrete language from interviewees so as to provide clear evidence of events and related feelings. The call for specifics and the repeated requests for descriptions of feelings are means of assuring legitimate indications.

But recognizing dissatisfaction and motivation requires more than the distillation of true events and feelings. It requires a sense of how those feelings have affected job performance. Just as the identification of an event insured a concrete point from which to describe feelings, a change in work performance and behaviors provide clear indication of dissatisfaction or motivation. That is, it is more concrete and measureable to describe the changes in a person's work performance than it is to indicate a change in his or her feelings about the work. Proof of dissatisfaction, for example, is reduced work performance.

Ascertaining performance change then depends on an understanding of what it is the workers are supposed to be doing and what constitutes satisfactory job performance. Therefore, prior to coding responses from this portion of the interviews, it was necessary to establish what comprises good job performance in the profession of teaching. By defining standard attributes of good teaching, the negative effects of dissatisfiers and the positive effects of motivators could be recognized as factors which displace teacher performance in either direction of that standard definition.

The work of teaching requires ongoing communications with three core facets of the work environment. These are depicted in Figure 4-1 below.

Figure 4-1: Teacher Job Relationships

subject matter

↑

TEACHER

colleagues/administrators   students
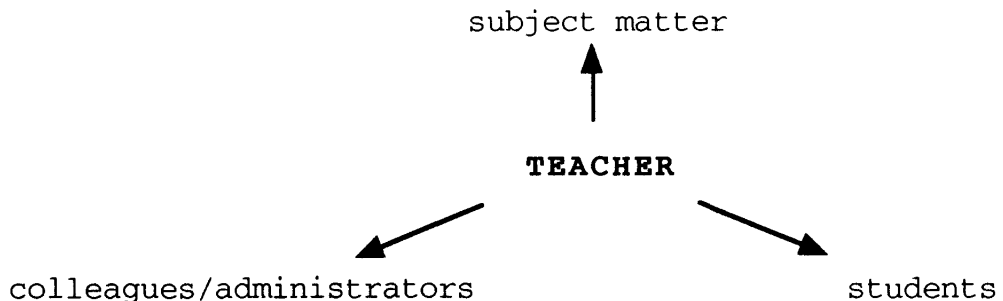
Job performance would improve if one or more of these relationship lines improved. Each of the three can be designated by various descriptors. For the sake of

identifying satisfactory teaching, teachers were considered
to be effectively performing their jobs according to the
following descriptors:

1. organizing and sequencing concepts within the
   curriculum of the department and school
2. communicating concepts to students in class with
   clarity
3. providing a safe learning environment in the
   classroom
4. determining student understanding of subject
   matter with regular assessments
5. providing support and motivation for students in
   their development of talents and self esteem
6. supporting and representing the policies of the
   school
7. collaborating and sharing resources with
   colleagues

The use of technology as a tool could affect one or more of
these descriptors. Dissatisfiers might cause an absence or
degradation of one or more of these descriptions while
motivators might augment performance along one or more or
provide for new capacities of job performance.

Hygienic patterns: In the interest of time and so as not
to force teachers to describe both a positive and negative
event, a single event was identified by each teacher. Three
teachers provided two events, both a positive and a negative.
Of the other 27 interviews, only two teachers chose to
describe a story which had a negative impact on their work
with instructional technology. Though interviewees were not
coached in any way to provide positive accounts, almost all
chose to do so.

Herzberg's dual theory suggests that the factors that
make people dissatisfied in their work are factors related to

the workplace; the working environment. In looking at the LoU ratings for each interviewee, the VTSDP seems to have moved baseline use to the routine level. The continued support, combined with plentiful access to computers and software, stimulated teacher use successfully to this point. Along with promoting teachers to the routine level of use, the availability of equipment seems to have created a suitable instructional technology environment for the interviewed teachers. No teacher complained that added technology equipment had caused space limitations or had in any other way negatively affected the physical work environment. Thus, in general terms, the hardware and software resources were not reported as having a negative effect on working conditions.

With all but three events being of positive effect on teachers, only several hygienic factors were focused on. The factors of possibility for growth, supervision, and job security were not noted at all. In the context of their use of instructional technology, the teachers were not directly supervised, making this factor unapparent in the descriptions given by teachers. The related factors of administration and company policy, along with those of salary, personal life, and interpersonal relations, did surface in the contexts described below.

There were two event anecdotes which described situations in which the teachers felt a lack of confidence in school administration and policy. In both cases, a situation of isolation had begun to develop. The teachers were working

actively within their departments as technology resource people, but their relations with superiors was strained and distrusting.

One teacher related an event which had had a negative effect on his feelings about his work in teaching. The key hygienic factors described in his story were administration, company policy, and interpersonal relationships. These three factors are very similar to one another and, in the account below, combined to create feelings of betrayal and disappointment:

> At the beginning of the summer of 1996, I requested to borrow a laptop computer to take home for the purposes of designing course materials. The security software on the machine had been left on from the school year; students have access to these machines and so they are protected from deleting files and stuff.
>
> When I asked to have the security software disabled, the computer person told me that it was against policy to do so but that I should be able to do my work with the security program running. A week later, I realized that I needed to install a new font in order to use the software I needed, but with the protection software installed, I couldn't do so. By the time I called, the computer person had left for summer break and could not be reached by phone in Wisconsin. One small little problem suddenly became large.
>
> I was (expletive) off because I couldn't meet my own internal expectation. I have a track record as a professional. I wonder what students think when similar draconian messages are given to them. But I should be treated different from students. The laptop was a tool to help me do my job, but I couldn't use the tool!
>
> The incident left me frustrated and angry. This kind of thing occurs regularly within our administrative structure here... This has reinforced my recognition of our bureacracy

wherein these problems are inherent. Had this
incident been the first, my outlooks would have
changed more. If such problems ever outweighed
all the good aspects of teaching, I'd look for
other pastures. (PC)

This teacher's animosity toward the computer resource
person had broadened into a general distrust and distaste for
the school administration and its policies. He reported
being professionally buoyed by the classroom teaching
components of his work. He spoke of enjoying VTSDP workshops
but noted that his interest was primarily in getting the
chance to interact with other teachers. In his LoU
descriptions, he described himself as a resource person
within his department, but had feelings that the school and
district program for integrating technology was misguided.

Similar feelings of miscontent with district
administration and policy arose in a separate account
involving the process of installing Internet wiring through
the district:

> We (the district) have had three complete
> system changes since we first began letting
> teachers connect from home. It has been very
> frustrating. It's made it harder to stay on
> top.
> Lines are being cut and we're not being
> told. There has been indecision and poor
> communication from the district to the building
> level. Only technology people are getting the
> information... I feel helpless and there's
> nothing I can't stand more than feeling
> helpless. But we keep on this cycle of adopt,
> excite, disappoint. (OL)

Here too, there was clear indication of broken relations
between adminstration and teacher. Both of these teachers

concluded their interviews by noting that they still enjoyed teaching but that they had come to accept administrative misdirection as part of the job. While, by their own accounts, their teaching roles in relations to students had not been affected, their role as a worker who supports school and district policy had suffered.

The factor of personal life arose in two teachers interviews and did so with a unique context in each. In one case, personal life had been negatively affected and, in the other it had been positively affected.

In interview eighteen, a teacher described the following as the key event in part three of her interview:

> About five years ago, our district switched from Apple IIe to Macintosh. I was so familiar with.AppleWorks[72] I just hated the switch. I had a IIGS at home and a Mac at work. There was no correlation.
> I felt stubborn, frustrated, and impatient. Home-school fluidity is very key for me. I would have to write at home and type at school. I knew the new software provided better results, but I didn't want to take the time to learn it...
> Time is a big factor. I try to be efficient in my work. I have three kids at home and really limited time to do work at home. The change had happened in my school, but it threw me off as a teacher and a parent too...
> Home-school compatibility is the key. It makes my job easier. I've learned the new software since then, but I remember that time being exceptionally bad! (BC)

While Herzberg's definition of the hygienic personal

life factor does not require that negative effects in that

[72] AppleWorks™ is a software program which contains word processing, spreadsheet, and database capacities. Its use with the Apple IIe and IIGS computers is analogous to the use of Microsoft Works™ and ClarisWorks™ on Macintosh and PC computers.

part of one's life be caused by events at work, such was the case in this anecdote. The teacher's personal life had been negatively affected by sudden incompatibility with new computer software at work. The incompatibility disallowed her to do significant work at home. The consequence of this was that she spent more time away from her home and family and felt that her role as a mother was comprised because of it. While her disposition through the course of the interview was cheerful, she stated clearly that she was unhappy during that time and saw a decay in the quality of material preparation for teaching. Her work performance was therefore negatively affected and personal life accordingly acted as a dissatisfier.

