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THE PLACE OF COMPUTER TECHNOLOGY IN A LIBERAL EDUCATION A CASE STUDY AT WIDENER UNIVERSITY

A Dissertation

Presented to the Faculty of the

School of Human Service Professions

Widener University

In Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education

by

Nancy Morrow Poole

Center for Education

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DEDICATION

This dissertation is dedicated with love to my family: my husband Jay, my daughter Jennifer, my two sons Scott and Ryan, my mother Jane Morrow, and my brother Chuck. I can always count on you guys for a good laugh.

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I would like to acknowledge those persons who were of inestimable help to me in this endeavor. Most important are those many faculty and administrative persons who so generously gave of their time to grant me interviews and provide me access to documentation. I am forever in debt to Jan Alexander and Mike Powell of Wolfgram Library, who tirelessly climbed stairs to unlock the Archives for me and helped me to find what I needed.

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I have to mention my children whom I would certainly not blame for doubting my intent to finish this epistle. Hopefully, they will aim as high and achieve their dreams, too.

And, finally, I have to thank the man in my life, the one who spread hot tar on roofs for three summers to pay for my master's degree. My favorite title is still, even after 30 years, "Mrs."

"Veni, Vedi, Velcro"

"I came, I saw, I stuck with it"

Jack L. Woods

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Abstract

Computer technology has become a ubiquitous presence within our daily lives and a part of our educational curricula at all levels. This happened slowly at first and then, with the advent of the microcomputer and its ever-increasing processing power and its constantly decreasing cost, at a frightening pace. Widener University has, as have many other colleges and universities throughout America, assimilated computer technology into its liberal education curriculum, using it first as a research tool for faculty, then as an instrumental tool for administrative duties, and presently as both an intellectual pursuit in the form of a computer science major and as an instrumental tool within other major areas of study. As our nation attempts to struggle toward excellence in education, the justification for the existence of computer technology as both an intellectual as well as an instrumental pursuit within a liberal education surfaces again and again. Widener University has found a place for computer technology within its traditionally liberal education curriculum.

The Engineering faculty at Widener University began using a mainframe computer for research purposes in the 1960s. They soon integrated computer usage into the Engineering curriculum. And, by the end of the decade, physics, mathematics, business, and liberal arts students were permitted to take courses using the new technology. As the 1970s progressed, modular courses dealing with computers and computing were introduced into the college-wide curriculur offerings.

Widener University began offering a major course of study in computer science in 1982. And, in 1983, the University opened several campus laboratories equipped with the new microcomputer. Students now had access to both the centralized mainframe and the decentralized processing power of the microcomputer and a wide variety of software.

Presently, Widener University students who graduate are computer literate as well as readied with a firm basis in the liberal arts.

The purpose of this research is to discover how, when, and why Widener University assimilated computer technology into its liberal education curriculum; what the argument for that assimilation was; and if the

curriculum reflects computer technology as an intellectual or an instrumental pursuit, or both.

CHAPTER I

Introduction

Statement of the Problem

In the last 50 years computer technology has appeared and infiltrated every facet of our daily lives, impacting upon the way we live, learn, and work. Whether we are buying groceries at the supermarket, using an automatic teller machine, making a long-distance telephone call, accessing a reference book at a library, or communicating with a colleague at another university or college, computers help us work faster and more accurately.

Computer technology appeared and became part of our educational curricula at all levels almost before we knew it. Within a space of twenty years, it was an intellectual discipline of its own and a tool for use within other disciplines.

Using Widener University in Chester, Pennsylvania as a case study subject, this researcher wanted to discover how, when, and why computer technology became such an integral part of a liberal education curriculum and how its assimilation within the curriculum was accomplished and justified.

Computer Technology and the College Campus

Computer technology did not make its appearance on the college or university campus until the 1940s. And at that time and for a long time thereafter, it was used primarily as a tool for research. The technology was simply too cost prohibitive for any other use. Many innovators had been experimenting with computing technology for many years before that, however.

Charles Babbage, with the financial support of the British government, designed and attempted to build an analytical engine for the purpose of making mathematical calculations quicker and easier. Although his invention could not be reproduced because of the inability at that time to manufacture the required gears, it has since been built and works.

In the late 1800s Herman Hollerith designed and built a tabulating machine used by the United States Government to calculate the 1890 census. And, in 1946, the University of Pennsylvania developed the Electronic Numerical Integrator and Calculator(ENIAC) which was implemented for the primary purpose of calculating trajectories for missiles.

By the early 1940s and for many years afterward, a good deal of the experimentation with computer

technology took place on the college campus. Researchers were experimenting with what computers could do and how they actually operated. From this research came the field of computer science.

With the advent of the microcomputer in the late 1970s, computer technology was no longer so cost prohibitive. The college could now afford to make computer technology available to administration and faculty as well as students. It soon became an integral part of the curriculum, both as an intellectual pursuit in the form of a major in computer science and as an instrumental pursuit for use as a tool within the study of other disciplines.

Definition of Terms

There were two concepts which needed to be clarified for the purpose of this study. They were *liberal arts*, its current meaning as the concept has evolved historically, and *liberal education*. The *liberal arts* include the traditional disciplines of arithmetic, geometry, astronomy, music, grammar, rhetoric, and logic or dialectics. This term evolved to include the social sciences of psychology and sociology. The American Heritage Dictionary defines psychology as the science of mental processes and

behavior and sociology as the study of human social structures and relationships. A liberal education is one which bases its curriculum upon the liberal arts, requiring students to earn a percentage of academic credit in the liberal arts.

"Traditionally, the liberal arts have encompassed all that knowledge which is not technical or vocational in nature. This includes the humanities, the fine arts, and the social sciences. Many critics, however, have long viewed the old liberal arts as an esoteric and impractical body of knowledge that has no direct application to today's rapidly changing technology-based world. The concept of the 'new' liberal arts integrates the seemingly scholarly knowledge of the old liberal arts with the 'pragmatic' knowledge of science and technology, since today it is important to be able to do something (technology) as well as to know something (humanities)" (Kurtz, p. 61).

Implications Which Follow for a Liberal Education

It has been an American tradition to include what are known as the *liberal arts* within our collegiate curricula, an idea based upon the philosophical educational base known as the *artes liberales*. The original seven liberal arts consisted of the study of

arithmetic, geometry, astronomy, music, grammar, rhetoric, and logic or dialectics (reasoning for the purpose of separating truth from opinion). The teaching/study of values has always been an integral part of the educational curriculum as well and also took its place within the *artes liberales* idea. For example, the Bible was more often than not used historically as a text. Teaching methods varied from dogmatic to dialectic instruction over the centuries.

The original seven liberal arts sustained a division into the Trivium versus the Quadrivium or the intellectual versus the liberal free idea during the Enlightenment, that time in history when Humanism became important. With the advent of the liberal free idea, experimental science (research) and inductive thinking replaced dogmatic epistemology and deductive reasoning.

In this century, the liberal free idea has evolved to include an instrumental base of study and, hence, the idea of electives. Throughout the Age of Englightenment and on into the present, however, the original seven liberal arts have continued to claim an important place within the curriculum of most institutions of higher education. Incorporation of the

liberal arts into a baccalaureate curriculum in higher education has come to be called a liberal education.

There has been much written about what actually constitutes a liberal education. Such authors as Everett Martin, Alan Bloom, and Mortimer Adler have differing views on the subject. It might be possible to say that a liberal education has always attempted to reflect what the thinkers of an era thought was important to know and to understand at a particular time in history. A liberal education "has always represented that civilization's compiled wisdom about the skills and knowledge a person needs in order to be at home in the world and to make the best use and obtain the greatest pleasure from whatever talents he or she possesses" (Saxon, p.16).

A liberal education has been and continues to be based strongly within the liberal arts. Just how strongly the liberal arts are stressed represents the difference between what different authors would deem to be a liberal education. Some colleges and universities claim to offer a liberal education or call themselves a *liberal arts* college when they actually offer a liberal-arts based curriculum or what is known currently as a liberal education. Very few colleges

and universities in the United States offer a liberal arts education, exclusively.

For example, in its mission statement, Widener University, refers to itself as a *multi-purpose institution*. Among its goals and objectives, it states that it wishes to ensure that its students "acquire a basic knowledge in the humanities, the social sciences, and the natural sciences and mathematics; that students master at least one curricular area; and that students are prepared for continued academic development in their chosen fields" (1994-95 Undergraduate Bulletin, p. 13).

Widener University supports three campuses: the main campus in Chester, Pennsylvania; the Delaware campus in Wilmington, Delaware; and the Harrisburg Campus in Harrisburg, Pennsylvania. The main campus houses seven schools: the College of Arts and Sciences, The School of Engineering, The School of Hospitality Management, The School of Human Service Professions, The School of Business Administration, The School of Nursing, and University College. The Delaware Campus houses Widener University School of Law and University College. The Harrisburg Campus houses The Widener University School of Law and the School of Nursing.

Although each of these schools works together within the mission statement as well as within the goals of the University, each school effectuates this mission and goals through its own mission and goal statements.

On the main campus, each undergraduate school requires its students, no matter what the major area of study, to take 12 credits within Humanities, 12 credits within Social Science, and 12 credits in Science/Mathematics. And all students of Widener University are required to complete a values component as a separate course or as part of another course offering within their major course of study. These curricula requirements are referred to as *distribution requirements*, the *liberal arts* being satisfied by the Humanities and Social Sciences. The College of Arts and Sciences incorporates what are referred to as *general educational* skills in writing, mathematics, critical thinking, and computer skills within these distribution requirements. The other Schools/Colleges of the University have integrated knowledge and use of computers as *principles* or *skills for graduation* within their mission statements.

St. John's College (Annapolis, Maryland and Sante Fe, New Mexico), on the other hand, offers a *classical*

liberal arts education, requiring its students to read 130 books of Western civilization and study and debate their meaning. The writers whose books are studied in depth range from Aristotle to Einstein, and include Darwin, Machiavelli, Saint Augustine, and Montaigne. St. John's approach is referred to as a *Great Books* curriculum. Almost all of the writers studied have been dead for centuries. Every student takes every course, and every teacher teaches every subject, from Greek to Newtonian physics. Despite the fact that many of its students go on to careers in science and engineering, no student is required to make use of a computer, although many students have them and use them as tools. Instead of science and physics, students and faculty discuss the writings of such authors as Ptolemy, who thought that the sun revolved around the Earth. There are no tests and no grades, although the universal grading system may be requested for such purposes as application to graduate school or employment opportunities. Students soon learn that they should be in class, not because of what they miss but because of what others miss learning from them. St. John's College awards only two degrees, Bachelor and Master of Liberal Arts. "St. John's College is a

community dedicated to liberal education" (St. John's Catalog, p. 6).

There are many differing views on exactly what a liberal education means. As stated on page 3, this researcher defines it as being an educational curriculum based upon the original liberal arts, one which requires its students to take a percentage of academic credit in the liberal arts. Hutchins and Adler will argue that it is an exercise in "addressing the intellect of man."

There are many authors who would argue vehemently that Widener University's curriculum represents a true liberal education (John Dewey and Alexander Meiklejohn) and that Saint John's offers an education based on the absurd. Still, other authors (Alan Bloom and Mortimer Adler) would argue that Widener University offers a *technology relevant* or *professional* education rather than a liberal education while Saint John's offers one based upon rational thought and analysis, a true liberal education. Students of both kinds of *liberal arts* colleges are, however, finding their places within the United States economy. Widener University students go on to graduate and professional schools of study, just as do students from St. John's College.

These two colleges represent a dichotomy in any discussion of a liberal education and what it means. A *classic* liberal education is offered by very few colleges and universities within the United States. The use of this definition of a liberal education is currently the subject of much philosophical debate at the higher educational level.

Historical Perspective: Widener University

For many years Engineering (mechanical, electrical, and civil) dominated the curriculum at Widener University. It was in the 1960s that Widener University (originally Pennsylvania Military College) first acquired a mainframe computer (the IBM 1620) and incorporated it into the engineering curriculum. In the latter part of that decade physics, mathematics, business, and liberal arts students were permitted to take courses utilizing this technology, although these new course offerings were based within the physics and mathematics departments. In the early 1970s the business department introduced the IBM 1620 into its accounting curriculum.

In 1973 a new program of required six-week modular courses was introduced into the curriculum for all

Freshmen. The purpose of these modular courses was to enable Freshmen students:

> to obtain a basic liberal arts education and acquire a meaningful understanding of each of three broad areas of knowledge -- the humanities, the social sciences, and science and technology.
>
> to select his or her academic major or perhaps to confirm or reject an initial area of interest.
>
> to become acquainted with many more of their professors than would be usual in the freshman year program (The Bulletin of Widener College, 1973-1974).

One of the modular courses offered that fall was *Computers and Computing* to acquaint students with the use of a computer for scientific and business problem solving. This particular modular course was offered for several years. In 1976 the programming language FORTRAN became a part of this modular offering (Bulletin of Widener College 1976-77). And in 1977 an additional modular course, *S/T 928 Modern Technology*, an introduction to technology and its impact upon society, was offered in addition to what was now

referred to as *S/T (Science/Technology) 905 Computers and Computing* (Bulletin of Widener College 1977-78).

By 1979 the Burroughs 1726 had replaced the IBM 1620, and S/T 939 *The Computer Revolution*, a history of the computer; its significance and extensive impact on society; and its role in the future, had been added to the listing of modular course offerings (Bulletin of Widener College 1979-80).

Modular courses continued to be offered through the 1980-81 academic year. And in 1980 Widener College became Widener University with a campus in Delaware as well as in Chester.

In 1982 Widener University offered a new major course of study within the College of Arts and Sciences--Computer Science. The Burroughs B6800 had replaced the Burroughs 1726 and ALGOL, BASIC, COBOL, FORTRAN, Pascal and RPGII became a part of that curriculum. In the fall of 1983 computer science acquired its own computing facilities with a VAX 11/750 computer. And the University acquired a Burroughs B6900 and four terminal laboratories for faculty and student use.

In 1987 Widener University entered the arena of distributed or decentralized processing. Distributed

processing is a system in which computers and storage devices are widely separated into many different locations. Widener University students now had access to various varieties of software and hardware as well as access to the new CDC Cyber 930. Computer science retained its VAX system and added several microcomputers for use by its major students. In 1990 computer science procured a DEC MicroVAX 3400 and several Sun workstations.

Since 1983 Widener University has enlarged its computing services facilities and now provides several large microcomputer laboratories and classroom laboratories for use by students, faculty, administration, and staff. All administrative offices as well as many faculty offices are provided with microcomputers, many of which are cabled to the Cyber 930 for access to electronic mail and internet services as well as college databases and library facilities. The Wolfgram Library is itself a study in the latest electronic on-line services for book and periodical research and acquisitions.

Since 1983 Widener University has expanded its curriculum to include computer literacy. Very few

students graduate without having used a computer as a tool to enhance their education.

Widener University: The Liberal Arts

Widener University, within its College of Arts and Sciences, speaks of the liberal arts as being courses (*subjects*) offered within the divisions of humanities and social sciences. These courses "provide opportunities for students who wish to obtain a broad undergraduate preparation for leadership roles in our society, for the development of creative talents which can address themselves to the value conflicts of contemporary society, and for intellectual development which adds to the richness of life" (1993/94 Widener University: Undergraduate Bulletin, p. 48). Students of Widener University are required to take 12 credits within humanities and 12 credits from the social sciences to qualify for graduation from the College of Arts and Sciences. These mandates are referred to as general education requirements.

The purpose of general education requirements is to ensure that a Widener University graduate of the College of Arts and Sciences is proficient in two areas: skills and knowledge. A student is to be skilled in writing, mathematics, critical thinking, and

computer technology. A student is also to be knowledgeable within the areas of aesthetics/philosophy, history, science, society/culture, and values. It is interesting to note that educational theory has, over the centuries, vacillated from an intellectual pursuit only affordable by the wealthy and leisure classes to a pursuit valued and pursued by the majority; and it has always included values education.

If one were to compare the original seven liberal arts with those areas which Widener University's College of Arts and Sciences currently includes within its general education curriculum, it is simple to see that they are very similar. For example, mathematics (arithmetic and geometry), writing (grammar), and critical thinking (rhetoric and logia) are definite components. Astronomy and music can be included within aesthetics and science. Widener University's curriculum also reflects the *liberal free idea* and its acceptance of research as a viable part of education.

It was also interesting to note, via a thorough examination of Widener's curricula as far back as 1862 when the University bore the name of Pennsylvania Military Academy, that the basis of its very limited

curriculum claimed, even then, to house the liberal arts and its division into the Trivium versus the Quadrivium or the intellectual versus the liberal free idea.

Research Questions

This researcher was interested to learn about Widener's history as it pertains to the liberal arts and a liberal education. This researcher was interested to discover how Widener University assimilated computer technology into its curriculum and how it justified that inclusion in its mission. This researcher attempted to answer the following questions in her47
research:

1. How, when and why did Widener University assimilate computer technology into its liberal education curriculum?

2. What was the argument for including computer technology within a liberal education curriculum?

3. Does Widener University's curriculum reflect computer technology as an intellectual or an instrumental pursuit, or both?

Research Method

This researcher used a case study research method. Yin tells us that a case study may be used to couple the hypothetical information to a study's introductory research questions and, finally, to its conclusion (Yin, pg. 28). He goes on to say that the case study method is most appropriate for studies where the initial research questions include those which pose *how* and *why* questions almost exclusively.

This researcher used Widener University as the setting from which to study how liberal education came to incorporate computer technology.

This researcher collected, analyzed, and interpreted the following information:

1. how, when and why computer technology became a part of the liberal education undergraduate curriculum at Widener University.

2. the argument for including computer technology within a liberal education curriculum.

3. computer technology within the curriculum at Widener University as an intellectual or an instrumental pursuit, or both?

A case study usually incorporates a wide variety of documentation, and this study was no exception.

Archival research into curriculum offerings as well as a general survey and interviews with those Widener University faculty and administrators involved was the foundation upon which this study was conducted.

CHAPTER II

Review of Relevant Literature

Introduction

What Louis XVI needed was a computer.

In May, 1779, the French monarch knew there was trouble in his realm; so, with an eye toward reform, he encouraged the people to submit their particular grievances to the crown.

The response was overwhelming. Thousands of Frenchmen let the King know of their dissatisfactions. The outpouring more than underscored the need for reform, but the sheer volume of the grievances made evaluating them an awesome task. Louis, never a strong decision maker, remained in a quandary.

Within two months the Bastille was stormed and the French Revolution had begun.

Almost 200 years later, the *data* Louis XVI collected are being closely scrutinized and analyzed with the help of computers by history students at Carnegie-Mellon University here (Farrell, p. 6).

Many authors believe that the computer itself was a university-based creation of research although there

were many men and women experimenting with the forerunner of the computing machine long before the computer appeared on the college and university campus.

Charles Babbage, an inventor and mathematician, designed a machine in the early 1800s to solve equations by calculating the differences between them. His efforts were supported, for a short time, by the British government. It was difficult at that time to manufacture the precision-machined gears required to build his engine, although his design was accurate. He improved upon his design before his death, and his Analytical Engine was actually built in 1991 and is now in the London Museum of Science. The importance of Babbage's crude machine was that it incorporated the basic features of all modern computers: an input device, a storage device, a processor, a control unit, and an output device. Most textbooks refer to Charles Babbage as the Father of Computers (Capron, p. 549) and the "first to establish the logical principle of digital computers" (Metropolis, p. 87).

In 1890 Herman Hollerith designed a tabulating machine which did computations for the United States census that year in six weeks rather than the usual ten years (Capron, p. 550). This invention aided the input

function with the invention of the punched card and the famous Hollerith Code.

Early Computers on the College Campus

The computer came to the college campus right before World War II. It was used as a research tool and was, in no way, identified with the pursuit of a liberal education. The use of computer technology at this time in history emphasized the economic value of the machine and its value for solving practical problems.

In 1930 Drs. Atanasoff and Berry of Iowa State University built the first digital computer (the ABC), which worked electronically, to help their students solve mathematics problems quicker and easier.

In 1944 Professor Howard Aiken of Harvard built the Mark I. It was an automatic sequence controlled calculator, using electromechanical components to perform elementary arithmetic operations and to store numbers. It used punched paper tape to control the sequence of operations (its program instructions). Thomas Watson, the founder of International Business Machines (IBM) supported Aiken financially by giving him $1 million to build this amazing machine. Although

the machine was never very efficient and sounded like a "roomful of old ladies knitting away with steel needles" (Capron, p. 151), it, nevertheless, put IBM on the map and made Howard Aiken famous.

The Moore School of Engineering at the University of Pennsylvania developed the ENIAC (Electronic Numerical Integrator and Calculator) at the request of the United States Government in 1946 for use by the Aberdeen Ballistic Missile Center. Its purpose was the calculation of trajectories for artillery and missiles; and it operated successfully from 1945 until 1955, when it was retired and moved to the Smithsonian Institute. Drs. John Mauchly and J. Presper Eckert based their design on the ABC, and when they attempted to obtain a patent for it were sued by Drs. Atansoff and Berry, with whom they had worked on the ABC (Levien, p. 11-31). The case was not settled until 1974 when Drs. Atansoff and Berry were named as the true artisans of the design. Mauchly and Eckert went on to construct the UNIVAC in 1951 and formed their own company, which was later bought by a firm which changed the name to Sperry-Rand.

Although International Business Machines (IBM) had some minute competition, it became primarily

responsible for the marketability of computers, beginning with its 700 series in 1953. In 1955, there were 88 domestic electronic digital computing systems; in 1957, 103; 1961, 222; and in 1964, 324 (Goldstine).

The Computer On Campus (1945 - 1970)

The computer at this time was very expensive, its necessity justified only by its use in performing repetitive tasks. It was very alien to everyday life, both physically and intellectually. It consumed less than 5 percent of the educational monetary outlay.

This was the era of the mainframe or maxi computer, the large computer. The primary power source was, at first, vacuum tubes which were later replaced with the transistor around 1960, and finally the integrated circuit in 1965. *Batch processing* and centralized operation was the order of the day. The user had to go to the mainframe computer, input data on a punched card or paper tape, wait his or her turn for processing, and then go to another centralized location to pick up a printout. If the program or instructions being used by the mainframe were incorrect, the process had to be repeated. This was both expensive and time consuming, sometimes making the whole process useless.

There was also a great deal of research being conducted at the university level in the area of the stored program concept. MIT developed a magnetic device for internal storage of data as well as programs, called CORE memory. Descendants of this device have provided internal storage for virtually every digital computer on the market today (Levien, p.13). University level research did much in the area of programming language design as well as the translators (assembly languages) for these languages. High level languages such as Fortran (FORmula TRANslator), developed in 1954 by IBM, and COBOL (COmmon Business-Oriented Language), developed in 1959 by CODASYL (Conference of Data System Languages), became standard. The development of the first removal disk pack for auxiliary storage also took place in the latter part of the 1960s.

"It is estimated that in 1969, more than 1200 institutions had computer facilities of some type in use. And the rate of increasing use has been impressive, averaging 42 percent a year between 1963 and 1968 and 22 percent between 1968 and 1969" (Levien, p. xv).

It was at this time (the late 1960s) that traditional educators argued that the computer was taking the place of thought, thus altering intellectual style. Others argued that it was freeing our minds to contemplate other higher planes of intellectual exercise (Levien, p. 19). No matter what the argument, it soon became apparent that this machine increased proficiency in problem solving and the ability to solve what were previously thought to be unsolvable problems. "The computer is a machine for amplifying man's intelligence" (Levien, p. 1).

The Computer on Campus (the 1970s)

At this point in time, the computer was still being used mostly for research purposes, although administration was finding it to be very useful for many repetitive tasks. The college professor, across disciplines, was also experimenting with this machine to aid in mechanization of routine and repetitive tasks, thus freeing himself/herself to be more creative and scholarly in his or her discipline.

It quickly became apparent that the computer was having an ever-increasing impact on higher education as both a subject which had to be taught as well as a tool for aiding in the processing of information. Because

of its influence in the disciplines of business, science, and engineering, it became part of the curriculum. Higher education is, after all, "society's prime creator and transferor of information"(Levien, p. 8); thereby, creating awesome potential for the computer's use as a tool.

The accessibility as well as the applicability of this wonderful device was definitely on the rise as its cost fell. It was estimated that its use and accessibility rose from approximately 33,000 machines and 150,000 users in the early 1970s to approximately 160,000 machines and 1,500,000 users by 1980.

The era of *time-sharing* arrived, making life for the user more convenient if not much easier. Several persons were permitted concurrent use of a mainframe computer from remote or off-site terminals to input their data. They were each given periods of time for processing by turn. Users still had to go to a centralized location to get their printouts. The mainframe continued to control everything.

Although it was widely recognized that computers could be used for quick and efficient number manipulation, it became acutely apparent by the late 1970s and early 1980s that that these numbers could be

reinterpreted as symbols as well, and so attempts were being made by researchers at the college and university level (Harvard, MIT, Carnegie-Mellon) to solve some problems which were considered to be unsolvable or sometimes solvable with difficulty. Some of these applications involved language translation, chess playing, theorem proofs, simple library reference functions, and the maneuvering of graphical information. Many of these puzzles required advanced knowledge in such fields as linguistics, number theory, mathematical logic, psychology, statistics, and probability as well as what computing machines could and could not do. Research on these puzzles soon became the job of across-the-curriculum teams of experts, and the discipline of computer science was born. This field of study developed into an understanding of computer theory coupled with an increasing knowledge of what they can do. R. E. Levien, in his article "Research Uses of Computers" published in 1972, expected the university to continue to play a major role in the field of computer science.

Many authors alluded to this decade as one in which much research was done on the campus in the use of sound as input and output. Massive innovations were

made in the disciplines of music, acoustics, and phonology (Levien, p. 17). And many authors referred to new disciplines, such as computational linguistics, artificial intelligence, weather exploration, and national economy analysis. The college and university presses increased production of printed material, and the use of a scanning device for architectural and engineering use was experimented with as was the use of the computer for medical record searching. There may have been other issues, but the major issue holding back technological development into what computers could actually do was money.

Many large campuses at this time had active research facilities which demanded some sort of computer service facility to serve them. Sometimes these facilities were, by necessity, expanded to serve other users as well. Campus users were no longer just faculty. They were, more often, becoming administration and students. This competition soon caused large-scale disruption and led toward a separation of campus research facilities and campus computing centers.

This disagreement of computer technology usefulness is significant. The widespread need for

computer technology as an integral aspect of research may have contributed to a growing view that the computer itself could become an object of academic attention.

A Period of Assimilation

The Computer on Campus (the 1980s)

Decentralization arrived with the microcomputer. Now the user did not have to depend upon a centrally located mainframe. He or she could input, process, and output at his or her own *workstation* instantaneously. There was and still is a need for the large, mainframe computer because of its capability to internally process and store large amounts of data, instructions, and information. The processing power of a microcomputer is nowhere near as great. However, the price of a microcomputer became affordable; and the processing power grew phenomenally, thanks to large scale integration (LSI) and very large scale integration (VLSI). The personal workstation and the introduction of national and international networking appeared.

Literature revealed that computer technology offered benefits in the areas of resource planning,

research facilities, and development of instruction. The user now had access to remote resources. Faculty could improve upon their teaching and communication through access to films and archival material as well as the ability to monitor model lessons. Venezky in his article "The Impact of Computer Technology on Higher Education" published in 1985 says"...computers will continue to flow onto the campus through the front gate, the back gate, the chimney, and through the coal chute. They will nestle into every corner and cubby hole they can find, chew up a little more silage each year, stir up a little trouble here and there, but leave the foundation intact and the house standing a little straighter than before" (Venezsky, p. 69).

As the 1980s wore on, campus computing was becoming contagious, particularly at the administrative level. Baldridge tells us that because administrative applications were taking so much of the available processing time, the spread of computing technology into academic areas was becoming more and more difficult. Administrative use was demanding from 50 to 60 percent of the available processing time of the mainframe computer housed on campuses (Baldridge, p. 6). During this era, many campuses tried to solve this

problem by acquiring separate computing facilities for academics and administration. This, of course, became more feasible as the microcomputer became cheaper, and, therefore, more easily accessible.

Scientific and research uses, quite naturally, were becoming increasingly more accessible, particularly for students. Computer assisted instruction (CAI) was rapidly finding its way into the classroom and laboratory. CAI included developing skills and using hardware. It also included training in computer literacy.

Office automation, particularly the use of word processing, became more and more popular with students, administration, and staff. The use of the computer for electronic filing, electronic mail, links to national databases, and resource catalogs was just becoming apparent.

Many colleges and universities were also forming task forces to examine the importance of computer literacy for their students. The emergence of a new *phobia* occurred. Cyberphobia or computer anxiety, the fear of computers for one reason or another, became rampant.