A second description of personal life helped provide a good example of the limitations of hygienic factors in motivating workers. During interview twenty-nine, the teacher described how her family relations had benefitted through the use of e-mail which had recently become available in the district:

> They should have invented e-mail before all this other stuff. I mean if they wanted me to spend time in front of a computer, they should have shown me that first.
> I am a widow and my two children live in Arizona and southern Illinois. I keep in touch with them though e-mail every day. I'm going to buy a computer and have one of our gurus help me set it up with a modem at home. But for now, I use the computer in the resource room. (BN)

While her account of using e-mail was clearly positive, there was no evidence in any of her descriptions that her

work as a teacher had improved because of it. Her LoU was
coded at routine and she recounted no instances where her use
of technology had improved the teaching and learning
processes. Thus, in this instance, the hygienic factor was
present but accordingly had no motivational quality to it.

The hygienic factor of salary was not described in the
context of its absence. Salary, according to Herzberg, is
not something that makes someone *want* to go to work. Salary
is instead why someone *has* to go to work. Since the context
of the interviews was that of instructional technology, there
was no inherent reference to money. However, VTSDP
participation carried with it the chance to earn a home
computer by attending sixty hours of workshop time. Thus,
participants were paid in the form of home computers for
their involvement, making salary a relatable factor.

Two teachers who selected their enrollment in the VTSDP
as the key event in their responses to the third part of the
interviews focused on salary-related reasons for choosing
that event:

> I got my computer in 1995 and immediately
> took my sixty hours. I saw a lot of stuff
> (software) that looked positive but not enough
> to make me want to go out and buy the stuff.
> Some of the workshops were better than others,
> but I figured, "Hey, it's free." (RL)

> Not only did we get the computer right
> away, but we got an interest-free loan. I've
> participated in three different phases and have
> purchased a computer, hard drives, a paper
> scanner, a modem, and a color printer. Without
> this loan, I may otherwise have not had the
> finances. (TG)

These two teachers were coded at the mechanical and

routine levels of use, respectively. Their standard teaching, as defined earlier, had not improved significantly based on the event they described and its subsequent meaning to them. These descriptions support the notion that salary does not improve job performance. While the hygienic factor was in place and no dissatisfaction was voiced, no improved work performance was indicated.

As a concluding note to the accounts which involved hygienic factors, the general factor of interpersonal relations should be mentioned. This hygienic factor is, in Herzberg's original work, subdivided into three types: relations with superiors, relations with peers, and relations with subordinates. Within the context of this research into teaching, superiors were identified as school and district administrators. Any accounts which described problems with superior relations were coded under the heading of administration as the hygienic factor.

Peers were defined as fellow teachers. There were, as described below in the accounts of motivational factors, instances where teachers described teaching colleagues certain concepts and skills within their department. The results of these new communications with peers was much more closely related to the motivational factor of recognition than the hygienic of peer relations. There was, however, one account of a negative experience in relating with peers:

> Last spring, I was teaching a class on how to surf the web. After I gave instructions on how to use the software and explore, I let the teachers in the class work individually at their computers.

> As I wandered around the room, I
> discovered a group of female teachers viewing
> naked pictures of Brad Pitt on the Internet. I
> was totally disappointed. I thought, 'Wow,
> here's this great tool and you're looking at
> pornographic pictures.' I really didn't expect
> that here. It seems counter to our culture...
> Adults need to model steering clear of obscene
> material. (MA)

Following this event, the respondent began to question whether or not the school should use software filters which would prevent access to inappropriate Internet material. His descriptions indicated that he had lost some faith in the good intentions of his peers and that his comfort with his work had suffered because of it.

Finally, with respect to the third type of interpersonal relations, subordinates were defined as students. Communications and relationships with students is a core component to the work of teaching. Therefore, when stories arose which described a change in the relationship between teacher and students, the nature of the work was identified as the operant motivational factor.

Overall, Herzberg's hygienic factors were applicable to the small number of events in which they surfaced. When absent, there was a decay in the quality of work. When hygienic factors were present, teachers often spoke with happiness, but no improvement was seen in any of the seven job components described earlier in this chapter.

Motivational patterns: In the third portion of their interviews, the vast majority of teachers related stories of positive effect in regards to their use of technology. This

result provided an opportunity to investigate the motivators within Herzberg's dual theory. While Herzberg isolated nine hygienic variables, only five motivators were established: achievement, recognition, responsibility, advancement, and the work itself.

Thomas Sergiovanni, in his book *Supervision: Human Perspectives,* includes a description of Herzberg's work and resituates it within the work of teachers. He states:

> In a separate teacher study...achievement and recognition were identified as the most potent motivators. Responsibility, although a significant motivator, appeared in only 7 percent of the events associated with satisfaction. We do not take advantage of the motivational possibilities of responsibility in education -- this factor is relatively standardized for teachers, in that responsibility does not vary much from one teacher to another.[73]

These comments are supported by evidence within the twenty seven teacher interviews wherein motivator factors were identified. While there were many unique descriptions of worker motivation, the three key factors which were coded for all the participants were achievement, recognition, and the nature of the work. Even Herzberg's original research showed varying occurrences of satisfiers and dissatisfiers for different occupations.

No teacher gave descriptions of career advancement based on their accomplishments with instructional technology. Several teachers had developed skills in design to the extent

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[73] T. Sergiovanni and R. Starratt, *Supervision: Human Perspectives* (New York, N.Y.: McGraw-Hill, 1988) pp. 146-147

that they were able to work part time in desktop publishing along with teaching. This extra work, however, would be considered a lateral as opposed to a vertical move in relation to teaching. None of this extrinsic work resulted in a change of title or status within the school.

Three teachers described events which, in their aftermath, had led to increased responsibility:

> In the summer of 1991, I was stipended to to preview and sequence some laserdiscs for A.P. Biology. I continued that work during the following summer. Having now cataloged hundreds of laserdisc images which all the biology teachers use, I now get a chance to choose the laserdiscs we're going to adopt in the future. (JS)

> In 1994 and 1995, a keyboard teacher and I wrote an interdisciplinary course which combined ESL with keyboarding for at-risk students. It was implemented last year with twenty-three students... We team taught and had a wonderful tool in technology. (GM)

> The VTSDP gave me a feeling of good will, trust, and enabling. It was not just getting something for nothing, it was technology. It was essential for the future.
> I've taken seventy hours of workshops and really dedicated myself to learning all these new things. I have gotten to know other teachers and I recognize a divisiveness between the technology 'haves' and the 'have-nots.' As someone who now knows the functioning of computers, I'm proud that I've become respected by those who respect the technology. People know that I know a lot, so when I requested that our computer lab be kept open later with my supervision, there was no problem getting that okayed. (OL)

These three scenarios depict teachers who, in their efforts to design new curricular opportunities for students, had been identified in new roles. These roles were adjunct,

though not hierarchically superior to, their extant teaching roles. The presence of a new role distinguished these responses from the more common motivational factor of recognition, which was also a coding for the above three situations. All of these teachers were, by virtue of their program design, ranked at the integration level of use. Their level of contribution had increased well beyond the seven aforementioned teaching descriptors and, while there had been no salary increase, they were both excited and gratified by their new roles.

The related factor of recognition surfaced seven times in the course of teacher interviews. Recognition was noted in instances wherein teachers were formally or informally identified for their knowledge of a technology tool or an end product produced by that tool. Of the seven who gave accounts of recognition, five were rated at the integration level of use, with the other two being rated at the refinement and routine levels. These last two had focused their use of technology on cocurricular components of their work and therefore had not reached the level of integration for their classroom teaching. Within their roles as band director and dance moderator, both had received recognition from peers in their respective cocurriculars because of their use of technology.

Among the accounts which included recognition are the following:

> For me, the key event was the arrival of the Macintosh. With its ability to give more control over the design of typewritten

materials, I was able to improve the appearance of our department documents and our music programs. Everything now has a more professional look and other band and choir directors have been impressed with the quality of our program materials. (SP)

In the spring of 1992, I went to Glenbard North and saw Geometer's Sketchpad for the first time. When I got the job here, I sold people on it. Then I found that the program materials did not suit my needs so I wrote my own. People grew to like it... The Swarthmore University Math Forum asked for it to be on their website, which is kind of like getting published. (RM)

I've gotten so into the software and hardware stuff, it's been wild! I really feel kind of glamorous and cool having acces to all these things. Every time I ask for something, it's here. The reason they give it to me is because they know that I'll build it in to my teaching. (GL)

All of the teachers who described instances of recognition reported that its effect had been positive not just on how they viewed technology, but on how they viewed teaching as a whole. The recognition that was important and most frequently described by teachers was that of their peers. While several of the respondents in this subgroup had actually participated as presenters in VTSDP workshops, this formal district recognition of their knowledge was not the focus of their stories. Their relations with peers within their own sphere of work had improved and they saw the capacity as a teacher of colleagues to be an important part of their work. Confidence in relating to fellow teachers had improved because they were seen to be leaders.

An interesting component of recognition-based responses was the lack of impact the recognition seemed to have on

teachers' perception of their classroom teaching. While they described positive feelings about their work and were motivated by their coworkers perception of them, many stated that they felt relatively unchanged with regard to their teaching. Their relations with students had not changed based on the technology skills which had brought them recognition by their peers. Instead they identified their teaching capacities as being more distributed than just inside the classroom.

The two preceding satisfiers, responsibility and recognition, both are dependent on some response from the workplace. That is, recognition is only realized when a person or persons identify a teacher and give attention to his proficiency with a particular technology tool. When that extrinsic attention allows for the development of new roles in the work place, the factor of responsibility is realized. In either case, these two factors are created by a response from the work place.