Both Victor Baldridge and R. E. Levien imply an apparent eruption of faculty resistance during this time. A group of faculty and staff surfaced who were either firmly opposed to any spread of computer technology on campus or convinced that it would soon go away. This group, more often than not experiencing cyberphobia, was usually small but very vocal and very aggressive. While everyone was 'wasting time' learning how to use the machine, the dreaded thing was gobbling up precious financial resources. They also were experiencing a threat, real or imagined, to their job security. These groups were, as mentioned, small and usually existed on small liberal arts college campuses. The technical institutions and more research-oriented campuses had fewer skeptics and adversaries.

On the other hand, there were larger groups of persons dedicated, almost religiously, to the veneration of computer technology and the use of the mainframe. These were the experts, usually the computer scientists. They were almost afraid of having their domain of expertise invaded by the common user.

And, of course, there was quickly developing another group of persons who were the heavy users of computer technology--the scientists, the social

scientists, and the administrative users. Although they sympathized with the computer scientists and their love for the mainframe, they developed a passionate love for what the microcomputer could do for them.

"The campus breaks down into various user groups that sometimes seem to have the intensity of religious camps; some worship the god of the computer but others fight it. Different people have different stances and their attitudes will help determine how computers are used, whether they are readily accepted or deeply opposed" (Baldridge, p. 9).

One might surmise from the very intensity of reactions to computer technology that computing had become increasingly integral to research and scholarship within many disciplines.

Both Baldridge and Hambler concur in their estimation of computer usage on college campuses during this time frame. Administration was commanding about half of the total computing expenditures. Baldridge goes on to say that "on the majority of campuses 50 percent of undergraduate students have never used a computer" (Baldridge, p. 13). "The fastest growing segment of computing in higher education is not instruction, not research, but administration. Over

half of the current expenditures are for administrative services" (Zucker, p. 39). But Baldwin predicted that academic use of the computer would increase. "In 1995 almost every course in every college and university will use computers to some extent" (Baldridge, p. 5).

The Computer On Campus (the 1990s)

M. B. Nakhleh predicted in a journal article written in 1983 that by 1990 almost 90 percent of all university students would be computer literate, as would 90 percent of all university faculties and high school students.

The 1990s have witnessed a spread of computer technology as the personal computer or microcomputer continues to decrease in price and increase in versatility; making computing available to almost everyone. Advances in communication technology permit people today to easily access and send information to other computers and computer users. There are many people who feel that learning how to use a personal computer is a basic skill necessary to succeed in any career one may choose or to simply function in society.

Because of this "many experts believe that, unless all students have equal access to computers, the gap between the haves and the have-nots will widen"

(Capron, p. 19). Many colleges and universities are spending large portions of their budgets to provide this technology, recognizing the fact that computers are being used in every potential field of study--graphics, commerce, energy, transportation, paperwork, money, agriculture, government, education, the home, health and medicine, robotics, the sciences, training, and even helping people lead more satisfying lives.

It is estimated that by the early 1990s approximately 90 percent of colleges and universities had access to some configuration of computing propensity (Hamblen and Baird). American higher education was beginning to think seriously about computing and its capabilities in the area of interfacing among students, faculty, staff, administration, and machines. Many campuses began an examination of such things as what instructional computing was actually taking place on their particular campus; how computing facilities were being and could be accessed; developing purchasing plans for both students and faculty; considering networking possibilities; implementing faculty and staff training programs; and promoting curriculum changes and acclimatization.

Unresolved Questions

These topics of discussion brought about the emergence of a new term *computer literacy* or *computer competency*. What does this term mean at this time in history?

Many authors have contributed to a discussion of its definition, suggesting that computer literacy means the awareness, knowledge of, and capacity to interact with computers.

Computer literacy (computer competency) definitions are still being debated. Many colleges and universities tend to develop their own definitions for their own purposes. Pepperdine University in California defined computer literacy in the early 1980s as being "the ability to write a simple computer program to solve a problem, to understand the basic components of a computer, and to demonstrate abilities to utilize software packages, including word processing" (Baldridge, p. 14).

The definition of computer literacy more often than not defines the place of computer technology within the curriculum, often forcing college students to choose between learning how to use a computer and learning, for example, a foreign language. Should

students not be required to do both? What is the place of computer technology and/or computer literacy within the collegiate curriculum and a liberal education?

Some campus leaders have decided that the use of computer technology for teaching, communication, and distance learning will be acute in the next decade. Based upon this educated predicticn, they are also arguing that computer technology may be the answer to improving today's challenge to higher education for improvement in quality. Use of this technology may help collegiate institutions cope with such things as a demand for better undergraduate teaching, a reduction in state support for public universities, the need to reduce or, at least, maintain private college tuition, and the growth in the numbers of non-traditional students. Is it time to stop thinking of computer technology as simply a nice 'add-on' to our educational offerings at the collegiate level and to begin thinking of it as a way of changing how our students are taught?

Peter Likins, president of Lehigh University, says "What must happen in teaching is that the computer must not only augment, but transform what we do."

William C. Jennings, vice-provost for computing at Rensselaer Polytechnic Institution, believes that

inculcating broader uses of technology into the curriculum is absolutely imperative. "We can't continue to increase tuition at well-above-inflationary levels. Parents are saying No."

A huge monetary outlay for computer technology was made by colleges and universities in the 1980s. However, many colleges and universities bought without extensive planning for its use. Now, expenditures for technology must be carefully planned for and justified.

Sometimes it costs less to incorporate computer technology as an instructional medium into the classroom than it might cost to improve instruction in that classroom by more traditional methods. The use of the computer to teach calculus, for example, has proved to be an asset to instruction and has, in many cases, reduced or eliminated the need to hire more faculty.

And, the ability to access library materials has reduced library budgets by eliminating the ever-increasing costs of printed journals.

The use of computer networks and the affordability of laptop and notebook computers has improved communication between student and teacher, thus improving and advancing the concept of independent study. Some institutions feel that this same

technology has improved the relationship between the part-time student and his or her institution of higher learning.

Distance learning, the ability of universities and colleges to provide networked as well as satellite television course offerings, is mushrooming. This, of course, improves enrollment opportunities for the handicapped, the working student, and the older home-bound student. Those public universities having to deal with huge increases in enrollments may find this to be an alternative to the need for additional campuses.

And, of course, the fact that computer technology is now affordable for almost all of us, most faculty can now manage to buy their own 'electronic boxes', thus discovering what its power can do for them and their disciplines.

David Roselle, past president of the University of Delaware, envisions faculty members illuminating their teaching through their use of computer and multimedia technology. For example, the retrieval of a live speech by John F. Kennedy via electronic database may enhance its discussion, analysis, and evaluation in a

history class. "That is really the frontier kind of stuff." Mr. Roselle says.

"Rather than improving productivity through mass production, higher education of the future should embrace new information technologies which significantly improve the quality of learning" (Sliwa, p. 12).

Has computer technology been assimilated as well into a liberal education at Widener University as it has elsewhere to address these questions and ease the fiscal crisis faced by us all?

Computer Technology on Campus Today

There are several thousand universities in the United States today; and they vary in size, focus, and economic flexibility. Many emphasize research; others emphasize teaching. Some specialize in engineering and/or technology; some are funded privately, others by the state in which they are located. Some rely on tuition almost exclusively for funding of anything special, while others have large endowments. Because of this diversity among institutions of higher learning in our country, it is impossible to summarize or even accurately estimate what computer technologies are being integrated into their curricula and with what

success. Suffice it to say, that some educators with vision are working hard to provide a situation in which teachers, students, administration, and staff have access to a variety of computing and information technology, based upon computers which vary from microcomputers (personal computers, laptops, notebook computers) to supercomputers and are located anywhere in the world. In the optimal situation, a personal computer would be attached to a campuswide network which reaches offices, laboratories, classrooms, and dormitories and extends off campus into faculty and student residences. Accessible via that network would be central computing resources, library resources, and auxiliary resources run by departments, project teams, and other groups within the university. This campus network would be connected with a national network, which would, in turn, be conveniently connected with an international network providing remote resources to all users. This ultimate dream is, today, a reality for many very fortunate campuses, those which can afford to pay for it.

Student ownership of personal computers has been growing at a fast pace because of the drop in purchase price. Required ownership, tried by some institutions,

is dropping off as a direct result of this drop in price. Requiring students to purchase a computer which can always run all the required software is becoming unrealistic. It is simply more cost-effective for the university to expend its resources for more powerful workstations, which can perform such tasks as computer-aided design and international communication and leave the low-level or more routine tasks, such as word processing and library catalog searching, to student personal computers.

Most leading universities have, at the very least, campus-wide networks; however, many departments must incorporate the connecting costs into their budgets. Science and engineering can usually afford these connections via research grants and other forms of external support. This is often not the case for education or humanities departments because of lack of budgetary support from central administration.

It can be said that computing activities within universities and colleges have made a dramatic impact in the areas of research, instruction, and administration, with, perhaps, the greatest impact being in the general internal structure which supports

communication and personal productivity by all those involved--students, faculty, staff, and administration.

Despite the tough financial times suffered by all institutions of higher learning during the late 1970s through the present, college and university personnel demand access to campuswide, national, and international networks. The creation of this network infrastructure has become generally recognized as essential.

Emergence of a Field of Study

The discipline of computer science was born in the 1970s as a study of the theory of computing machines. This interpretation of computer science has grown and evolved into many other things, including theories of mechanics, information processing and output, hardware and software design and facilitation as well as algorithms and interfacing. In other words, computer science is an activity which requires study and method and results in knowledge and explanation gained through experience. How do computers work and what can they be used to do? Computer science, although somewhat instrumentally oriented, has always been considered an intellectual endeavor as these machines can be used to

perform some fundamental intellectual processes usually performed by humans, such as: operating with words and sentences as well as letters and numbers; reading; forming and interpreting operations that underlie inference (ex. the way arithmetic operations underlie computation); and storing and recalling information from files comprising billions of datum (Levien, p. 7).

The curriculum designed for the computer science major is usually very difficult, requiring a firm basis in mathematics. Students are required to take many core courses as well as technical electives. Some of the core courses required at Widener University include physics, probability theory, scientific problem solving, symbolic logic, programming languages, computer architecture, and operating systems. Some of the technical courses include such topics as graphics, software engineering, and communications. Each student is required to complete a senior project, in which he/she must solve a problem by using a computer. Students also have the option of completing an approved computer science internship and/or an approved independent study of a topic within the realm of computer science.

The intellectual discipline of computer science is carefully guarded by those in the discipline for the direct purpose of retaining its strict adherence to the idea of the liberal arts. In fact, some educators have insinuated at times that computer science might be considered the 'eighth liberal art.'

As computer technology has thrust itself upon us in higher education and been taken into the fold, so to speak, there still remains disagreement among educators as to how it fits into the curriculum. We recognize its place as a discipline unto itself, but what of its place within the general curriculum?

This question seems to be surfacing more and more as the decade progresses. As our nation's institutions of higher learning attempt to meet students' expectations of an excellent education for the job market, they are finding it very difficult to stay current with all the technological equipment out there. The technological institution may be finding it a little easier, but the liberal arts college/university is not. Many educators and administrators are having a battle with the idea of a truly liberal education and how the curriculum can possibly support all this instrumental technology, not to mention the cost of it.

Computer science as a discipline is one thing, but including instruction on the use of the computer as a tool is quite another. Has instruction that incorporates computer technology within a liberal education compromised the discipline of computer science? What has Widener University done historically and what is it doing presently to attempt to include both the intellectual and the instrumental within its curriculum base? What arguments have surfaced that claim that courses in computer technology tend to reflect the instrumental and not the intellectual?

CHAPTER III

Procedures

Introduction

The thesis of this project was that Widener University, since its inception, has, as claimed in its historical documentation, attempted to maintain a liberal education curriculum, one which managed to assimilate computer technology. This narrative stressed a point by telling a story to substantiate it. The story grew from the analysis of the textual content of a series of interviews with study participants. An historical case study method was used to investigate the thesis.

Restatement of the Research Questions:

1. How, when and why did Widener University assimilate computer technology into its liberal education undergraduate curriculum?

2. What was the argument for including computer technology within a liberal education curriculum?

3. Was computer technology assimilated into the curriculum at Widener University as an intellectual or an instrumental pursuit, or both?

Identification of Study Participants

In the fall of 1995 this researcher requested a list of all full-time faculty and administration from the Office of the Registrar of Widener University, Chester, Pennsylvania. This list included each person's School/College (origin) affiliation and the date he/she was hired.

A copy of the Preliminary Survey Form (Appendix C), a cover letter (Appendix A), explaining the research this researcher wished to conduct, and a Consent Form (Appendix B) was sent to each of those persons (245) in early October 1995. Following a second mailing (to those persons not responding to the first mailing), this researcher received 133 responses, approximately 54 per cent (.542), from faculty, administration, and selected others (Wolfgram Library personnel and Freshmen Programs). The data received from the Preliminary Survey was used to construct Tables 3.1 and 3.2.

Table 3.1 (Respondents to the Preliminary Survey) was arranged according to time constraints of 10-year blocks, beginning with the decade 1960-1969 (One respondent had been been hired in 1957).

To select those faculty respondents who would participate in the Primary Interviews, this researcher took a total of only those persons from each decade who had used computer technology in the classroom in the past two years. (See Table 3.2)

Table 3.1

Respondents to the Preliminary Survey

Decade	50s-60s	70s	80s	90s	Totals
Arts & Sciences	6	9	22	15	52
Engineering	2	1	9	2	14
Hospitality Management			6		6
Human Service Pro.	1	2	10	7	20
Business Administration	1	4	5	6	16
Nursing		6	7	2	15
Freshman Programs		1			
Administration		2	4	1	7
Wolfgram Library			2		2
Totals	10	25	65	33	133

This researcher multiplied that total (those using computer technology from each decade) by the corresponding percentage of respondents represented

within that decade. The following table (3.3) was constructed using the results of that calculation:

Table 3.2

Preliminary Survey and Use of Computers

	Yes	No	Totals
1960s	9	1	10
1970s	16	9	25
1980s	47	18	65
1990s	21	12	33
Totals	93	40	133

Table 3.3

Selection of Interview Participants

1960s	9 respondents * 7.51%	1-2
1970s	16 respondents * 18.79%	2-3
1980s	47 respondents * 48.12%	22-23
1990s	21 respondents * 25.56%	4-5
Total No. Of Interviews		29-33

This researcher chose the Primary Interview participants by drawing a cross section of the decade as well as a cross section of the Schools/Colleges represented and the years the participants had begun using computer technology in the classroom. For example, this researcher chose two participants from

the decade of the 1960s. One was from the School of Arts and Sciences, had been hired in 1957, and had begun using computer technology in the classroom in 1985. The other was from Engineering, had been hired in 1962, and had begun using computer technology in the classroom in 1967.

Each participant's expertise with computer technology was also taken into consideration, although not exclusively. It stands to reason that those who are known to be especially involved with the technology would most likely be the best sources of information about its inclusion into the curriculum. This researcher chose to interview only those faculty who taught in the undergraduate program as this research was based upon the undergraduate curriculum.

Description of the Participants in the Preliminary Survey

Of the 245 faculty and administration to whom this researcher sent the Preliminary Survey, 133 responded. Of these 133 respondents, 7 were administrative staff personnel who may or may not have ever taught. These 7 individuals were reserved for possible context interviews at a later date. Of the remaining 126 persons (faculty, library staff, freshman programs), 93

(approximately 69.92 percent) had used computer technology in the classroom in the past two years, and 40 (30.07 percent) had not. Of the 133 respondents, 10 (7.5 percent) were hired in the 1960s, 25 (18.79 percent) were hired in the 1970s, 65 (48.87 percent) were hired in the 1980s, and 33 (24.81 percent) were

Table 3.4

School/College Origin of Participants in the Preliminary Survey

School/College	Number	Percentage
Arts and Sciences	48	36.09
Engineerings	14	10.52
Business Administration	17	12.78
Administration	7	5.26
Nursing	17	12.78
Human Services Professions	19	14.28
Hospitality Management	8	6.01
Wolfgram Library	2	1.5
Freshman Programs	1	.75

hired in the 1990s. Forty-four and thirty-six hundredths percent (44.36%) of the respondents were women, and 55.64 percent (55.64%) were men. The breakdown of respondents by School/College (origin) is represented in Table 3.4.

Of the original 133 respondents, 67.66 percent hold the academic degree of Ph.D., 12.78 percent hold the professional degree of doctorate, and 14.29 percent hold a master's degree. In addition, four respondents hold a C.P.A., two hold both the Ph.D. and the C.P.A., and two hold the J.D. degree as well as the C.P.A..

Description of Participants in Primary Interview

This researcher completed a total of 29 primary interviews with faculty. The Schools/Colleges to which the faculty participants in the Primary Interview belonged as well as the years in which they began their sojourn with Widener University is illustrated in Table 3.5.

Table 3.5

Primary Interviews with Faculty

	50s-60s	70s	80s	90s
Arts and Sciences	1	1	6	1
Hospitality Mgt.			3	
Engineering	1	1	5	1
Wolfgram Library			1	
Nursing		1	1	1
Business Adm.		1	3	
Totals	2	4	20	3

Of these respondents, 93 (69.92 percent) had used computer technology in the classroom in the past two years.

Design of Surveys and Interviews

Surveys

Preliminary Survey

This researcher initially wanted to find out which faculty were currently using computing for any aspect of their classroom instruction, which faculty actually instructed his/her students in the use of this equipment, when they began using the technology, and if they planned to continue using the technology. This was the base group, from which this researcher would choose persons with whom to carry out more intensive interviews at a later date. Therefore, this researcher attempted to design easy-to-answer questions which would yield information in an easy-to-interpret manner. The questions this researcher used for the Preliminary Survey were:

1. Do you include computing in any courses you have taught in the past two years?
2. Do you expect your students to learn any aspects of computing independently of class interaction?

3. When did you first begin to incorporate computing into your courses?

4. Do you intend to include computing in any of the courses you expect to teach in the future?

Interviews

Primary Interviews

After receiving the Preliminary Survey form (Appendix C) back from the participants, this researcher identifed those persons to be used for the formal/primary research survey interviews. Those persons who answered in the affirmative to a willingness to share their experience(s) with the integration of a computer component(s) within their course(s) were automatically included in the study. This researcher also used Table 3.3 as a guideline to select those persons included in the Primary Interview. Those persons received a list of Primary Interview Topics (Appendix D) before the actual interviews took place.

This researcher designed these questions to be open-ended so that she could examine more closely each person's experience with computers in and out of the classroom. She wanted to discover how, when, and why

the use of computer technology was absorbed within the teaching curriculum, how and if faculty had updated and continued their pursuit of knowledge of this technology, and what they deemed to be the future of its use within their discipline and at the college level. These interviews, of course, suggested further intervews with other faculty or staff and with individuals who had left the employment of Widener University.

The topics which formed the basis for the formal interviews were:

1. What are your earliest recollections of computer technology as part of instruction at Widener University?

2. Could you describe your professional experiences using computers as part of your research and teaching?

3. Can you trace the history of your personal experiences as computer technology was integrated into the curriculum? How well did you think it fit? What would have some of the benchmarks, milestones, memorable events been? Why?

4. What are some of your memories of how other persons (to be discussed anonymously, of

course) at Widener University were affected by the influx of computer technology into their research and curricula? How well did they think it fit?

5. What is your personal vision for the future of computer technology at Widener University?

The questions contained within the Primary Interview Topics form (Appendix D) were discussed orally for the purpose of discovery.

This researcher divided the responses to these interviews into three categories: history, assimilation experiences, and curriculum for the purpose of a general content analysis.

Context Interviews

As a follow-up to the Primary Interviews, this researcher also conducted, at the suggestion of many of the persons interviewed, context interviews with additional Widener University faculty, administration staff personnel, and selected others. The purpose of these context interviews was to help her to get a better vision of what happened historically as computer technology was integrated into the curriculum and to help her to better understand what faculty and staff at Widener University believed the future of computer technology to be within a liberal education curriculum.

This researcher also wanted to support the historical assimilation of computing technology into the curriculum at Widener University through the eyes of persons who were actually there from the beginning and those who came in at various stages along the way.

This researcher used the same list of Primary Interview Topics with those persons who participated in the Context Interviews and subjected the resulting information to the same content analysis.

Other Sources of Evidence

This researcher understood that faculty were not the only source of information about this research topic. Those faculty chosen to be participants in the study were able to supply her with the names of other persons at the University, administration as well as staff, who were of invaluable assistance in this research endeavor.

To augment the more formal, oral interviews, it was necessary for her to examine documentation, such as course syllabi, Widener University catalogs, Presidents' Reports, University and Faculty Council Minutes, minutes of the meetings of the Widener University Board of Trustees, University studies, and Middle States Reports.

A study done by John David Norton (1977), entitled Widener College--Minimizing Conflict in Accomplishing Change, held some very valuable information in relation to Widener's first dealings with the dawn of the information age. John Norton's study was concerned with change at one college (Widener College) over a 15-year period of time and how and why that change occurred. His fundamental explanation for that change hinged on Widener's development of a military career saga or tradition in the early years, which translated to an adherence to an authoritarian form of leadership coupled with a strong desire by that leadership, in the form of faculty, staff, and administration, to uphold its allegiance to a liberal education curriculum while continuing to offer a solid career emphasis.

Reliability and Trustworthiness of the Study

In order to establish reliability for this research study, this researcher used documented as well as oral data. The oral data were gathered first. This data was organized and analyzed historically within a span of four decades. The document analysis was conducted after all the oral data had been analyzed. The document analysis provided a basis of truth for the oral data. A duplication of this study using the same

procedures would have resulted in the same findings and conclusions.

To establish trustworthiness, this researcher drew data from many sources through specific methods of collection--interviews and document research. Because this was largely a qualitative study, the data withstood some subjective evaluation. The research was reviewed by a committee which aided in the establishment of construct validity. Internal validity was protected through the establishment of inferences derived through interviewing and documentation. These inferences were derived based upon careful consideration of rival explanations and possibilities as well as convergent evidence. External validity was established through analytic generalization of occurrences into support for the thesis of this research as stated on Page 48.

Analysis

The information generated in this study was both numerical and textual. Consequently, descriptive and comparative statistics tests were computed whenever appropriate. Textual information was used as descriptive illustrations of defining patterns, themes, and trends that surfaced from inferences. Since the

discovery of themes and patterns was an emergent process, especially for interview responses, the analysis of text was conducted thematically, as opposed to a more empirical approach.

CHAPTER IV

Results

Introduction

Widener University celebrated its 175th year in the school term of 1995 - 1996. Since its inception, the University has claimed in its historical documentation to have supported a liberal education curriculum, one which has assimilated computer technology as a tool for use within its curriculum as well as a discipline of study. This researcher attempted to discover how, when, and why Widener University absorbed computer technology into its undergraduate curriculum, the argument for this absorption, and whether computer technology was accepted as an intellectual endeavor, as an instrumental endeavor, or both.

Organization of the Analysis

This researcher used four kinds of exploration in this chapter. They included a preliminary survey, primary interviews, context interviews, and document analysis. The preliminary survey identified those members of the faculty and administration of Widener University who used computers for research or classroom

instruction. From the preliminary survey participants, this researcher chose 29 faculty members to participate in primary interviews. In addition, this researcher chose nine other persons to participate in context interviews. The primary and context interviews helped her to understand how computer technology was introduced and sustained within the liberal arts curriculum at Widener University and how it evolved into both a tool of instruction and a discipline of study. The document analysis, which was completed last, was organized to reflect three themes which emerged from the primary and contextual interviews.

Within each theme, this researcher chose to delineate the information within decades, just as the investigation of what was happening on American college campuses during the 1960s, 1970s, 1980s, and 1990s in Chapter II was presented. In this manner, this researcher was able to corroborate historical findings at Widener University with those events which actually occurred as computer technology was integrated into the curricula of American higher education.

Results of the Preliminary Survey

Five questions made up the Preliminary Survey. This was the survey which was used to identify participants in an interview which occurred later in the research sequence. The purpose of the survey was to explore which faculty had used computing for instructional purposes within the past two years; which faculty expected their students to learn some aspects of computing independently of class instruction; when these faculty users had introduced computing into their course instructions; and which faculty intended to retain computing as part of any course instruction in the future.

Responses to these questions were subjected to content analysis and tabulated as summaries. Their open-ended manner permitted this researcher to explore recollected experiences of the participants' responses; that is, relatively more subjective information.

Question 1: Do you include computing in any courses you have taught in the past two years?

Table 4.1 summarizes the affirmative and negative responses to this question:

Each decade represents the total number of respondents from that decade (minus any administrators represented within that decade). The decade of the 1970s included 2 administrators, the 1980s included 4 administrators, and the 1990s included 1 administrator, for a total of seven administrators.

Table 4.1

Use of the Computer in the Classroom

	Yes	Percentage of the Total	No	Percentage of the Total
1960s	9	10	1	3
1970s	15	16	8	24
1980s	47	51	13	38
1990s	21	23	12	35
Totals	92	100	34	100

In reviewing the use of computers in the classroom setting, it was interesting to note that the majority of faculty, particularly those who arrived on campus within the past ten to fifteen years (during the 80s and 90s), required their students to be familiar with word processing software and to make use of it. A large number of these same individuals expected their students to know and make use of a spreadsheeting

software application program as well. "Spreadsheeting and word processing skills are assumed."

The majority of responding faculty mentioned instruction in the use of the available word processing and spreadsheeting software offered as a separate course somewhere within the curriculum or as included as a portion of a course or courses within the curriculum, usually within the first year of study. For example, the School of Business Administration, which harbored a major in Management Information Systems, provided an introductory course in the use of the computer for word processing and spreadsheeting. This faculty also made use of a large amount of course specific software, software which comes with the required text.

Many faculty required students to have electronic mail accounts, evidently a common communication tool between faculty and students. "Students are expected to communicate with me via e-mail."

Many faculty obtained (usually from the Wolfgram Library staff) or provided instruction in the use of the computer as a research tool, particularly in the area of humanities within the College of Arts and Sciences. "Students are expected to do computer

database searches, which include CD Rom and Internet databases."

There are many faculty who required students to make use of SPSS for statistical analysis of data on a personal computer, particularly in the areas of social work and psychology. "Our students are required to review statistical concepts and procedures and learn to analyze data using statistical packages."

The faculty within the School of Nursing as well as in Science made use of computer assisted instruction, simulation software, and CD ROM instruction. This same faculty was increasingly learning and making use of the multi-media package PowerPoint for lecture and presentation, as are many faculty throughout the University. "Many of our faculty are making use of PowerPoint to build their lectures and classroom presentations."

Engineering continued to teach programming for computational purposes, having moved from FORTRAN to C and C++ (an 18-year endeavor). One faculty member reported the use of True Basic. And, of course, Computer Science continued to teach programming, C and C++, as well as Quick Basic.

And, as mentioned above, the powerful research tools available in our on-line library encouraged faculty to obtain assistance for students in its use.

Question 2: Do you expect your students to learn any aspects of computing independently of class interaction? (Please explain.) Twenty-eight persons reported that they did not expect their students to learn any phase of computing independently of the classroom, although one person went into detail to explain how he used his own personal software and did not permit the students to use what was available at Widener University to complete any of his coursework. For the most part, these persons were the same individuals who also answered Question 1 negatively.

The remainder of the group (105) answered that they did expect their students to learn some aspects of computing on their own, independently of course instruction. These same persons hastened to explain that they sometimes gave students introductory explanations or tutorials. For the most part, one class period was deemed adequate for this. Students were then expected to proceed on their own. "I try to

spend at least one or two classes tutoring my students in the use of word processing."

Virtually all respondents mentioned that they expected their students to be proficient in the use of word processing and spreadsheet software for completion of homework assignments. Many mentioned the use of statistical programs such as SPSSX (for the mainframe) and SPSS for the personal computer. "Our students are usually proficient in the use of SPSS for the personal computer before they reach my courses."

Many others mentioned the use of CAI, CD ROM, interactive video, and tutorials, all of which were available in many of the independent laboratories on campus; for example, in the School of Nursing. Still others expected their students to be familiar with the use of MATLAB, graphical packages (SRGP and SPHIGS), email, programming languages, and course-related software. "There are many course-related software packages available in our lab, and we expect our students to take advantage of them."

A very large number of respondents assumed that their students would know how to do literature and database searches in Wolfgram Library. A Humanities faculty member said, "We provide our students with a

hands-on library tour. They should know how to use these resources by research-paper time."

Many faculty mentioned that early courses within each School's curriculum included the use of basic software and programming lanuguages. Therefore, students were expected to know how to use these tools by the time they had advanced in their undergraduate studies. Many of those faculty who began teaching at Widener University within the past 15 years also mentioned that they assumed that their students would be familiar with the concept of the Internet and would want very much to learn how to use it to help themselves. "It's available all over campus. They should learn how to use it. I mention this to my students frequently."