Achievement is different from these two in that it can be felt and applied intrinsically. Many of the interviewed teachers had feelings of accomplishment which were very satisfying to them even though no outside acknowledgement of them had been made. In these instances, the motivational factor of achievement was noted.

While achievement does not require outside identification, it does require a task. Herzberg pinpoints the importance of this in his analysis of the dual theory:

> It is clear why the hygiene factors fail

to provide for positive satisfactions: they do
not possess the characteristics necessary for
giving an individual a sense of growth. To
feel that one has grown depends on achievement
in tasks that have meaning to the individual,
and since the hygiene factors do not relate to
the task, they are powerless to give such
meaning to the individual. Growth is dependent
on some achievements, but achievement requires
a task.[74]

Within the stories told by respondents there were
fourteen accounts of teachers who felt a sense of achievement
based on their work with technology. Prerequisite to this
feeling is the presence of a meaningful task. The district
investment and incentives in technology had created a task to
be accomplished: the learning and integration of technology
into teaching. The language, concepts, and skills of
technology create a subject to be learned, a task to be
accomplished. Was the development of new skills with
technology within the district program a key source of
achievement?

A review of the events which triggered feelings of
achievement indicates that the learning of technology did not
act as a primary cause for achievement. In fact, none of the
teachers whose interview codings contained achievement
identified the VTSDP as the event from which they developed
feelings of accomplishment. Among the descriptions in which
achievement was identified were:

Three years ago, I adopted the Skills Bank
program, tested it, and encouraged the purchase
of it. I previewed it and learned it and
finally got it to work to completion... The

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[74] F. Herzberg, *Work and the Nature of Man* (New York, N.Y: Thomoas Y. Crowell, 1966) p. 78

software provides a cyclical nature of
learning. The students use the tutorials, take
an assessment test, print their results, and
these results are shared with parents and case
managers. This adds variety and structure to
their learning... I feel a sense of
accomplishment and gratitude that this program
has worked out so well. (HS)

When I started using the Opening Night
software, students with different primary
languages were working together! The whole
project took two weeks and students worked in
teams of three. I'm planning to do it again in
the Spring of '97. The students enjoyed
playing with it. The bell rang and they didn't
leave!
I felt a sense of elation. I was uplifted
and felt like I had greater energy. I was
satsified with a day, like I'd made a real
contribution. (BM)

In the summer of 1993, I went to Greely,
Colorado for a conference which the district
paid for. That was when I learned how to use
Microsoft Works. I am a terrible typist, but
"delete, cut, copy, paste" is totally spiffy.
I love to change fonts and sizes. It looks so
much more professional.
Now I'm more confident, more organized and
I think that helps kids. It hasn't changed my
creativity or my relationship with kids, it's
just changed end products; a little extra kick
in the end! I show my husband some of the
things I put together and say, "Look at this,
it's a thing of beauty!" (FJ)

The critical pattern which emerges from these accounts

is that teachers did not identify with the learning of

technology but with success in applying their knowledge

within their own spheres of teaching. All of the stories

described events wherein teachers created something with a

technology tool that had a positive impact on their students,

either academically or within extracurriculars. While there

had not been outside peer recognition, there was a tangible

end product which had been created. Consistent in each of
these and all the accounts of achievement was the internal
sense of pride felt by the teachers. Because what they had
created and implemented with their knowledge of technology
had been meaningful to them, they felt as if they had grown
in doing so. It was the process of creation, not the process
of learning, that led to achievement.

As with other motivational factors, Herzberg would want
to know what observable changes could be seen in the quality
of work due to achievement. Beyond the positive feelings had
by the teachers who recounted stories of achievement, were
there indications that their work had improved from their
experiences? Of the fourteen teachers whose responses
included feelings of achievement, seven were at the
integration LoU, five were at the refinement stage, and two
were at the routine level. All of the teachers but one had
improved the learning opportunities for students in their
classes based on their use of the specific technology tools.
The exception was a teacher whose created end products were
certificates for dancers in an extracurricular function.

For many of the teachers who described feelings of
achievement, an improved relationship was felt with their
subject matter as described in Figure 4-1. That is, they
felt that the changes which technology integration had
brought improved the clarity and meaning of their subject
matter for students. Those who were identified with only
achievement as their motivational factor did not describe
improved relations with students.

The nature of the work is the final factor which surfaced within part three of teacher interviews. According to Herzberg, when the entire contents of work descriptions shifts so as to be more meaningful to a worker the worker will show greater job performance. For teachers, critical shifts occurred in all three of the key relationships shown in Figure 4-1, based on their integration of technology.

Thirteen instances were coded wherein teachers described changes in relationships with students or colleagues. In these descriptions, the thirteen teachers responded to question 3-9 by noting that they more greatly identified the profession of teaching with their improved relationships with either their subject matter, their students, or their colleagues. In the context of this study, technology had acted as a catalyst for this changed perception of their work.

Among the descriptions given which were coded as changes in the nature of work were:

> My whole introduction to technology began when I went a couple years ago to my public library and found that the card catalog had switched over to computer. I felt scared and illiterate.
> Soon after, our school technology program began and outcomes were being written that demanded technology integration. The next summer, I babysat a computer and, with the help of my nephew, learned how to use one. Ever since then, I've been a sponge!
> Since I learned first from my nephew, I have no problems learning from students. I have students working on projects where their teaching me as much as I'm teaching them... There's something that happens when students teach you. They seem to bond with you. A

certain dynamic. It almost makes them more teachable. You are modeling what a student should be. (CC)

I guess the event which I would pick would be the arrival of a full classroom set of graphing calculators. This was followed by a new textbook adoption that supported the use of the graphing calculators... The calculators allowed the emphasis to be on problem solving as opposed to algebra techniques. I felt the freedom to teach what kids really need: higher order thinking skills. (TD)

For me a key moment was when I decided to do a "Christmas Around the World" project on the Internet. The whole year this one kid had been a total slacker; the kid you call a 'tough cookie.' Well he got totally into this project. He not only worked on his own project but helped other kids in the class with theirs. He even worked on it outside of class time. It was the first time he had a feeling of success in my class. He now asks to do Internet projects regularly. (MB)

Four years ago, I headed a textbook task force for our department. We wanted to integrate Geometer's Sketchpad, but we wanted to do it the right way... So computers were used in so far as it made sense to use them. We met for a whole year. We built interpersonal dialog skills. Now the six of us meet weekly and each gives ideas to the others. Our discussions aren't always about technology... Dealing with human beings is the central thing (IK)

In May of 1996, I decided to do a project in which freshmen could e-mail people in Bosnia during the time of the conflict going on there. The kids established communications and then gave presentations on what they had learned after a couple weeks.
While the project had some little frustrations and some kids got themselves overwhelmed, it was really inspiring... The freshmen are so malleable that it really allows for creative experimentation. (BS)

When teachers described how technology had changed their relationship to their subject matter, it was usually in the context of how it provided more control over the organization and manipulation of information. This added control allowed for more acclerated arrival at higher level concepts which the teachers identified as being most important for their students to understand. The learning process was described as more efficient because of this acceleration. This change was noted repeatedly by math teachers who had integrated graphing calculators in their classrooms.

Interestingly, many of the accounts which described improved relationships with students came from special education contexts. Due to the range of special student needs which can be present, teacher-student relations are often a focus more than teacher-subject matter relations. Teachers spoke of how students' interest in computers increased their attention level in class and gave them a sense of motivation. In lieu of lecture-based classroom formats, more project-based formats were adopted and the teachers shifted their role from teaching the subject matter to supporting student investigation and creation. Instruction became more individualized. The subject matter itself did not change but the relationship between teacher and student did.

In conclusion, the motivators of achievement, recognition, responsibility, and the work itself all occurred within the coding of teacher responses. The hygienic factors of salary, personal life, adminstration, company policy, and

interpersonal relations were evidenced as well, though to a lesser extent than the motivational factors.

Unlike the LoU scale, the motivational factors of Herzberg are not hierarchically arranged. As described earlier in this chapter, there are some conceivable ways to rank motivators. Achievement was noted as an intrinsic motivator, with recognition and responsibility following and being dependent on external identification of accomplishment. However it is impossible to say within this research that recognition was cause for more extensive motivation than achievement. All satisfiers must be regarded as equally influential in causing better work performance.

In response to the second core objective of this research, this study therefore cannot answer that higher LoU levels were cause for higher levels of motivation. Motivation was either present or not present, but not determined along a continuum of values. What can be seen from the data and its coding is that the learning and, more importantly, applying of instructional technology skills created tasks which teachers found meaningful and which therefore motivated them in their work. When level of use moved to the point of application, teachers found their use of technology to be growthful experiences.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

In this study, thirty teachers who were involved in a
technology staff development program were interviewed about
their use of and feelings toward instructional technology.
The Concerns Based Adoption Model's Level of Use scale
sufficiently stratified usage levels and Frederick Herzberg's
line of questioning and dual factor theory on motivation
assisted in categorizing teachers' feelings about their work
with technology.