Question 3: When did you first begin to incorporate computing into your courses? Table 4.2 illustrates the time frame during which faculty respondents began using computers. It is apparent that the majority began incorporating them into their coursework and teaching in the 1980s and 1990s.

Table 4.2

The Beginning of Computer Use

1960s	2	1.5 %
1970s	1	.007%
1980s	44	33.08 %
1990s	46	34.58 %
Non Applicable	40	30.07 %
Totals	133	99.993%

Question 4: Do you intend to include computing in any of the courses you expect to teach in the future? (Please give details.) Twenty-three persons indicated that they had no intention of including computing in any future coursework. Three of these persons were leaving Widener University, and one was retiring. The remainder (110) of the respondents indicated that they definitely planned to include computing in their future coursework.

Use of electronic mail, the Internet, and the Worldwide Web were frequently mentioned for research purposes, along with providing students with available list serves. Many faculty mentioned tutorials, CAI, CD ROM, data analysis software, and the use of databases. Science faculty alluded to continued use of MATLAB, interactive physics software, exploration into the UNIX

operating system, research design and methods software, as well as continued use of CAI, CD ROM, and simulation software.

Faculty of the School of Hospitality Management intended to continue to expand their use of computing with hotel and human resources/personnel function programs and training. Business Administration faculty intended to extend computer use within their curriculum and mentioned an increased awareness of what is out there for application purposes. One Humanities professor has become more and more captivated with the new programs for symbolic logic from the American Philosophical Association. And many faculty reported that they were investigating, with increasing success, computer assisted instruction, CD ROM applications, course specific software, Internet, and Worldwide Web tools, anything which would enhance their teaching.

Although many of the faculty who arrived on campus in the 1960s did not have access to computers, there were a small number who were instrumental in its intoduction into the University's curriculum. The credit for this belongs to the engineers. Those

faculty who arrived in the 1970s soon discovered that they needed the power of the technology, and those who arrived in the 1980s learned how to use this power to their advantage. Those arriving in the 1990s were probably instructed in part by computers and could not imagine living without computer assistance.

Findings from the Primary Interviews

This researcher chose to use open-ended questions in the Primary Interviews because she wanted to engage respondents in the telling of a story, a story that, with each retelling, might repeat core details of an historical process and, thus, be valid. This researcher also wanted these respondents to speak from their experience, thus demonstrating a committment to and a passion for their teaching profession. By interpreting their answers, this researcher was able to describe how they felt about computing, its introduction and assimilation into their teaching profession and scholarship, and about how they felt about Widener University's incorporation of the computer into its liberal-arts based curriculum.

Six questions made up the Primary Interview. These questions were designed to discover early recollections by the participants of the use of computers for instruction at Widener University; participants' professional experince with the use of computers for research and teaching purposes; any personal experiences which participants had had as a result of the computer's integration into the curriculum, how well they thought the technology fit, and what some of the milestones of the integration had been; what they had observed about how others had accepted the influx of computer technology; their personal vision for the future of computers at Widener University; and if they would be willing to share their course syllabi.

Responses to these questions were analyzed thematically. The results of the thematic technique were organized according to three emergent themes, as follows:

Embracing Computer Technology. Widener University's faculty, staff, and administration embraced computer technology enthusiastically, emulating what all of higher education in the United States was also doing at the time.

Devotion to the liberal arts. These people were and still are extremely devoted to the concept of a liberal arts-based education and displayed little or no argument with the inclusion of computer technology within its framework, recognizing its place immediately.

The computer as an intellectual and instrumental pursuit. The Widener University curriculum has always been based upon the liberal arts concept and has evolved to reflect computer technology as both an intellectual as well as an instrumental pursuit.

Theme 1: Embracing computer technology. Three of the interviewed faculty, one who came in 1974, one in 1975, and one in 1978 talked about using computers before they began their employment at Widener University. One person was from Engineering, one from Nursing, and one from Arts & Sciences. They came with the committment to the technology and have enhanced it since their arrival.

A Nursing faculty member introduced the technology to the graduate Nursing curriculum in the summer of 1985 with borrowed computers from various offices.

These machines were standalones using one of the original DOS versions and program disks. The course was so well received that she began offering it very soon thereafter to the undergraduates, teaching word processing, database management, spreadsheeting, electronic mail, distribution lists, and interactive video. This person was also instumental in the development, equipping, and staffing of the present Nursing laboratory, which houses a variety of computer software as well as CD ROM equipment, CAI, and interactive video. It is interesting to note that Widener University's Nursing School was the first to have a computer literacy statement, which laid forth computer requirements for graduation.

A faculty member who came in the early 1960s talked extensively about a decision made in the late 1950s and early 1960s to retain Engineering as an interdisciplinary major, civil; electrical; chemical; and mechanical students taking essentially the same core curriculum. A new person was hired at that time, whose primary task was to, over the next several years, select faculty and purchase the first mainframe computer. This mainframe, the IBM 1620, was housed in the basement of a dormitory on Melrose Avenue. Cement

floors had to be installed to house the equipment, classrooms, personnel, etc. "When completed, the Engineering School had the best facilities on campus."

As early as the 1970s faculty were proposing and offering modular courses with computer-related topics. Students could elect to take two in one semester, each module being worth 1 and 1/2 credits. "These courses were in a constant state of flux, everyone hurrying to keep up with the latest development."

Many of those faculty who arrived in the early 1960s and 1970s made frequent mention of Dr. Clarence Moll's (president of Widener University from 1960-1980) support and encouragement to computerize. He wanted all students, not just Engineering students, to learn computing. "Dr. Moll was our most enthusiastic supporter."

Not one faculty member interviewed mentioned a hesitation on the part of any other faculty member to embrace the new technology. In fact, many faculty gave of their time to offer workshops and private tutoring to those faculty wanting to learn. And according to those interviewed who did these things, the lineup of those wanting to learn was neverending. "I had to ask for a course-load reduction in order to help the many

faculty who requested help. I loved it." One person did mention that the only thing holding back some faculty, usually the older ones, was a certain "lethargy." Most overcame it.

Many Science faculty mentioned the enthusiasm that their numbers displayed with the new technology, hurrying to learn it and pass it on to students.

Humanities was an area where this researcher found a lower level of interest in technology. This faculty, overall, seems to be the least technically oriented, especially the older faculty. Although one of its distinguished numbers has published in the area of Internet use, the majority of faculty have only chosen to require students to use word processing for paper processing and our vast library facilities for their own and student research. However, even though afforded the chance to ask for computer equipment in their offices, they choose not to. One Humanities faculty member, who makes extensive use of the computer herself and attempts to do her best for her students says:

> The advent of Internet useage for research cannot and must not be ignored, and faculty support for its use must be upgraded. Students, although

having access to labs, have not been trained.

The School of Business Administration, with the American Assembly of Collegiate Schools of Business accreditation pending, would have been forced to include computer technology within its curriculum, even if it had not done so already.

As one Engineering professor put it:

> ..teaching Engineering without computers is like fixing your car with only a pocket knife. You may be able to do it, but why would you want to?

The School of Engineering includes a description of every computer component included in a course within each course syllabus. It is required to do this by its accrediting agency.

Theme 2: Devotion to the liberal arts.

The majority of the faculty interviewed felt that it was important to maintain the liberal arts component of the curriculum at all costs, even though it would be so much easier to offer technical electives in place of distribution (general education requirements). "Fortunately, most of our department still agrees with a values education as well as the basic concepts of the liberal arts as a basis of a college degree." And,

this concept has been reinforced by Middles States Accreditation Agency.

The School of Nursing has never questioned its liberal arts-based curriculum, believing it to be "an education for life." "There are those of us who have and always will guard that component of our curriculum."

The School of Hospitality Management also calls its liberal education component "an education for life," as well as "attention to the present, past, and future."

The School of Business Administration stresses oral and written communication skills as well as critical thinking skills (original liberal arts) within its curriculum. Every School of Business Administration faculty member this researcher interviewed mentioned this.

"Science strongly supports the liberal arts." However, Science is also disturbed with the ease with which nonscience majors can acquire science distribution or general education requirements. For example, nonScience majors can take an "easier" version of biology to fulfill general education requirements,

whereas Science majors must take the "harder" biology, which includes a lab.

This researcher was surprised when several interviewed faculty referred me to the University Mission Statement and its goals:

> Goal I To ensure that undergraduate curricula provide the opportunity for students to acquire a basic knowledge in the humanities, the social sciences, and the natural sciences and mathematics...
>
> Goal III To teach students the methods of critical thinking, of scholarly inquiry, of scientific research, and of problem solving....
>
> Goal V To develop in students a sense of ethical and moral values and a sense of their social responsibilities to community needs...(1996-1997 Widener University: Undergraduate Bulletin, p. 3-4.)

These people went on to say that these goals were usually present (the current Widener University Bulletin) on the table within every committee meeting they had ever attended or chaired. "It has been my experience that every faculty and administrator at this

University is dedicated to preserving our liberal education base."

Including computer technology within the curriculum was, for the most part, simply a given. It was another way to enhance learning; and because Widener University was and continues to be a *teaching* institution, it embraced it and made a place for it within all curricula. *We take your education personally.*

Theme 3: The computer as an intellectual and instrumental pursuit.

With the exception of faculty teaching Computer Science, all faculty members referred to the computer as a fabulous and now necessary tool used to aid and clarify learning. Computer scientists refer to the use of a computer as an intellectual endeavor because it employs the study of so many liberal arts--mathematics, physics, engineering, logic, and ethics. "Teaching students how to use a computer as a tool to help oneself is not an intellectual endeavor. Teaching a student to create with a computer is an art." "A person using a computer with love is pursuing the

intellectual; a person using a computer to help himself is using it as tool."

The mere fact that Widener University offers a major course of study in Computer Science is demonstrative of its effort to seek the intellectual. The vast majority of faculty who have embraced the computer as a tool used to enhance and further learning is proof of its dedication to both the instrumental and the intellectual pursuit of knowledge.

Findings from the Context Interviews

In addition to 28 Primary Interviews with faculty, this researcher also chose to conduct 9 context interviews. She wanted to interview persons, who, although they may or may not have replied to the Preliminary Survey, were or had been very involved in computing on the campus of Widener University. Some of these persons were suggested by participants in the Primary Interview, some this researcher sought out herself, and others had participated in the Preliminary Survey. The year in which each participant joined Widener University is illustrated in Table 4.3.

Table 4.3

Distribution of Participants in Context Interview

Decade	50s/60s	70s	80s	90s
Administration	1	1		
Faculty			5	
Administration				
Retired	1			
Administration				
Ex-Staff		1		
Totals	2	2	5	

Context interviews were important because they tended to reinforce many of the themes which this researcher saw emerging from the Primary Interviews. Although those persons participating in the Context Interviews were primarily administrators, they had observed and, in may cases, participated in what happened in the area of computer technology at the University. These people enhanced and sustained my story.

The Context Interviews, just as the Primary Interviews, were conducted in an open-ended manner. This researcher used one question for each Primary

Interview: "What have you seen happening with computer technology at Widener University? Tell me your story." Their stories were fascinating and correlated with the emerging themes just as well as the Primary Interviews did.

Thematic Analyses of Context Interviews

Embracing computer technology. "Widener University (at that time PMC) was the first institution in this area to ask an IBM service bureau to aid in record keeping." This occurred during 1948 and 1949. The turnaround time was 48 hours.

A faculty member who has been at Widener for many years says "It has been my experience that administration has always supported and tried its best to help us to learn, obtain, and utilize the technology."

In fact, all the faculty this researcher interviewed commented positively on administrative support for the inclusion of the computer into Widener University's curriculum. In turn, administration praised faculty for its contribution to the endeavor:

> We have faculty at this institution who constantly amaze me with their all-out effort to embrace anything which will help our students to learn

better and themselves to teach better.

Humanities faculty reported that they are not enough aware of current technology, and that there are fewer on-campus workshops available for faculty today. To quote one respondent, "Humanities has had technology forced upon it, but learning how to access information is a must; and it, too, will and, in many cases, has become computer dependent."

Another faculty member talked extensively about the first mainframe computer, the IBM 1620, which was housed in the basement of a dormitory. It was replaced with an IBM 1401 and an IBM 1700 in the 1970s and moved to the location of the present Computer Science laboratory in Kirkbride. They was used by both administration for payroll purposes and by engineering students (Burroughs 1700). It was about this time that engineering students were required to have a computer component in each of their courses.

Early Attempts to Apply Computing to the Curriculum. A faculty committee was organized for the purchase of a computer for academic use in the early 1980s. It was the opinion of this committee that the Burroughs 6900, which was eventually purchases, was not academically appropriate; it did not support PASCAL,

and it incorporated batch-mode processing, rather than the new time-sharing. This machine was more appropriate for industrial, not academic applications. Many bids were taken for replacement of the Burroughs, and there was much discussion between faculty and administration about an appropriate machine to serve the needs and desires of all faculty groups. The Cyber from CDC Corporation was suddenly purchased that summer. Many faculty felt that its purchase was based solely upon the fact that CDC offered the lowest price.

Engineering was most unhappy with the Cyber purchase because it did not fulfill departmental needs adequately. This led to a lot of fund-raising and grant writing by Engineering for a departmental laboratory of its own design. Electrical Engineering began a consistent upgrade of its own computer equipment and now has four laboratories equipped with the latest in technology for its students. Many other departments followed; and, now, Nursing, Engineering, Business Administration, Computer Science, and Science have their own independent laboratories.

In the early 1980s SCT Corporation was hired to manage computer sources on campus. In addition to the purchase of the Cyber, student laboratories were

outfitted with personal computers for student use. Faculty were offered subsidized purchasing for the new PCs.

Science integrated computer technology readily and prepared its majors with basic computer courses in preparation for a more advanced course of study. For example, physics students had a laboratory experience for the purpose of being familiar with spreadsheets before they advanced to the higher level physics courses. Computer Science majors coordinated their computer use with engineering students so as to facilitate upper-level course work. Astronomy students were provided with training in spectographics and optics before moving on. Laboratory science majors were well versed in computer usage, having a computer component within almost all their major coursework.

The School of Engineering updates its computer software monthly, making installations at the request of its faculty. The School now has four independent laboratories and one network control laboratory. The software available in these laboratories includes just about every feasible program known to the disciplines of electrical, chemical, mechanical, and civil engineering. These include such mathematical programs

as MATLAB and TKSolver as well as AUTOCad, Pspice, Aspen, Ansys, and filter design software. This software is housed on a mixture of personal computers housing 486 and 586 chips.