In reviewing the results of this research, important
conclusions can be reached. General patterns emerged from
both teachers' LoU codings and their responses to the
critical incident line of questions. From these patterns,
suggestions for further research as well as staff development
programs can be made. This final chapter presents the
conclusions and recommendations of the research and thereby
completes the third and final objective of the paper.

Conclusions

In regard to the CBAM model, the LoU scale fits this
study but three exceptions were noted in its use. First,
technology as a whole cannot be used to represent an
innovation. Instead, specific hardware and software uses,

such as computer-based presentations or graphing calculators, must be used to represent innovations as described in CBAM research.

Second, different software programs require different levels of knowledge and have differing ranges of applicability. In this study, software programs were categorized by their level of difficulty and applicability. This categorization assisted in determining how greatly teachers' use of technology had really affected their teaching.

Third, there were portions of the LoU scale that did not apply to the participants. The interviewed sample, by virtue of their participation in the VTSDP, could not be coded at levels 0 to II of the LoU scale. All the teachers were using technology, thereby moving them past these anticipatory levels. At the other end of the scale, Level VI, no teacher had exhibited the characteristics of renewal or major modification to an existing use of an innovation. Due to their limited capacity in obtaining alternative resources and the inherent evolving nature of technology, no teacher described reevaluations or overhauls of existing uses.

Very few relationships emerged between teacher demographic information and levels of use. The external factors of computer and training availability had been largely homogenized within the sample. The intrinsic factors of age and gender showed no effect on teacher use of technology. The factor of pre-service training improved the likelihood that teachers were using technology at high levels

of use. Subject matter did not affect level of use, but did influence the nature of use. Teachers of science and math classes focused on how technology use improved their ability to control and teach concepts within their subject matter. Teachers in ESL and special education settings spoke most frequently about how technology integration had improved student motivation and aided the student-teacher relationship.

Just as teacher use codings were most prevalent at higher levels of the CBAM hierarchy, teacher responses to Herzberg's critical incident questions were largely positive. The hygienic factors of salary, personal life, administration and peer relations did surface, however. Befitting their label as dissatisfiers, these factors, when absent, caused unhappiness and a decline in one or more aspects of teachers' work. When these factors were noted as present, teachers spoke positively of the situation, but exhibited no improvement in their teaching.

The VTSDP seems to have been a cause for the paucity of environmentally-related responses. Teachers spoke positively abut the effects which computers had had on the physical environment. Several teachers noted having previously felt threatened by the lexicon and potential of computers. By the time of their interview, however, they did not feel threatened and described technology as a means of staying fresh in their teaching. In this context, technology had moved from being a part of the workplace to being a part of the work. It therefore could be evaluated as a motivator,

not a hygienic factor.

The three primary motivators which surfaced through the course of interview codings were achievement, recognition, and the nature of the work. Responsibility was noted on several occasions, but not with the frequency of these three. Advancement was not noted at all.

Achievement, as defined by Herzberg, requires a task which is meaningful. Interestingly, while their increased familiarity with technology via VTSDP participation was certainly a task, the learning of technology showed little evidence of being a source of achievement. As evidence of the need to apply knowledge, teachers with lower levels of participation in the VTSDP often times had high levels of use. Teachers' application of their knowledge of technology within their own departments and classrooms served as the basis for achievement. When teachers structured their own tasks, they experienced the greatest meaning and feelings of growth. Throughout this study, technology has been described as a tool. It was less the learning and more the application of this tool that provided feelings of achievement with teachers.

When the factor of achievement arose as a motivator, teachers most commonly described their achievement as having a positive affect on their classroom teaching. For some, their self-designed tasks had improved their control over and ability to describe their subject matter. For others, their relationship with students had improved. Thus, from Figure 4-1, achievement was felt from improvements in two key

relationships in the work of teaching.

When uses of technology specifically improved relationships with colleagues, the factor of recognition was coded. Teachers at higher LoU levels had created departmentally recognized programs and resources based on their use of technology. These teachers gave evidence of being motivated by identifying their work as including the ongoing teaching of colleagues and generation of department resources. Their identification in such new informal roles was indication of improved performance.

Finally, many teachers described situations in which their technology use had changed the nature of their work. For some, their role within the classroom had changed because technology had made it possible for students to learn on a more individual basis. Other teachers described how peer relations had become a more central component to their perception of their work. Technology use had caused them to reprioritize their set of work contributions or, in some cases, add new contributions to that set.

Throughout all of the hygienic and motivator codings, very little patterned evidence could be seen about the effects of technology use on teacher relations with administration. The technology commitment of District 214 had brought computers to classrooms, built labs, and created a staff development program to train teachers. Teachers regularly commented that they felt supported. In assessing the consequences of this support, however, little evidence arose of teachers feeling that relationships to building or

district administration had improved. Building staff and administrators were regarded positively in relation to the hygienic support, but not referred to in terms of motivation. When interviewees described feelings of distrust towards school and district administrators they commonly indicated a lack of control in regards to this relationship. Many subsequently focused on their improved relationships with colleagues and achievements within the classroom.

Recommendations

Suggestions for further research: As technology becomes more distributed in education, the studies on its effects will likely become more diverse. The growing complexity of computer uses suggests that specific capabilities in technology such as multimedia, Internet access, and speech recognition, can act as individual bases for effects studies. The results of this current study give evidence that meaningful research could be conducted in numerous areas closely related to teacher work and motivation. The three recommendations for further research which follow are all specifically related to technology and teacher motivation.

One clear suggestion for further research would be to employ both the LoU scale and Herzberg's theory in the context of teachers who are not actively using technology innovations. Such an investigation would balance this current study by providing descriptions of levels 0 through II of the LoU scale and relating them to hygienic and motivational factors. Do teachers first view computers as

components of their work environment instead of components of their work? If so, how does their presence affect teachers attitudes about their work?

Second, the effect of technology integration on teacher-administration relationships is not clearly ascertained in this study. Important work can be done isolating this relationship in the context of technology use. How do teachers who use technology identify with administrators and their decisions and policies regarding technology? Has administrative use of technology improved relationships with teachers? Communications is a central capability of computers. Have computers improved communications between administrators and faculty? The use of e-mail could be a focus innovation in such a study.

Third, a very important body of work lies in investigating technology's impact on teacher motivation and effectiveness in special education settings. Special education and ESL teachers made up a significant minority of the interview sample in this study. There was a clear pattern of response from them as to computers' ability to assist in the control and motivation of students. Does school technology allocation head first to special education settings in which benefits to learning and teacher motivation seem clear? Can e-mail assist in further strengthening the important student-teacher relationship component to special educational settings? Are special education teachers as willing to learn the language and uses of technology as mainstream classroom teachers? The human

relations effects of technology integration in special education are grounds for important further research.

Suggestions for staff development: In this study, the VTSDP provided a good benchmark by which to assess the effects of a staff development on technology integration. Based on what it did and did not contribute to teacher technology use and motivation, several recommendations can be made for designing staff development programs to maximize meaningful technology integration.

There were positive impacts of the VTSDP on both level of technology use and teacher satisfaction. Providing training had significantly escalated teachers past the introductory levels of use. Recognizing that increased familiarity leads to increased comfort and expanded use, structured workshops clearly have a positive effect on improving familiarity. An ongoing program of workshops wherein teachers can learn technology concepts and skills together is a recommendation of this study.

Providing resources in classrooms and labs then allowed for teachers to implement their knowledge within their teaching. The result within the sample of interviewees in this study was a minimum of complaints about environmentally-related factors. No teacher reported having limited access to hardware. Thus, technology resources were not considered an environmental uncertainty. Instead, teachers identified the technology tools as being part of the work, transforming them from being dissatisfaction-related to being

satisfaction-related. This study therefore recommends that access to technology be commensurate with technology training. Coupled with each other, training and access will increase level of use and diminish technology as an environmentally-related work component.

The primary goal of the VTSDP was to assist in the integration of technology so as to improve teaching and learning. Seen within this study, higher LoU scores are only one contributor to this goal. True improvements to teaching and learning can only be recognized if teachers are motivated in their work. Therefore, the following recommendations are made to focus staff development on improved teacher motivation.

This research indicates that teachers are indeed motivated and do better work when they feel a sense of meaningful achievement. Teachers can learn new concepts and skills in technology training workshops. Such might serve as a task which becomes the basis for accomplishment. This research suggests that learning technology is not a meaningful task to teachers. Teachers recognize that technology has its concepts and lexicon, but the respondents within the study repeatedly emphasized that it is a tool, not a subject to itself. Being a tool, involvement with it finds meaning when that tool is put to use and applied.

When teachers integrate new software programs in class or design new projects, materials and assessments with technology, they create tasks for themselves. The accomplishments of these tasks are made possible by

technology. Most importantly, these tasks are meaningful to teachers. Thus, when completed, these tasks create improved motivation.

Staff development programs can make such achievement possible by designing technology training in hierarchical fashion. Introductory level training can focus on specific concepts related to a particular technology tool. Beyond that baseline training, however, staff development programs need to support project-based opportunities for growth and achievement. Teachers, either individually or in collaboration with colleagues, need to be given time and resources to create things with their technology skills. Thus, along with breadth of topics, opportunity for depth and continued exploration should be provided.