Devotion to the Liberal Arts. After World War II, Pennsylvania Military College, as did every college and university in the United States, received a giant influx of students, and the liberal arts component of the curriculum emerged.

> The current Associate Dean of Science commented: There has been an on-going struggle to maintain the liberal arts component of all major curricula. It would be so much easier to permit students to take a technical elective pertaining to their major. Fortunately, the majority of faculty within the Schools agree with values training and distribution (general education) requirements for all graduates.

In 1983 President Robert Bruce of Widener University charged the Ad Hoc Committee to Study General Education of the College of Arts and Sciences with the task of reforming its baccalaureate general education requirement. This committee surveyed thirteen

comparable colleges and universities to discover if their general education requirements differed from that of Widener University.

In January of 1987 the faculty of the College of Arts and Sciences approved a general education curriculum which went into effect in the fall of that year. The goals and requirements remain the same to this day: Writing Skills - 3 credit hours (English 101 being the minimum requirement); Mathematics Skills - 3 credit hours; Computer Skills - as specified by the major, and Critical Thinking Skills - to be satisfied by specified major courses and a values seminar. These skills are accompanied by 12 credit hours of humanities, 12 credit hours of science, and 12 credit hours of social science. These general education requirements were adopted by every School of the University which offered a baccalaureate degree. They are also published in every Widener University Bulletin and supported through the Goals of the University as part of its Mission Statement.

The computer as an intellectual and instrumental pursuit. According to these participants, the inclusion of computer technology within the liberal

education curriculum at Widener University had little or no effect whatsoever upon the major course of study in Computer Science because of the peculiarities of that particular major. The computer was viewed as an instrumental tool as well as an intellectual pursuit at the University. "It is accepted quite naturally as both a tool and a discipline of study."

Summary It became apparent very quickly that the majority of administration and faculty at Widener University embraced the inclusion of computer technology with enthusiasm. Most faculty hastened to learn as much about it as they could and to pass the knowledge onto students; and administration did as much as was possible to support this effort.

There were many arguments over the years about mainframe support as well as support for discipline-specific hardware and software for the University. As a result, some academic departments, such as Nursing, Engineering and Computer Science, developed their own personal computer laboratories maintained independently of campus-wide computing service facilities. This has, nonetheless, received the support of administration.

The liberal arts component of the University's curriculum has been heavily supported since the very

beginning, judging from earlier curriculum documents of the PMC era. 128

Even when it was popular to be very career-oriented; and students had the choice of many elective courses, Widener chose to maintain a strong liberal education component within the curriculum. The faculty and administration of the University worked hard to maintain and upgrade this, finally launching a major revision in the general education curriculum within Arts and Sciences in 1987. These general education requirements were subsequently adopted by every School/College within the University.

Computer technology was embraced as very valuable tool within all components of the University just as Computer Science as a discipline was adopted within the College of Arts and Sciences in the early 1980s and remains today.

Following completion of both the preliminary and the context interviews, a review of all relative documentation for the purpose of authentication of information obtained from the interviews was effected. Organizing the information gleaned among the same three emergent themes, this researcher gathered historical,

assimilation, and curricula data to validate this information.

Findings from Document Analysis

The archives of Wolfgram Memorial Library house much written testimony to the incorporation of the computer into Widener University's historically liberal-arts based curriculum. These documents include President's Reports, minutes of meetings of the Board of Trustees, and Middles States Association of Colleges and Secondary Schools Self-Studies and Reports. These documents seriously support the themes which emerged from this research.

When the current President of Widener University began his term of office at the University in 1980, he instituted a yearly President's Report, in which he summarized all that had happened at Widener University in the previous year---a "state of the union" so to speak. The information contained within these Reports provided me with an historical discussion of how computers were integrated into Widener University's curriculum. Use of this information helped me to contrast what was happening in American higher education with respect to computing, at this time in

history, with what was happening at the same time at Widener University.

The Middle States Association Reports and Self Studies of the 1960s, 1970s, 1980s, and 1990s as well as the minutes of the meetings of the Board of Trustees from those decades corroborated the determination, as did other papers, to retain a liberal-arts based curriculum in all the Schools and Colleges of Widener University.

All the documents which this researcher had the privilege of reviewing aided in her historical summary of the inclusion of computer technology within the liberal-arts curriculum base at Widener University, both as a discipline of study as well as a tool for use in the pursuit of knowledge.

Using the themes which have emerged through the primary and contextual interviews which have formed the basis of my research, this researcher traced Widener University's entry into the information age using a decade approach, just as this researcher did with the entry of higher education in America into the information age.

Embracing computer technology.

Widener University - the 1960s. As American higher education was becoming increasingly aware of the value of harnessing the power of a computer, the Engineering Department at Widener University introduced use of a mainframe computer into its freshman curriculum using the IBM 1620. At the same time, the Science Department was considering the possibility of offering a major in Computer Science. By the end of the decade, it was apparent that the IBM 1620 was vastly overburdened. The Business Office needed it, and Engineering wanted a better machine. The machine lent itself better to business and scientific applications, rather than to Engineering applications.

At this time in Widener's history (Pennsylvania Military College), the Engineering Division was taking the lead in the introduction of the computer into the undergraduate curriculum.

> There is a considerable emphasis on the use of computers. The digital computer (IBM 1620) is introduced in the first semester of the freshman year, and the analog computer comes in during the second semester of the sophomore year in System Analysis courses. Thus, all junior and senior

> courses may use the computer without separate instruction (PMC Accreditation 1967 - Report on Self Evaluation, p. 108).
>
> The Science Division was hastening to catch up. The Division is examining areas of contemporary interdisciplinary emphasis in the sciences with view to the introduction as soon as feasible, of programs in earth and space sciences, radioisotope technology, and computer science. The latter courses will be developed in conjunction with and coordinated through the interdisciplinary Computer Center Advisory Committee. (PMC Accreditation 1967 - Report on Self Evaluation, p. 105).

At the April 4, 1963 meeting of the Widener University Board of Trustees, President Clarence Moll asked the Executive Committee to confirm an action to enter into a contract with IBM for the rental of an IBM 1620 to be used by the business office and for research and instruction. The cost of this rental was estimated to be approximately $1000 per month. And, at the November 20, 1964 meeting of the Board of Trustees, a discussion occurred about the current status of the data processing equipment. The IBM 1620 was obviously being overtaxed. Because it was felt that this machine

lent itself better to scientific applications rather than business applications, it was recommended that a second system be installed, at the annual rental cost of $25,000, exclusively for the use of the business office and for educational purposes (although the minutes do not specify for which educational purposes).

Widener University - the 1970s. The 1970s was a time of discovery of what the computer could do for educational research as well as its use in the performance of routine and repetitive tasks. Its usefulness in the fields of business, science, mathematics and education was becoming apparent. Its cost was falling, although not quite fast enough for Widener University; and its accessibility was growing. Its integration into all curricular areas at Widener University during this time was not quite as fast as that of other institutions, but there were plans being made for a significant expansion in computing facilities.

Although computers had been introduced to the curriculum in a small way in science and engineering, they had not yet commanded quite as much attention as they would in the 1980s. However, the use of computers for research purposes proved to be invaluable to the

College when it endeavored to obtain incorporation for the three campuses as one institution, two of which were and still are in the state of Pennsylvania and one of which is in Delaware. The legal firm, Potter, Anderson and Corroon of Wilmington, Delaware (Somers S. Price, Attorney-at-Law), which represented the College, was chosen because of its expertise in computer research of similar cases.

The minutes of the October 5, 1975 meeting of the Widener College Board of Trustees meeting states: "Our computer facilities are at the present time obsolete and were so recognized when the accrediting committee made its last report (1968)."

As a result of this meeting, a committee was formed to evaluate the computer needs of the college. This group made a proposal for a new $2 and 1/2 millon computer system to serve the college in three ways: the business office, student affairs (records, alumni records, course scheduling, etc.), and academic computer facilities for faculty and students in science, business, management, and social science. This computer system was to be shared with Crozer Chester Medical Center to aid this facility with its needs. The cost to Widener College would have

approached $120,000 per year. Unfortunately, Chester Crozer, after several years, dropped its interest. The January 1, 1973 Board minutes state "Not much progress has been made with Chester Crozer, and that project may have to be shelved." It eventually was.

In the early 1970s one person was hired to direct computing services for the campus; and, in the late 1970s and 1980s, one of the first people was hired to work with students and, on a lighter level, with administration. That person was in charge of the mainframes--the IBM 1620 (used for FORTRAN) and the IBM 1401 used for administration (payroll and registration). This person also taught day and evening courses in computer technology.

As the 1970s progressed, it became apparent that there was a continuing need for someone to oversee the operations of the mainframe for both administration and academics. That position was filled by several persons, all of whom reported to the Vice President of Administration and, later in the decade, to the Vice President of Finance, these administrative positions being combined.

A follow-up report presented to Middles States Association of Colleges and Schools in March of 1980 by

Widener College states "A significant expansion in computer capabilities is planned. ...the conversion of academic computer requirements will take place from the card-batch process mode to terminal operation" (p. 13).

Widener University - the 1980s. The 1980s introduced the personal computer to American higher education. Its lower cost and ease of accessibility, not to mention its vast increase in processing power, made it very appealing as both a tool and as an intellectual pursuit. Widener University equipped several student computing laboratories during this decade with personal computer workstations as well as many faculty and administrative offices. A growing number of faculty began to introduce and, then, integrate it heavily into coursework. And, Computer Science became a major course of study within the College of Arts and Sciences.

As each year of the decade unfolded, the computer became more and more a part of the curriculum as an instructional tool. Computing facilities were expanded to include the new personal computer and lots of new equipment, both hardware and software. The computer began to provide help with instruction, and the

Wolfgram Library began its entry into an age of automation. Greater control of computing facilities was achieved; and there was movement toward the achievement of computer literacy for all Widener University graduates.

The 1980s were a time of computer-glut on college campuses across the United States because of the decreasing cost of the microcomputer or the personalized *workstation*. Academics no longer had to fight for computer time with administration. This trend coincided with the retirement of Clarence Moll and the inauguration of Robert Bruce as President, as well as the termination of Widener College and the beginning of Widener University (July 1, 1982), with eight Schools and Colleges located in Chester, Pennsylvania and a two-year division of the University (Brandywine College) located in Delaware.

The early part of the decade. Computer technology had been present on the Pennsylvania campus of Widener University since 1963. Computer resources in the 1980s were administered by the Computing Services Department, which allocated nearly half its budget to academic computing. Additional computer resources were, by this time, maintained by individual colleges, schools,

divisions, and programs of the University. The Burroughs 6900 was meeting with some opposition because of its software limitations, and the University was exploring other mainframe solutions.

The minutes of the meeting of the Board of Trustees of April 3, 1980 reflects a discussion of the Burroughs 6900 and the fact that Brandywine college and the Delaware Law School were demanding increased services of this machine. It was recommended at this meeting that a new machine to handle these increased demands should be purchased and that a new computer center and a competent director for it be obtained as soon as possible. In order to make this new machine effective, it was also recommended that $85 thousand in terminals and software be purchased as well. By June of that year a contract was signed to lease a Burroughs 6930, which would be, within 7 year's time, purchased.

The IBM PC became the standard in 1983. A Faculty Resource Center was provided for course development and enhancement of faculty computing. Two microcomputer labs were built and staffed for student use, and their use grew steadily. The University made IBM PCs available to faculty, staff, and students at substantial discounts. However, the growing demand for

computing was apparent and would very soon necessitate expansion. "At least 50 percent of the faculty responding to a computer utilization survey report that they use computers" (Self-Study for Middle States Association of Colleges and Schools: 1985, p.75). "Computers represent a valuable and useful learning resource for the Pennsylvania Campus, one which has enormous potential for instructional support" (Self-Study for Middle States Association of Colleges and Schools: 1985, p. 76).

The President's Report issued for the academic year 1981-1982 discussed at length a new data processing program begun at Brandywine College on the Delaware campus within the Business Administration Department. This program was designed to enable a student to graduate with a concentration in data processing for transfer purposes or immediate entry into the job market. A strong competency in the programming language COBOL as well as knowledge of computer software applications being used in commercial firms was stressed.

There was also discussion of a significant expansion of computing facilities at Brandywine College on the Delaware campus in order to support this new

program--four new terminals hooked to the mainframe housed on the Chester, Pennsylvania campus, with six to eight new terminals planned for the immediate future. At the time, there was also full implementation of word processing into the current Office Administration curriculum, including two new courses in word processing, word processing concepts integrated into all the office administration curriculum courses, and a new Word Processing Center staffed by Office Administration students. IBM electronic typewriters as well as IBM Displaywriters (dedicated microcomputers) were being used in this endeavor. "This has led experts in the field to comment that Brandywine College has established itself as a leader in this aspect of office administration" (The President's Report 1981-1982, pg. 18).

Also located on the Brandywine College campus of Widener University was a Travel/Tourism Management program. Six hands-on industry terminals tied to the TWA/PARS computer system were installed on campus in the academic year 1981-1982. The Travel/Tourism Management program remained at Brandywine College until the termination of the two-year program housed on the Delaware campus in 1992.

It was also in that academic school term that the data processing facility was reorganized into three areas: Data Center Operations, Academic Computing Services, and Management Information Systems. This Center serviced both the Pennsylvania and Chester campuses.

> The Data Center Operations, along with Management Information Systems completed the conversion of administrative application programs from the Burroughs 1700 to the new Burroughs B6800. Working with the system users, processing schedules were developed, improving the timely processing of reports and output.....Improving the quality of data input has become increasingly important as the Data Center has met a 40% increase in user requests for processing over the past 12 months.
>
> The MIS group, working in conjunction with the Personnel Office and payroll staffs, satisfactorily implemented a new payroll/personnel system which will be refined throughout the academic year. ...on-line file inquiry to the student data base was developed and made available to the Delaware Law School(acquired in 1975)

registrar. Implementation of this important feature will soon be accomplished to the other registrars.

An Academic Computing Service Group was formed to better support the University's needs. Forty-four terminals connected to the Burroughs B6800 were made available to students and faculty, located in terminal labs and faculty offices on both campuses. The staff began offering student and faculty workshops and seminars on the use of the hardware and special application packages. The monitoring of computer usage by students and faculty has shown a strong trend of increased utilization through the fall and spring semesters of the past academic year. With additional computer-related courses being offered in 1982-1983, it is anticipated that this trend will continue (The President's Report: 1981-1982., pg.35).