Achievement can be thought of as a kind of internal recognition. Herzberg's research lists recognition as a separate motivator, defining it more specifically as identification by others. Technology, as evidenced within this research, can be a platform for recognition. When teachers spoke of recognition they most often did so in the context of recognition by peers.

For peer recognition to be possible, two factors must be in place. First, a teacher needs to be operating at a LoU above routine. Above this level there is sufficient knowledge and confidence to share expertise with colleagues. Second, teachers must have visibility to what their colleagues are doing with technology. When the door closes and class begins for teachers and students, the occupation of

teaching becomes very insular. For teachers to feel
recognition, more interaction is needed with their peers.
Staff development programs can foster recognition by
providing time and resources for teachers to spend
collaborating with each other. The tools of technology make
it possible to create. Creation and increased peer
interaction can bring recognition.

Finally, staff development directors and school
administrators as a whole need to continually assess how
technology might change the nature of the work of teaching.
Already there are opportunities for students to use computers
for self instruction. Indeed, a computer itself can act as a
teacher. Germane to this study and its recommendations,
however, are the uses of technology which will alter, not
replace, the role of the teacher.

Will teachers be comfortable with the changes brought by
technology? Will they view new capabilities as threats or as
new opportunities? Evidence within this study indicates that
teachers will identify a change in the nature of their work
when their relationship with their subject matter or their
relationship with their students changes. Teachers of high
track levels and teachers of math and science focused most
intently on how technology had improved their control of the
subject matter. Teachers in lower track and special
education settings noted improved relations with students.

Effective staff development must seek to make teachers
comfortable and motivated as their roles change. Teachers
who are content-oriented should be shown how technology can

improve the efficiency and depth of instruction. Teachers whose instruction is more student-centered can be shown uses of technology which decentralize instruction and therefore increase the opportunity for individual relationship-building. Doing so will once again remove technology as an environmental component and make it a potentially motivating component of the work itself.

APPENDIX A

INTERVIEW CODINGS

For the sake of space, complete interview transcripts have been withheld from this paper. Collectively, these transcripts total 144 written pages. In lieu of these transcripts, this appendix provides summary codings of each interview. These codings are sequenced in the chronological order of the interviews, beginning with January 7, 1997 and continuing through March 12, 1997. Each summary is divided into three parts, corresponding to the three parts of the interviews. So that codings within each of these sections can be interpreted, the following explanation is provided.

Table 4-1 in chapter four of this paper describes the abbreviations used throughout the coding. For easier reference, that table reappears below with end note remarks included as footnotes.

Table 4-1: Coding abbreviations

Abbreviations related to high schools and departments

Abbreviation	Meaning
BD	Behavior Disordered
BGHS	Buffalo Grove High School
EGHS	Elk Grove High School
ESL	English as a Second Language
JHHS	John Hersey High School
LD	Learning Disability
PHS	Prospect High School
RMHS	Rolling Meadows High School
VTSDP	Voluntary Technology Staff Development Program
WHS	Wheeling High School

Abbreviations related to software and hardware

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CA.........................clip art
CAI........................computer based
                          instruction
CBL........................computer based labs
CD.........................compact disc
CP.........................computer programming
CW.........................ClarisWorks¹
DB.........................database
DP.........................digital photography
DTP........................desktop publishing
GB.........................electronic grade book
GC.........................graphing calculator
GM.........................Grade Machine²
GS.........................Geometer's Sketchpad³
HS.........................HyperStudio⁴
IN.........................Inspiration⁵
INT........................Internet
LD.........................laserdisc
MIDI.......................musical instrument
                          digital interface
SL.........................computerized slide shows
SS.........................spreadsheet
TB.........................test bank
WP.........................word processing
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Part One of the codings includes key biographical
descriptors. The first of these is a two-letter
identification given to each participant to insure the
anonymity which was promised to them prior to the interviews.
Other descriptors include:

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[1] ClarisWorks is an integrated software program which contains word
processing, spreadsheet, database, drawing, painting, and communications
modules. District 214 has adopted this software as its principle word
processing software.
[2] Grade Machine is a comprehensive grade keeping program. It is the
preferred grade keeping software program in District 214.
[3] Geometer's Sketchpad allows students to draw, manipulate, and measure
the angles of polygons. It is used in several of the high schools in
District 214 as a hands on instructional tool for geometry classes.
[4] HyperStudio is a multimedia program which lets teachers and students
create presentations and tutorials. The software allows for the
intermingling of text, pictures, movies, animations, sound, and
interactive buttons.
[5] Inspiration is a program which allows students to interrelate concept
maps and flow charts with standard outlines. It is primarily used as a
visual organizer.

1. date of interview
2. length of interview
3. school
4. department
5. teacher's age
6. teacher's years of teaching
7. completed hours of Voluntary Technology Staff
   Development Program workshops
8. specific location of interview

In addition to these items, a general description of the teacher's demeanor, persona, and appearance through the course of the interview are provided.

Part Two provides coding summaries related to the CBAM LoU portion of the interviews. This section includes the LoU ascribed to each participant and descriptions which evidenced that LoU. In addition, individual software and hardware uses are listed in chronological order of when they were learned by each interviewee. Next to each abbreviated use is a number which teachers gave to describe their proficiency with the corresponding uses. The numeric scale is from 1 to 10, with 10 being the highest level of proficiency.

Part Three of the codings displays information on the portion of the interview dedicated to Herzberg's sequence of questions. Included are the motivational and hygienic factors which were ascribed to the teachers' chosen events as well as the events themselves and the descriptions given to them.

ID	GL	**Date** 1/7/97	**Gender**
Length	40	**School** RMHS	⊙ **Female**
Department	Science	**Age** 48	○ **Male**

Years of Teaching 23   **VTSDP Hours** 76

Location   Math/Sci resource conference room

**General
Descriptors**   Extremely energetic, invested in science, particularly
biology. Seems to derive a great deal of self esteem from
being a pioneer in new teaching methods and materials. Has
completed her doctoral work in 1980.

LoU   Integration

Uses   WP(10),GB(10),CBL(7),CM(9),LD(7),CAI(9)

**LoU
Descriptors**   Students are using technology as an alternative means of
experiencing science phenomena that is microscopic or
otherwise unavailable firsthand. Use of concept maps for
remediation preceded available software.

Use of technology is enthusiastic, demanding, and fulfilled.
Gets what she wants in the way of resources. Uses student
expertise to lead her when necessary.

Has offered instruction to colleagues.

Factor(s)   Recognition

**Herzberg
Descriptors**   Event: finding the Journey North CD last year

Having extra stuff is glamorous, sort of. Sort of cool and
gamelike.

ID	SP	**Date** 1/8/97	**Gender**
Length	37	**School** WHS	◯ **Female**
Department	Fine Arts	**Age** 55	⦿ **Male**

Years of Teaching 29   **VTSDP Hours** 46

Location   His office off the music/band room

**General
Descriptors**   Head of Music Department. Very concerned about and interested
in creating professional-looking documents and music
materials. SP seems to be a perfectionist and greatly wants
control over materials and their appearance.

LoU   Refinement

Uses   WP(10),GB(10),DB(10),DR(9),DTP(9),MIDI(4)

**LoU
Descriptors**   A very typical timeline of learned technology skills,
beginning with grade keeping and moving through DTP. Refers
to himself as an advanced user in all software uses except
MIDI. Uses of technology do not directly involve students but
rather the preparation of presentations and printed materials
for classes and performances. "I could retire and do design."
Another instance of technology awakening new
professional/hobby interests.

Factor(s)   Recognition, nature of work,

**Herzberg
Descriptors**   Event: getting his first computer

SP related that technology has not changed the manner in which
he relates to students. However, his motivation and
excitement about his work seems to come from the new roles he
can perform within his work due to his increased productivity
and design capabilities.

ID	RL	**Date** 1/8/97
Length	30	**School** WHS
Department	English	**Age** 55

Gender
⦿ **Female**
○ **Male**

Years of Teaching   30   **VTSDP Hours**   76

Location   English office room

General Descriptors   Extremely detached and somewhat disinterested. I'm not sure why she agreed to the interview because she had very little in the way of positive descriptions. "I took my 60 hours to get my computer because it was free." Knitted during the interview and made multiple references to her desire to retire from teaching shortly and pursue her secondary career in fashion design. Had minimum interactions with anyone during the interview.

LoU   Mechanical

Uses   WP(6),GR(4),INT(3)

LoU Descriptors   Students are taken to one of the available computer labs about once every two weeks for word processing time on their compositions.

"We've got a lot of stuff." Feels supported by the equipment and colleague knowledge of it.

Factor(s)   Salary

Herzberg Descriptors   Event: VTSDP

Has enjoyed most of the workshops, but cited one in which she felt insulted and left. Was fascinated by the ability to draw and render objects on a computer. So unmotivated in her work that the only enthusiasm she could apply to technology was her understanding of how it might be applied in fashion and design. Technology represented a way to expedite her final three years of teaching.

ID	OL	Date	1/8/97	Gender

Length 65   **School** WHS   ⊙ **Female**

Department Reading   **Age** 45   ○ **Male**

Years of Teaching 21   **VTSDP Hours** 70

Location   Inside reading resource lab

General Descriptors   Charismatic and opinionated. Has a job that gives her the opportunity to apply technology with students who thrive with multiple approaches.

LoU   Integration

Uses   WP(7),GB(10,INT(6)

LoU Descriptors   Has pioneered the use of the Internet with her students, working to get them access stickers and providing time and resources for their use of it. OL describes the technology haves and have-nots and includes herself as one of the former.

Factor(s)   Responsibility and administration

Herzberg Descriptors   Event: VTSDP in 1994 Through her use of technology she has become recognized amongst her colleagues. Like others, she feels the nature of student-teacher interaction has not changed with her use of technology. Negatively, she is impatient with the indecisiveness of district admin. about Internet wiring and integration.

ID	GR	Date 1/15/97	Gender

Length 42 **School** RMHS ⊙ **Female**

Department Dance **Age** 34 ○ **Male**

Years of Teaching 11 **VTSDP Hours** 24

Location Dance studio

General Descriptors Very social, but very reclused in her department and location. This seclusion seems to make her shy in approaching colleagues with questions.

LoU Routine

Uses WP(6)

LoU Descriptors Has a computer in her classroom now. Uses WP to create documents and awards for her students and her role as chairperson for Illinois Showcase.

Factor(s) Achievement and recognition

Herzberg Descriptors Event: four years ago when I took the chair of the Student Choreography Showcase. She now sends all communications and certificates by using a DB and WP.

ID	MA	**Date** 1/15/97	**Gender**
Length	50	**School** RMHS	◯ **Female**
Department	Computer	**Age** 26	◉ **Male**

Years of Teaching 4   **VTSDP Hours** 126

Location   RMHS technology lab conference room

General Descriptors   M is a computer support person in the district. He is extremely likable, genuine and sensitive. His phrasing, demeanor, and attire give evidence of him being a spiritual person.

LoU   Integration

Uses   CP(6),WP(10),INT(9),MM(8)

LoU Descriptors   Has written software tutorials for concept mapping and health. He has completed the design of learning modules which act as "lab stations" for students to learn software programs.

Factor(s)   Peer relations, achievement, recognition

Herzberg Descriptors   Event:Relates a story of how he found several workshop attendees viewing pornographic pictures of Brad Pitt and felt extremely disappointed.

Event: wrote two tutorials

ID	HS		**Date** 1/16/97		**Gender**
Length	44		**School** BGHS		⊙ **Female**
Department	Special Ed.		**Age** 46		○ **Male**

Years of Teaching   21   **VTSDP Hours**   53

Location   Outside her classroom in hallway

General Descriptors   Very pleasant and patient. Wears a great deal of make-up and was fashionably dressed. Students are LD/BD and were on an early dismissal due to cold weather. Has taught Bus. Ed. for thirteen years prior to Special Ed. She described, without hard feelings, a shortage of available resources for her use. We moved halfway through interview so she could proctor students. The atmosphere was distracted.

LoU   Integration

Uses   WP(8),DB(5),CAI(8)

LoU Descriptors   Has students use Skills Bank program. Uses DB for mail merging student council letters. She encouraged the purchase of the Skills Bank software. It has increased student accountability and improved the clarity of communications with parents.

Factor(s)   Achievement

Herzberg Descriptors   Event: beginning the use of Skills Bank in math class in 1994.

Use has created a nice cycle of work, review, adjustment and continued progress.

ID	KK	**Date** 1/16/97	**Gender**	

Length 51   **School** BGHS   ⊙ **Female**

Department Science   **Age** 34   ○ **Male**

Years of Teaching 9   **VTSDP Hours** 48

Location   Her biology classroom

General Descriptors   KK was pregnant at the time of this interview. She seems very independent and self-reliant learning of software and media. She speaks most favorably about her fellow science (team) teachers as support people.

LoU   Integration

Uses   WP(9),GB(10),GR(9),LD(7),IN(9),CAI(9),SL(7)

LoU Descriptors   Uses LDs for presentations, controlled by computer. Available laptops in classroom for graphing - used a lot due to availability. Speaks of being intimidated and turned off by computer support staff. Has tried new assessment techniques by allowing students to give slide show presentations and has taught other teachers the use of this in class.

Factor(s)   Achievement

Herzberg Descriptors   Event: computer gradebook program crashed on the penultimate day of the term. The crash has made her continuously wary and tentative of computer-related resources. She feels compelled to be perfectly prepared ahead of time. The event has made her sympathetic to student troubles with computers. She now has a greater sense of control over her use of technology because she balances enthusiasm with caution.

ID	BS	**Date** 1/22/97		**Gender**
Length	48	**School** BGHS		○ **Female**
Department	Social Studies	**Age** 29		⊙ **Male**

Years of Teaching   4   **VTSDP Hours**   86

Location   Social Studies resource area

General Descriptors   Young and intelligent, coupling passion with some cynicism. Learned a lot of technology prior to beginning his teaching. He is generally unhappy about the computer support staff at the school.

LoU   Integration

Uses   WP(9),DTP(9),GB(9),TB(7),SL(10),HS(7),CAI(10),INT(7.5)

LoU Descriptors   Spends a great deal of time providing direct software instruction to his students during class time. Uses DTP for freelance design outside of teaching. Has students work in pods using books, CD ROMs and the Internet for research. Is very guarded about students copying and pasting text and plagiarizing. Speaks of lacking good CD tutorial/presentation software. Acts as a resource person for other teachers school-wide.

Factor(s)   Achievement and nature of work

Herzberg Descriptors   Event: successful creation and completion of a Bosnia project wherein students actually e-mailed people in that country during the war. Kids were totally immersed in the project. Felt a great deal of pride.

ID JS   **Date** 1/22/97   **Gender**

Length 35   **School** BGHS   ⊙ **Female**

Department Science   **Age** 51   ○ **Male**

Years of Teaching 18   **VTSDP Hours** 49

Location Her science classroom/lab

General Descriptors Teaches in both science and math departments. Comfortable asking students and other teachers for assistance. She notes the mechanical impacts of her technology work but feels the interpersonal role with students is more important and has been unaffected by her technology use.

LoU Integration

Uses WP(10),SS(10),TB(10),GB(10),GC(7),CAI(10)

LoU Descriptors Has done extensive work cataloging LD images and arranging them into presentations. Scores herself highly in seven of eight different software programs. Originally lobbied for LD media purchases. Generally has applied technology to make learning more engaged for students.

Factor(s) Responsibility

Herzberg Descriptors Event: LD adoption and programming during the summer of 1991. Was stipended for advance cataloging and sequencing of frames. Continues to act as a previewer of digital media for the science department.

ID	CC	Date	1/23/97	Gender
Length	55	School	WHS	⊙ Female
Department	ESL	Age	48	○ Male

Years of Teaching 8   **VTSDP Hours** 52

Location Her office in Student Advocacy

General Descriptors CC is part counselor, part ESL teacher who works specifically with the at-risk Hispanic student population. Our interview was interrupted by a student who dropped in needing help typing a paper. A very sincere student advocate. Slightly intimidated by technology.

LoU Refinement

Uses WP(5.5),GB(6),DP(6.5),CAI(4)

LoU Descriptors Has assisted students directly with WP and overseen media projects involving digital photography. Willingly seeks technical help from students and support staff. Makes computer in her room and the computer lab available to students.

Factor(s) Nature of work

Herzberg Descriptors Event: went to public library and found that card catalog had been switched over to computer format. Felt threatened by a language barrier with technology. Learning of technology has changed and strengthened my relationships with students. Sees a whole new world of possibilities for interrelating with students in the contexts of technology.

ID	ME	**Date** 1/30/97		**Gender**
Length	44	**School** JHHS		⊙ **Female**
Department	Special Ed	**Age** 58		○ **Male**

Years of Teaching 25   **VTSDP Hours** 113

Location   Her classroom

General Descriptors   ME is very pleasant and motherly in her appearance and demeanor. Refers to herself as a compulsive person.

LoU   Refinement

Uses   WP(10),DB(10),GB(10),IN(10),PR(4)

LoU Descriptors   Speaks highly of support people. Does presentations in class then provides computer lab follow up time for students. Openly solicits help from anyone available. Parents have been shown student work and their enthusiasm has meant a lot to students and ME.

Factor(s)   Achievement and nature of work

Herzberg Descriptors   Event: adopting a word processing template for creating book reports. Students were proud of the work they did within this framework. ME contacted students' parents at the end of the project. Administration did not really recognize this project, but ME felt proud. Felt "in" with the technology literate. Recognizes more fully that continued learning will be imperative.

ID	HH	Date	2/3/97	Gender
Length	36	School	RMHS	⊙ Female
Department	Language/Spanish	Age	30	○ Male

Years of Teaching   8   VTSDP Hours   30

Location   Her office

General Descriptors   Chatty and effervescent. Seems very dynamic with students and engages them. Her answers are somewhat scattered and she digresses frequently.

LoU   Refinement

Uses   WP(9),GB(7),DB(5),DTP(4),PR(5.5),INT(2)

LoU Descriptors   Gives herself intermediate scores in all areas except WP. Enjoys using presentation software. Feels very supported by both hardware and personnel. Stresses the need to diversify instruction to maintain student attention.