It was also reported that the School of Engineering had acquired a new high-speed printer to "expedite student work," and a Victor microcomputer system was purchased as a "first item in a

microcomputer communications network lab" (The President's Report: 1981-1982, p. 17).

"The computer has taken hold of students in the School of Management" (The President's Report: 1981-1982, p. 17). Forty percent of students enrolled in that School were also enrolled in a Management Information Systems track. The students in the School of Management had to take a computer literacy course to demonstrate a basic level of proficiency before entering the MIS core curriculum.

The School of Hospitality Management received its first technical elective in 1981. One personal computer was used in Hopsitality Computer Applications. That course is now taught exclusively using computer technology.

Brandywine College developed in year 1982-1983 a Word Processing/Information Processing Specialist program. "Today, nearly every student in the College receives experience on a computer. Almost all students are required to take at least one course in data processing, and over 50 students major in this area. In 1983, every student will have to take data processing to graduate "(The President's Report: 1982-1983, p.18).

The President's Report 1983-1984 speaks of the continued infiltration of computers into the curriculum in all Schools/Colleges. For example, the School of Engineering added three more microcomputers, assorted special boards, and electronic instrumentation to its microcomputer communication laboratory. The School of Management incorporated the personal computer as a tool into its undergraduate curriculum, and the School of Hotel and Restaurant Management implemented a computerized management simulation (CHASE--Cornell Hotel Administration Simulation Exercise), into its undergraduate curriculum. Brandywine College absorbed data processing into its new Administrative Technology curriculum, with more emphasis being placed on computer concepts and applications. And a new microcomputer laboratory was housed in the library on that campus for data processing students.

> Shortly after the beginning of the fiscal year, an extensive amount of study and planning was undertaken to determine the best approach to the full-scale introduction of microcomputers to the University. After considerable staff research, the Academic Support Services Committee of the faculty's University Council and an ad hoc

> committee of administrators were each asked to independently review the microcomputer issue as it related to their respective areas of the University.
>
> Based on the committees' work, a multifacted contract was signed with IBM for the acquisition of the IBM PC. To further assist members of the faculty with purchases of the IBM PC for their own use, the University offered a program which combined a grant and advantageous financing.
>
> ...65 individuals have purchased the IBM PC under the University contract, 50 units have been installed or ordered for academic use, and 22 for administrative offices. The bulk of micros for academic use were installed in three separate, newly constructed "micro labs" located in the classroom buildings, two on the Pennsylvania Campus, one on the Delaware Campus (The President's Report: 1983-1984, p. 36).

The President's Report- 1983-1984 goes on to discuss a new resource center located on the Chester Campus to assist faculty in becoming acquainted with the new equipment and a similar center to be located on the Delaware Campus in 1984. Also, video display units

to implement instruction directly from an IBM PC to a wide screen monitor were planned for September of 1984.

> In less that one year, the University has extensively planned and carefully implemented a microcomputer program which has drawn overwhelming approval from students, faculty and staff. No doubt there will be need for expansion of the microcomputer resources, particularly for academic purposes, but the progress made to date has been remarkable (The President's Report: 1983-1984, p. 37).

That same academic year (1983-1984) saw Academic Computing make improvements on the mainframe Burroughs system, providing additional capacity for academic users. There was also continued emphasis on assisting faculty with the identification and installation of software appropriate for instructional purposes. Administrative computing was busy converting various modules of the administrative computing needs to a new Prime system. This system would now process all financial transactions, including student financial aid, as well as maintain personnel, alumni, student registration, and development records. Pre-registration and billing for the fall semester 1984 was

accomplished using this new system. Furthermore, administrative offices now had access to computer-based records, making it easier for both academic and administrative offices to have ready data access.

The academic year of 1984-1985 saw the College of Arts and Sciences incorporate 14 new computer-related courses; a computer-assisted learning program (PLATO) in physics and chemistry courses in cooperation with the School of Engineering; a new major in media studies; the use of advanced technology within many course offerings for the purpose of instruction; and the appropriation of new hardware and software in the social science laboratory for the study and facilitation of research and classroom demonstration purposes.

The School of Engineering introduced computer-aided engineering graphics for its microcomputer laboratories and a new Prime 2550 microcomputer with MEDUSSA, EMS, and THEMIS software, and computer-aided design tools for mechanical engineering. Chemical engineering acquired flowsheet software (FLOWTRAN). The PDP-11 process control computer in the laboratory was reprogrammed to improve its function when controlling the laboratory distillation column. And,

new software was installed on the University's mainframe for multicomponent distillation design and solution of partial differential equations, including several simulation examples.

The School of Management increased its emphasis on the development of computer skills throughout its curriculum in the academic year of 1984-1985. Introductory courses in accounting and economics and the incorporation of the PC into the classroom as a teaching and learning tool were integrated into the curriculum. Special tutorials and self-paced study materials were developed by many faculty for student use.

The School of Nursing made plans that year for a *hands-on* computer course at the undergraduate level, emphasizing nursing education.

The middle years of the decade. The academic year 1984-1985 marked the first full year for Widener University students to have access to microcomputer laboratories. The use of these laboratories increased steadily throughout the year. "Use of computers is occurring in almost every academic discipline" (The President's Report 1984-1985, p.39). Students were using programming languages, such as BASIC, FORTRAN,

Pascal, and COBOL, as well as word processing and spreadsheeting software in three primary computer laboratories. "Student use of microcomputers reached a total of 43,510 hours for the spring term" (The President's Report: 1984-1985, p. 39). The use of the mainframe by students continued to decline as memory upgrades made to the microcomputers provided access to high-level software, until now requiring the larger memory capacity of a mainframe computer. And, a discussion of the possible purchase of an academic mainframe was instituted.

A complete academic analysis was initiated involving all faculty for the purpose of exploring the effectiveness of all aspects of computing service delivery and the uses of computing by the University. This analysis was to be the basis for a "revision of the academic computing plan guiding computing growth over the next several years" (The President's Report: 1984-1985, p. 39).

The academic year (1985-1986) also marked the beginning of discussions for the automation of Wolfgram Library.

In Widener University's Self-Study for Middle States Association of Colleges and Schools published in

1985, mention is made of all the aforementioned computer enhancements as being "back-up tools for mastering the chosen major." The academic support systems discussed for each school of the University indexed the computer laboratories and facilities available for student and faculty use. "Computing facilities have been enhanced" (p. 33).

The academic year of 1985-1986 saw a Pennsylvania Institutional Equipment grant of $175,753 to be used for state-of-the-art programming packages for the VAX 11/750 mainframe. Wolfgram Memorial Library purchased computer equipment for the automation of acquisitions using an IBM XT. The School of Nursing expanded its computer applications software; and Engineering introduced computer-assisted design software and doubled the capacity of its CAD laboratory to six workstations through grants which aided in the increase of the Prime computer system capacity. Social Science, Science, and the University Writing Center introduced computer components

The School of Management increased its use of hardware and software, thus incorporating the computer more heavily into the classroom as well as providing more research capability for its faculty. Statistical

packages for forecasting, policy analysis, production and inventory control as well as resource planning were acquired. In order to support the introduction of a new course in human resource management, the School also established a computer laboratory to be shared with the new Media Studies program and Education.

That same year an effort was made to improve the delivery of support services for microcomputers in response to a 30 percent increase in usage by students and faculty.

> There are now approximately 100 software packages available in Widener's four microcomputer laboratories. By regularly obtaining the most current version of these programs, students and faculty are assured of up-to-date-support (The President's Report 1985-1986, p. 21).

It was also at this time that a decision was made to replace the Burroughs 6900. Plans for the development of an Academic Computing Needs Analysis to plan for the future of computing growth at the University was initiated as well.

The academic year 1986-1987 saw plans for the construction of Academic Center North on the Chester campus, the future home of the School of

Hotel/Restaurant Management (now the School of Hospitality Management) and the Scott Center for Computer Technology, to be completed by the summer of 1988. The School of Hotel/Restaurant Management was moved from the Delaware campus of Brandywine College to the Chester campus at that time. The Scott Center housed computing services and facilities.

A new Media Studies Center was established. It housed computer graphics equipment and software for production of high resolution 35mm film and overhead transparency charts and graphs.

The School of Engineering enhanced its CAD laboratory with two new IBM PC ATs as well as several new IBM personal computers for data acquisition, process simulation, experimentation, and graphics instruction.

It was at this time that the School of Management was working to "meet the increased demand of faculty for technical support for classroom teaching and research. A faculty resource center has been set up and our library of software is growing" (The President's Report 1986-1987, p. 27).

The School of Nursing reported a 5 percent increase in use of its Nursing Resource Center. That

School also introduced a new 1-credit computer literacy course required at the junior level to help in working with data systems and anticipated graduate studies.

The late 1980s. During the academic year of 1986 - 1987, the University terminated its contract with Systems and Computer Technology Corporation (SCT) and offered University employment to its staff on campus. Widener University Computing Services was born and divided into Academic Computing and Administrative Computing. And, the Board of Trustees approved the purchase of the CDC Cyber mainframe in December of 1987

Use of the Kapelski Learning Center microcomputer lab had exceeded expectations by this academic year, and plans were made to install a local area network during the summer of 1987. Computing Services began publishing introductory hand-outs on various software packages as well as providing training sessions for specific courses. Desktop publishing entered the academic world of the University in the form of TeX, a desktop publishing software package. Computing Services continued to support the selection, purchase, ordering, training, consultation, and repairs of the microcomputer.

A key step was achieved in moving toward a completely automated library with the installation of Innovacq, a fully integrated computerized library system used for fund accounting, serials and monographic acquisitions, and serials control. This system eased many labor-intensive manual procedures and dramatically improved the workflow.

The year 1988 saw The Nursing Learning Resource Center and Chemical Simulation laboratories enhanced because of increasing use by graduate as well as undergraduate students. A program for computer-assisted instruction for dietary analysis was added to the laboratory facilities as well as pharmacology calculation software.

It was recommended by Computing Services and the faculty's Academic Support Services Committee that the University should acquire a Control Data Corporation Cyber 930, a mainframe computer providing 64 megabytes of main memory and 5 gigabytes of disk storage, which could supply support for 100 simultaneous users. This would replace the Burroughs 6930 acquired in 1980. The Cyber was known for reliability and ease of use. The Cyber was made available to both faculty and students to meet the growing needs for instructional computing

and research. It also provided a large variety of previously unavailable software packages, extensive on-line manuals and *help* facilities. It was reported to the Board of Trustees in October of 1988 that the purchase of the new Cyber had met with "enthusiasm" in Science, Engineering, Management Information Systems, Social Science, and Education.

That same year saw an upgrade in the Prime system used for administrative computing from the original Prime 850 to a Prime 9955. And, because the Computing Services Department was moving to the Academic Center North in the summer of 1988, a new data communications network was designed during the 1987-1988 school year. It included fiber optic cable being installed throughout the major campus buildings as well as a high-speed data line connecting the campuses of the University. This network was primarily designed by the staff of University Computing Services.

During this academic year (1987-1988), Widener University was designated as a Campus Technology Center, which enabled the University to continue to provide the faculty, staff, and student population with the IBM sales program and recognized the University as

an authorized warranty repair center for the IBM PC line of products.

Wolfgram Library acquired the LePac catalog system in 1988 to replace the card catalog with a laser database system updated several times a year. Users were now able to access information from all three Widener libraries. This acquisition provided an pause in the process of the acquisition of a integrated online library system, then at the planning stage. The personal computer was being used at this time for periodical listings and to perform more and more routine library tasks. Wolfgram Library also participated in the completion of a union list of periodicals as part of a state-wide database.

The School of Hotel and Restaurant Management came to the Chester campus in the fall of 1988, and with its arrival came a new generic computer laboratory housed within the new Academic Center North building.

Engineering upgraded its Computations and Graphics Laboratory that year to include a local area network and ten workstations. The LAN line provided access to a larger printer, plotter, and hard disk storage. Each workstation was an IBM PS/2 Model 30/286 with 1 megabyte of internal memory, numeric coprocessor,

mouse, and color VGA monitors. Each workstation had access to the Cyber 930's processing power as well. The School of Hotel and Restaurant Management made greater use of the personal computer in its lodging systems course and a new Hotel Administration Laboratory was housed in Academic Center North, which lodged 15 IBM PS/2-30s linked to the Novell Local Area Network. This equipment was able to run state-of-the-art hospitality industry software packages. "This lab has enabled the School to take a giant step forward in establishing its reputation as a leader in hospitality computer technology education" (The President's Report 1988-1989, p.19). A new Mathematics Center was also housed in Academic Center North for the purpose of providing developmental help and tutoring. Among other instructional tools, it also housed several IBM PS/2 microcomputers with a variety of software.

The academic year 1989-1990 saw the plans for a new on-line University library system take place. "...a committee involving faculty and administrators helped develop the specifications for the purchase of a new on-line University library system that will link the catalog, serials, acquisitions, circulation, and

other functions together into one computer system" (The President's Report 1989-1990, p. 2).

Engineering added to its Computations and Graphics laboratory two IBM PS/2 Model 70s and a laser printer, and its computer-assisted design laboratory was relocated and updated with eight Tektronix workstations with TechniCad software. A LAN line provided access to disks, tapes, the color printer and plotter.

The fall of 1989 found the college with three general purpose student computer laboratories, one in Kapelski Learning Center, an upgraded existing laboratory in Wolfgram Library, and a third in Academic Center North. There were also three teaching computer laboratories, two in Kapelski Learning Center and one in Academic Center North. All three were equipped with VGA projectors and laser printers as well as LAN lines for access to the academic mainframe for student use and instructional purposes. More faculty offices were equipped with personal computers, most of which were connected via fiber optic cable to the academic mainframe. "The application of computing resources at Widener continues to grow" (The President's Report 1989-1990, p. 45).

Widener University - the 1990s. Computer access is now available to almost everyone at Widener University. There are still some who do not use or desire to use the technology. This is not unique to Widener. Widener University, as are most private colleges and universities, is struggling to keep abreast of technological change. Although prices have dropped considerably, provision of the latest in computer technology to the college student is an expensive process.

Many prospective students now ask what computing capabilities they will have access to at Widener University before they ask how much the tuition is. Students are equating excellence of education with computer technological capabilities. Without doubt, computing is helping many undergraduate institutions provide better teaching, attract more monies in grants and aid for private institutions, maintain tuition rates, and attract more and more non-traditional students at the undergraduate, graduate, and doctoral levels. Widener University has made a definte impact in all these areas, just as many other American colleges and universities have. Computer technology has helped significantly.