Factor(s)   Nature of work and achievement

Herzberg Descriptors   Event: attending first presentation software workshop. After learning Persuasion software, class presentations kept students much more attentive. Seems somewhat doubtful about maintain student interest and attention. Presentations help to keep focus and pace.

ID	BM	Date 2/3/97	Gender
Length	38	School RMHS	⦿ Female
Department	ESL	Age 57	◯ Male

Years of Teaching 22   **VTSDP Hours** 147

Location   Her desk in ESL area

General Descriptors   BM is very affable, maternal, and wanting to please. Answers are a bit confused and apologetic. Previously taught Home Ec.

LoU   Refinement

Uses   WP(9),CA(7),CAI(8),PR(6),INT(5)

LoU Descriptors   Students have access to a lab of fifteen computers and can also take laptops home overnight. Speaks highly of the resource people in the building. Offers a limited range of assistance to students in WP.

Factor(s)   Achievement

Herzberg Descriptors   Event: beginning the use of "Opening Night" software program. The software teamed students of different first languages together and empowered them to be creative. They benefited from hands-on work.

ID	RM	**Date** 2/5/97	**Gender**
Length	35	**School** PHS	⭕ **Female**
Department	Math	**Age** 31	⦿ **Male**

Years of Teaching   10   **VTSDP Hours**   12

Location   Small math meeting/computer   room

General   Primarily a geometry teacher. Recently became a father at the
Descriptors   time of the interview and was tired from the baby having been
ill. Very confident, self-reliant, and charismatic about his
technology use. Also likes the use of DTP for creating
polished documents.

LoU   Integration

Uses   WP(10),GS(10),CA(6),DTP(6.5),GB(10),INT(8.5),PR(6),

LoU   RM has written an extensive number of exercises and learning
Descriptors   scenarios for use with GS software program. Has taught the
use of the software to teachers in the district. Well
supported and stocked with hardware and software. Speaks
unpleasantly about the support people at PHS.

Factor(s)   Achievement, recognition, nature of work

Herzberg   Event: In Spring of 1992 RM found GS and began writing course
Descriptors   materials for its use at PHS. Developed school and district
materials from his subsequent knowledge of the software.
Feels that his development work with GS prevented him from
getting burned out. Added a new dimension to his work.

ID	SR	Date	2/5/97	Gender

Length	42	School	RMHS	◯ Female

Department	English	Age	59	◉ Male

Years of Teaching 36   **VTSDP Hours** 72

Location His classroom, triangular in shape

General Descriptors Very proper and eloquent. Former drama director. Teaches honors levels. Neatness is extremely important to him and he demands that all written work be typed. He is proudest of the independence that his technology skills have brought him.

LoU Refinement

Uses WP(10),GB(10),DB(10),PR(8),INT(8)

LoU Descriptors SR has written a research skills unit into his freshman classes which involves using online information in the library. First reaction to arrival of computers was panic but received significant tutelage under a colleague. Feels he now knows more than 75% of current faculty about technology. Has become self-reliant with computers. Feels support at school is poor.

Factor(s) Achievement

Herzberg Descriptors Event: learning the use of the Apple IIe computer under the volunteer coaching of a colleague. Felt extremely grateful for this assistance. The colleague was not an official technology support person. SR feels much less panicky now about computer use and feels his aging has contributed to that more relaxed feeling as well.

ID	TD	Date 2/6/97	Gender
Length	53	School EGHS	○ Female
Department	Math	Age 57	⊙ Male

Years of Teaching   33   **VTSDP Hours**   48

Location   His classroom in Math department

**General
Descriptors**
Initially was very hesitant, brief, and unenthused. Slowly grew more descriptive and ultimately shared some great stories and opinions. Teaches lower level junior and senior math classes.

LoU   Refinement

Uses   CP(7),WP(7),GB(8),GC(8),CAI(9),LD(8),

**LoU
Descriptors**
Focuses his attention on use of graphing calculators and has a full set in his class. Uses LD series which allows for problem-based learning of certain math concepts. Uses game-like computer tutorials. Has been to several technology conferences and gleaned ideas for use. Established a Math Grant with Harper College which allows EGHS to have TI83 calculators which students can bring home.

Factor(s)   Nature of the work

**Herzberg
Descriptors**
Event: acquiring a full set of graphing calculators for classroom use. Having these allows for teaching students what they really need. Higher order thinking skills. Removes teacher as focus of class time.

ID	BC	**Date** 2/6/97	**Gender**
Length	43	**School** JHHS	⊙ **Female**
Department	Social Studies	**Age** 45	○ **Male**

Years of Teaching 22   **VTSDP Hours** 25

Location   Her office at district headquarters

General Descriptors   BC works part time as administrative assistant in the district. Teaches AP US History. Very bubbly and engaging. Situated closely to staff development office and is part of VTSDP. Relates both teaching and learning tools of technology and is supportive of both. Seems enthusiastic, but indicates the key need to use technology to make her work easier. Identifies herself as a parent first.

LoU   Routine

Uses   WP(9),CD(7),GB(8),IN(6),CD(4)

LoU Descriptors   Describes herself as well-supported. Expects all AP papers to be typed. Used to provide in-class lab time for paper typing when she taught other classes. Worked with a colleague in 1988 to write a template for students to create their own Newsweek-like publication on Apple IIe. Was adopted by all teachers of Intro to Social Science. No longer in use now. BC is still first to learn new software.

Factor(s)   Personal life

Herzberg Descriptors   Event: converting from Apple IIe to Mac-based software in 1992. Very frustrated by lack of compatibility between home and school. Home-school fluidity was interrupted.

ID	IK	Date 2/12/97	Gender
Length	58	School BGHS	○ Female
Department	Math and Science	Age 43	⊙ Male

Years of Teaching   16   **VTSDP Hours**   8

Location	Math/Sci resource area, but we later moved to a hallway for his proctoring time
General Descriptors	Very monotone, insistent, and opinionated about school policy towards technology. Confident and well-versed in programming and integrating computers. Feels strongly that technology's context has been overdone in district.

LoU	Integration
Uses	CP(9),WP(9),GB(9),SS(9),GS(9)

LoU Descriptors	Creates all his own test and course materials; does not trust the spelling of secretaries. Uses some digital media, GS for math, and spreadsheets for lab data. Rates himself high on all software. Emphasizes the importance of technology allowing students to learn more, better, faster.

Factor(s)	Nature of work/Relations with peers, company policy
Herzberg Descriptors	Event: heading a textbook task force in 1993 to integrate GS in geometry classes. Focused on keeping technology in sensible context and improving our collegial dialog with each other. Improved both our curriculum and our working relationships. Feels the event and its consequences kept him in the classroom and confirmed what he had believed to be the important matters of teaching.

I D	MK	**Date** 2/12/97		**Gender**
Length	36	**School** BGHS		○ **Female**
Department	Computer	**Age** 27		◉ **Male**

Years of Teaching 3   **VTSDP Hours** 48

Location   Meeting room in off of computer applications lab

General Descriptors   Very young, enthusiastic, and computer-based. Had to move in and out of interview to check on students in lab, so interview was interrupted. Has 30 computers which are used for direct instruction. Works had to earn respect of students and colleagues.

LoU   Integration

Uses   WP(9),SS(7.5),GB(10),DB(8),DR(9),DTP(7),MM(9),

LoU Descriptors   Brought a good deal of application know-how with him from college. Has learned many applications at BGHS, particularly animation, painting and drawing software. Has written modules for instruction in DB and SS portions of classes which make learning sequences more understandable and easier to grade/track.

Factor(s)   Achievement

Herzberg Descriptors   Event: purchase an animation software package in March of 1996. Spent in school and at-home time rewriting curriculum for the animation/design class.   Made substantial improvements to look and meaning of module binder.

ID	GM	**Date** 2/12/97	**Gender**
Length	52	**School** WHS	⊙ **Female**
Department	ESL	**Age** 53	○ **Male**

Years of Teaching 20   **VTSDP Hours** 72

Location   in her classroom during lunch break

**General
Descriptors**

Has returned to teaching following an extended time away during which she raised her family. Very thoughtful and motherly. Describes herself, within her age category, as feeling behind. Became very emotional as interview concluded on a down note. Feels compelled to be up-to-date.

LoU   Integration

Uses   WP(5),CAI(10),CD(8),GB(6),CAI(8),INT(5)

**LoU
Descriptors**

Began the "Breakfast Club" several years ago by having her class open by 7:00 a.m. Describes herself as very well resourced. Makes use of several labs for WP and CD ROM edutainment. Very fond of computer support person at WHS. Procured ESL grant monies and bought software for reading and skills training.

Factor(s)   Responsibility, nature of work, achievement AND

**Herzberg
Descriptors**

Event: collaborating with a keyboard instructor to write an interdisciplinary course for at-risk ESL students. The course debuted last year and was successful with 23 students. Held an open house so that students could show off their work to their other teachers.
This year, cutbacks caused limited continuation of this program. Feels resentful and hurt about this.

ID	PC	**Date** 2/12/97	**Gender**
Length	58	**School** BGHS	◯ **Female**
Department	Science and Math	**Age** 36	◉ **Male**

Years of Teaching 9   **VTSDP Hours** 52

Location   His classroom in Math/Science wing

General Descriptors   Teaches in both departments. Very analytical and interested in research. Gives himself high marks in all software applications. Has given workshops in VTSDP.

LoU   Refinement

Uses   WP(10),CAI(10),CBL(9),GC(10),SL(9),INT(8)

LoU Descriptors   Has employed a range of teaching and learning software tools. Extensive use of CBL for data collection and interpretation. Shares ideas with colleagues. Considered himself computer literate when he began teaching and a key resource person with his cohorts.

Factor(s)   Administration, company policy

Herzberg Descriptors   Event: In June of 1996, the computer coordinator denied him access to passwords that were needed to disable protection software and do the summer work he was hoping to do. Felt treated like a student. Couldn't meet his own expectations for accomplishment. Unhappy with people in and structure of administration.

ID	SM	**Date** 2/19/97	**Gender**	

Length 36   **School** BGHS   ○ **Female**

Department Math   **Age** 25   ⊙ **Male**

Years of Teaching 3   **VTSDP Hours** 50

Location His classroom, after school

General Descriptors Teaches math at three track levels. Seems most interested in the "80's" upper level program. Also mentions preference for MW due to its ability to write math symbols. Very amicable - seems not to ruffle any feathers.

LoU Refinement

Uses GC(8),WP(9),GB(8.5),GS(6.5),CAI(6)

LoU Descriptors Speaks most attentively about the GC's. Also uses GS on alternate days, bringing students to the nearby lab. Speaks of eagerly gleaning ideas from other, more veteran teachers. Feels well resourced, especially with GC's.

Factor(s) Nature of work

Herzberg Descriptors Event: introducing the GC's during his first year of teaching. Recognized motivation in students as they were able to manipulate equations more quickly. Defines benefits of GC use at each track level, with a common point being added variety.

ID	TG	**Date** 2/19/97		**Gender**
Length	50	**School** PHS		○ **Female**
Department	Science/Math	**Age** 37		◉ **Male**

Years of Teaching 12   **VTSDP Hours** 10

Location His physics classroom

General Descriptors   Has experience with computers from college. A bit of a purist in using applications. Has owned many computers. Heavily involved as a coach and repeatedly describes a lack of time. Seems a bit low-energy and flat in his answers. Very tactile in his description of technology, speaking mainly about machines, not people or programs of use.

LoU   Routine

Uses   WP(10),SS(10),LD(6.5),CBL(8),GC(8.5)

LoU Descriptors   Has used graphing calculators in math, and CBL in science. Fought to keep Microsoft Word as the word processor in the department. Struggles in identifying impacts which technology has had on colleagues and students. Knows a lot but doesn't speak of curricular change. Seems related to machines and software more than people.

Factor(s)   Salary, working conditions

Herzberg Descriptors   Event: arrival of VTSDP in 1994. Participated in program in several waves. Happy about financial and resource support but feels the workshops are taught below his knowledge level. Describes a feeling of isolation from district. Highlights that computers have made his job easier.

ID	MB	**Date** 2/20/97	**Gender**	
Length	31	**School** JHHS	⊙ **Female**	
Department	Special Ed.	**Age** 35	○ **Male**	
Years of Teaching	11	**VTSDP Hours**	30	
Location	Her office			

General Descriptors   Teaches a wide range of subject matters to BD/LD students. Seems like a team player, though has negative opinions of some staff. Seems camp counselor-like in her demeanor.

LoU   Refinement

Uses   WP(8),GM(9),MM(6),SL(7),CAI(8)

LoU Descriptors   Uses a variety of multimedia tools to structure projects for students. Provides direct instruction on use of scanners and video incorporation. Brings students to tech lab. Uses presentations and gaming for instruction and review. Felt more supported at previous school. Interacts primarily with fellow BD/LD colleagues.

Factor(s)   Nature of work, achievement, peer relations

Herzberg Descriptors   Event: created an Internet project for students to research Christmas around the world. One difficult students came alive and participated with great interest. Added creativity and excitement and therefore assisted in improving student behavior.

ID	FJ	Date	2/20/97	Gender

ID FJ   **Date** 2/20/97   **Gender**

Length 33   **School** RMHS   ⦿ **Female**

Department Science   **Age** 42   ◯ **Male**

Years of Teaching 17   **VTSDP Hours** 27

Location Her classroom

General Descriptors Feels as though her participation in VTSDP and technology is insufficient. Speaks gratefully and energetically about the help she's received. Creativity is extremely important to her.

LoU Routine

Uses GB(8.5),WP(8),DR(8),CBL(2),LD(8.5)

LoU Descriptors Has used a wide variety of teaching and learning software. Feels very supported by staff and colleagues. Sites her use of at-home program computer - does a lot of work at home. Very animated about the new levels of text and design made available by WP.

Factor(s) Achievement

Herzberg Descriptors Event: learning new WP software at a conference in Colorado during the summer of 1993. FJ is a poor typist and gained considerable added control over the appearance of her completed materials. Feels more confident, organized and professional.

ID	MD	**Date** 2/25/97	**Gender**	
Length	48	**School** EGHS	○ **Female**	
Department	Language/Spanish	**Age** 41	⊙ **Male**	

Years of Teaching 16   **VTSDP Hours** 34

Location Language Office

General Descriptors Very quiet, unassuming disposition. Initially hesitant about responses. Seems on the whole to be happy teaching, but somewhat suspicious of the administration.

LoU Refinement

Uses WP(8),IN(6),LD(7),INT(6)

LoU Descriptors Has been frustrated with integrating software that accompanies textbook; feels as though it may bog down the curriculum. Has used LDs and digital pictures within HS presentations to portray different aspects of Hispanic culture and geographic areas. Has also experimented with concept mapping.

Factor(s) Nature of work

Herzberg Descriptors Event: participation in VTSDP. Had reached a plateau in his teaching and felt supported and renewed with the arrival of technology. Has been very academic and studious about learning the software and hardware. Pursued getting extra computers in his classroom to allow for small group work.

ID	JP	**Date** 3/4/97		**Gender**
Length	51	**School** JHHS		○ **Female**
Department	English	**Age** 29		⊙ **Male**

Years of Teaching   6   **VTSDP Hours**   38

Location   His classroom, after school

General Descriptors   Very opinionated and dedicated to teaching. Speaks frequently of being overworked. Also moderates the forensics team, which uses technology extensively. Teaches upper class students only, currently.

LoU   Integration

Uses   WP(10),GB(9),HS(8),INT(6)

LoU Descriptors   Demands that all papers be typed. Spends class time demonstrating use of HS in giving presentations. Has an installed projection monitor for showing computer and video images. Has given department workshops on using HS.

Factor(s)   Recognition

Herzberg Descriptors   Event: getting his laptop computer as part of the VTSDP in 1994. Because of extensive workload which he takes home, the portability gave him freedom. Felt supported and recognized for his teaching and cocurricular work.

ID	BN	**Date** 3/5/97	**Gender**	
Length	37	**School** PHS	⊙ **Female**	
Department	Social Studies	**Age** 53	○ **Male**	

Years of Teaching 12   **VTSDP Hours** 46

Location Social Studies office

General Descriptors   Very chatty and scattered in her responses. Seems more interesting in having a conversation than answering the questions. Laughs frequently. Refers to herself as a widow.

LoU   Routine

Uses   WP(7),CAI(8),INT(6)

LoU Descriptors   Has used geography tutorial software in computer lab as well as legislative simulation software. Has directed students to use Internet in their research, but has not provided in-class instruction.

Factor(s)   Personal life

Herzberg Descriptors   Event: getting an e-mail account and being able to keep in touch with family members across the country. Continues to be amazed at how easily and inexpensively she can communicate over long distances. Feels less lonely from the loss of her husband.

ID	SB	**Date** 3/12/97	**Gender**	
Length	58	**School** PHS	⊙ **Female**	
Department	English	**Age** 45	○ **Male**	

Years of Teaching 2   **VTSDP Hours** 24

Location English office

General Descriptors Worked as a teacher aide for several years prior to teaching. Had experience using database with Eastern Airlines. Very interpersonal. Speaks of worrying that computers will make teaching less personal.

LoU Routine

Uses WP(5),GB(6)

LoU Descriptors Expects upper level classes to type all their papers. Senior classes use WP as a writing and revising tool every day. Speaks highly of support people and colleagues. Does not spend much class time providing WP instruction.

Factor(s) Nature of work

Herzberg Descriptors Event: participation in VTSDP in January of 1994. Feels that equipping teachers with this tool shows respect for teacher time and makes the work more comfortable. Great availability has been an encourager of use.

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VITA

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The dissertation submitted by Timothy Gerard Sassen has been read and approved by the following committee:

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The final copies have been examined by the director of the dissertation and teh signature which appears below verifies the fact that any necessary changes have been incorporated and that the dissertation is now given final approval by the Committee with reference to content and form.

The dissertatin is therefore accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

April 1, 1998
Date

Director's Signature