The more vocal faculty at Widener University, who also possess high-end expertise in computing, observe that the use of computer technology for teaching, communication, research, and distance learning will be acute in this decade. In fact, this decade might well be termed a decade of enhancement. Service at Wolfgram Library continues to be enhanced through new techology in the form of electronic databases (indexes on CD-ROM and the Internet) for bibliographic information and DYNIX, an automated system providing not only online cataloging but efficient control of book circulation, reserve and the acquisition of new materials. The control of periodicals and the installation of a campus network provides access to the Internet, thus widening options and the scope for research and study. Outside resources have become equal in importance to inhouse materials and, in some instances, cost less. And as Library technology makes research easier for faculty and students, it has also provided additional education and assistance for faculty wishing to use new technology in the classroom through substantial growth in the Audiovisual Services Department.

At the same time, the 1990s have seen a continuous upgrade in computing capabilities and access for both

student and faculty, thus improving communication between the two.

> "About 100 information literacy classes, incorporating PowerPoint presentations and other instructional media technologies, were offered to more than 1,200 students. In addition, Netscape software, making the World Wide Web available, [were] installed on two reference workstations. Workshops for WWW were offered to faculty and staff" (The President's Report, 1994-1995, p.7).

In 1995-1996 a Joint Technology Advisory Committee was formed for the purpose of researching future comprehensive support for academic studies and research.

> To further this strategic planning effort, a leading consulting group was engaged to assist with the process of focusing on decisions that will be made regarding our technology organizational structure and hardware/software needs.
>
> A first major decision is the creation of the position of Chief Technology Officer. The officer will have the task of pulling together and managing the many administrative and academic

providers and supporters of information technology at the University. This position will report to the president (The President's Report, 1995-1996, p. 1-2).

The University is working to provide a campus-wide network to reach offices, laboratories, classrooms, and dormitories by the fall of 1997.

Theme 2: Devotion to the liberal arts.

Widener University - the 1960s. Widener University was experiencing a decline in enrollment in military science at this time in its history. The Vietnam War was having a monumental impact on all college campuses in the United States. So, Widener University began to focus more heavily on the liberal arts curriculum, enhancing and expanding it.

At the time, Widener University had five undergraduate academic divisions, with corresponding departments--Liberal Arts; Science (biology, chemistry, mathematics, physics, and science education); Econonics/Management (accounting, economics, and management); Engineering (bio, chemical, civil, energetics, physics, science, and structural design); and Military Science. The core program for all

students consisted of five courses which had to be completed for graduation, four to be taken in the first year and the fifth in the second year. These five courses provided study in English, social science, mathematics, laboratory science, and modern language. The course selections differed according to Division, of course. "These courses differ in context and scope" (PMC Accreditation 1967 - Report on Self Evaluation, p. 69). There were two mathematics courses from which students could choose--one for mathematics, chemistry, physics, science, and engineering students; and one for the liberal arts, biology, science education, and economics/management majors. The Engineering Division offered an additional mathematics and laboratory science course in lieu of a modern language. Accounting and management majors could opt for an advanced mathematics course in lieu of modern language. There was a physical education supplement which all students had to take.

> Certain additional courses in the core areas are required by the several departments. These are taken in the second and third year, in addition to the major subject requirements, by students

majoring in these departments (PMC Accreditation 1967 - Report on Self Evaluation, p. 69).

These courses were usually taken in the liberal arts, history, English, language, political science, biology, and chemistry.

Widener University (PMC) was in a constant state of change at this time in its history. "Any traditional program that survives will do so because it remains relevant (PMC Accreditation 1967 - Report on Self Evaluation, p. 70).

> The curricular goal at this time was to provide the student with an education of excellence-one that will cause the very best student to reach, that will create and sustain his interest in the world, that will impress upon him that education is a continuous process, that will develop in him the skills, knowledge, interest, and problem-solving approach he will require not just for graduation, but for his lifetime (PMC Accreditation 1967 - Report on Self Evaluation, p. 70).

"Each of the major fields now offers the student a breadth of courses, which serves as an excellent foundation for a sound undergraduate education" (PMC Accreditation 1967 - Report on Self Evaluation, p. 70).

The Middles States Evaluation Team of 1968 stated this in its Report: "Liberal arts as a whole appears to be in a condition of second class citizenship at PMC" (p. 6). The Team went on to say that the long-range planning aimed at correcting the problem was not in evidence. The biggest problem seemed to be "the lack of a sense of urgency" (p. 6). Only four disciplines (history, political science, literature, and languages) offered majors in the liberal arts; all the rest were weak. The condition of sociology, psychology, anthropology, philosophy, religion, and the fine/or performing arts was serious. However, the interdisciplinary study in the Liberal Arts Division was commended.

The Team recommended that the liberal arts faculty, the Committee on Curriculum and Philosophy, and the President devote major effort to the "enhancement of the prestige of the liberal arts" (p. 7). The Team also cited the Science Division as being a weak component and felt that it should be housed within the liberal arts in order to strengthen the program.

Widener University - the 1970s. Widener College's Mission Statement still reflected its continued

dedication to the concept of a liberal-arts based education as signified by a few of its goals:

> To ensure that all students will improve their ability to reason analytically and critically, be proficient in quantitative reasoning and in the scientific method, and be able to communicate orally and in writing their beliefs and knowledge to others.
>
> To develop in students a sense of ethical and moral values as well as a sense of social responsibility.
>
> To instill in students the importance of aesthetic sensibilities (Widener College: Self-Evaluation Report 1977, p.2).

"Since Middle States' last visit, Widener's philosophy and goals have shifted to meet the new challenges of career-oriented education while still maintaining its foundation of Liberal Arts" (Widener College: Self-Evaluation Report 1977, p.56).

The core curriculum established in 1965 was abandoned in 1970, resulting in an extensive revision, growth, and refinement of the curriculum. The present core curriculum began to take shape with 12 credits each being required for graduation in the humanities,

the social sciences, and science/technology. Basic English composition was required for graduation.

Widener's efforts with the enhancement of the liberal arts as well as it commitment to the technology necessary to support them were commended by Middle States when A Report to the Faculty, Administration, Trustees, and Students of Widener College was issued in 1978. This document was prepared after a visit to the campus by Middle States in February of 1978.

> As an entire system, Widener has committed considerable effort and monies to the development and building of instructional support facilities. Another sizable effort has been made to equip these facilities and provide service. What now seems to be required is a coordinated instructional support administration which will 1) initiate long-range development of such services in harmony with the overall Widener instructional program and their goals; 2) centralize those functions requiring central administration; and 3) provide simple, easy access to and use of all modes of information (print, visual, audio, and digital) by faculty and students.

Widener University - the 1980s. The March 11, 1982 minutes of the Board of Trustees' meeting reflects a discussion of the declining numbers of high school graduates. "We must look forward to a possible declining student population. All institutions will be competing for a shrinking student pool and tuition dollars. Widener University, for the next decade, concentrated on the attraction and retention of students. Strengthening its liberal education curriculum was one way of dealing with the situation. Every School/College in the University reviewed and revised its curriculum.

Widener University made evident its determination to retain a liberal education curriculum when, in an address to the Board of Trustees in December of 1982, the President of the University expressed a concern among American educators who saw a shift in emphasis from liberal arts to technology as being detrimental. "I assure you that Widener will never become a vocational university. Our students are seeking and receiving a utilitarian education grounded upon a base of general education" (p. 284).

Arts and Sciences received in 1982 a grant from the Association of American Colleges for Project

Lodestar for the purpose of encouraging liberal learning. This study went on for several years.

The School of Engineering had offered a general degree in Engineering since 1962. Its Advisory Board made the recommendation in 1982-1983 to revise that and offer four professional degrees instead--electrical engineering, civil engineering, chemical engineering, and mechanical engineering all grounded within a general education base.

The February 2, 1985 Minutes of the Meeting of the Board of Trustees of Widener University documents a discussion about a report generated by the American Association of Colleges. This group found that undergraduate education in America was "fragmented, overspecialized, lacking in focus and rigor, dominated by self-perpetuating departments, devoid of a sense of sequence and coherence, and filled with irrelevant electives" (p. 169). The report went further to define nine "benchmarks" necessary to a liberal education:

1. Inquiry, abstract logical thinking, critical analysis.

2. Literacy in writing, reading, speaking, and listening.

3. Understanding numerical data.

4. Historical consciousness.

5. Scientific inquiry.

6. Values necessary for a democratic society.

7. Appreciation of fine and performing arts.

8. International and multicultural experience.

9. Study in depth involving sequential learning and efforts at synthesis.

In response to this report from AAC (American Association of Colleges) as well as a recommendation made by Middles States Association of Schools and Colleges in 1977-1978, Widener University created a task force on University structure in 1985. This group recommended that Arts and Sciences, Engineering, Management, and Nursing become Schools of the University just like Brandywine College, Delaware Law School, the School of Hotel and Restaurant Management, and University College. A new University-wide governance organization named University Council and chaired by the Provost was created.

The University Mission Statement and its goals reflected the University's commitment to the liberal arts:

Goal 1 - To ensure that students acquire a basic knowledge in the humanities, the social sciences, and

the natural sciences and mathematics. That students master at least one curricular area, and that students are prepared for continued academic development in their chosen fields.

1. To ensure that all baccalaureate programs of the University include a general distribution requirement covering the areas of humanities, sciences and mathematics, and social science.

2. To ensure that all associate degree programs of the University have a required core of liberal arts offerings (Self-Study for Middles States Association of Colleges and Schools: 1985, p. 4).

3. To ensure that all students in associate and baccalaureate programs of the University have required course work in English composition

Goal II - To teach students the methods of scholarly inquiry, of scientific research, and of problem-solving; and to foster within students the desire to continue learning throughout their lives (Self-Study for Middles States Association of Colleges and Schools: 1985, p. 5).

The academic year of 1986-1987 brought a focus on the need for reorganization of general education requirements for the College of Arts and Sciences.

> Recognizing the pressure on the University's major disciplines to offer highly specialized work, oftimes at the expense of the liberal arts, it is expected that the College of Arts and Sciences' requirements will become a model for all Schools within the University. We at Widener continue to believe that a broad-based academic experience is a critical foundation for anyone entering the pre-professional disciplines. (The President's Report: 1986-1987.)

The May 5, 1986 Minutes of the Meeting of the Widener University Board of Trustees cites the President of the University as saying, "... committees dealing with the revision of the undergraduate general education requirements agreed on a statement of goals and have designed the curriculum to ensure competence in the skills areas of writing, mathematics, and critical thinking, and will acquaint students with the content and prespectives of art appreciation, history, science, social science, and ethics" (p. 262).

During the academic year of 1987-1988, the reform of the College of Arts and Sciences' general education requirements were finished, requiring a minimum of 12 credit hours each in Science, Social Science, and

humanities. In addition, students had to demonstrate skills in writing, mathematics, and critical thinking. Courses in aesthetics (art, music, or English literature), history, ethics, laboratory science and empirical approaches to human behavior were integrated into the curriculum within all the Schools of the University. The President of the University asked the other Schools/Colleges to use this as a model for reform in general education within their curricula as well. At the April 9, 1987 meeting of the Board of Trustees, the President of the University stated, "I feel very comfortable with the new directions we are taking in general education...new distribution requirements, which will provide a model for the other colleges of the institution to adapt and adopt, insuring that all our graduates will have broad-based academic preparation" (p. 316).

The next school year found the other Schools and Colleges following suit. "The new general education requirements for Arts and Science majors have been used as a model for general education revisions in other schools and colleges" (The President's Report 1988-1989, p. 7). The College of Arts and Sciences amended the general education requirement to include philosophy

within the aesthetics goal option by adding course offerings in art history, English literature, and music; and Engineering adopted a values seminar as part of its curriculum beginning in the fall of 1989.

It was reported to the Board of Trustees in October of 1988 that enrollments in liberal arts courses were up because of the general education program--history by 73 percent; literature-a sizeable increase, modern languages up by 157 students at the elementary level and 30 students at the intermediate level. And, the laboratory sciences, particularly Biology, enrollments were up by 56 students.

The School of Management began its quest for accreditation by the American Assembly of Collegiate Schools of Business during the 1989-1990 academic year. Widener University - the 1990s. Widener University, as did every American college and university, continued in this decade to improve its educational offerings while dealing with the ever-present cycle of what major course of study was popular at the moment. Some curricula continued to prosper, other curricula continued to downsize. At the time, Science flourished, Hospitality Management did not. The liberal arts enjoyed a comeback, while Nursing was

again in less demand. These cycles in what was popular to study and what was not will always be present, no doubt.

According to official documentation, Widener University has spent the last 175 years since its inception trying to provide a liberal education to its graduates. In the last decade (the 1980s), it finally put a capstone on this effort with the revision of its Arts and Sciences curriculum to include 12 credits of distribution requirements in humanities, social science, and science/mathmatics. Every school and college within the University then followed suit and has demonstrated loyalty to this endeavor. In the past few years, many course offerings within these three areas have been developed and added to the curriculum. Students have no end of choice within the liberal arts to satisfy these 36 credits. Graduates of Widener University acquired "a basic knowledge in the humanities, the social sciences, and the natural sciences and mathematics; mastered one curricular area, and prepared themselves for continued academic development in their chosen field" (1996-97 Undergraduate Bulletin - Widener Unversity, p. 3).

Theme 3: The computer as an intellectual and instrumental pursuit.

Widener University - the 1980s

"Studies are being made to determine the desirability of beginning a Computer Science program as an option in the science offerings" (A Follow-up Report presented by: Widener College of Widener University: March 3, 1980, p. 19). This planning involved representative faculty from the Centers of Management/Applied Economics, Engineering, and Science. A positive preliminary report was expected by the end of the academic year. The program was presented to the Board of Trustees and approved in the 1980-81 academic year. Computer Science became a discipline of study on the Pennsylvania campus in the 1981-1982 academic year, and Computer Technology became a discipline of study on the Brandywine College campus the same year. It was reported to the Board at its October 1, 1981 meeting that 35 students were enrolled in Computer Science that fall, and enrollment grew. The minutes of the April 1, 1982 Board of Trustees meeting reflected the following statement: "Science--with the exception of Computer Science--is not keeping pace and possibly should be subject to program review" (p. 242).

University College introduced an undergraduate major in Management Information Systems the same year, which stressed a competency in systems development with a stress upon general management applications.

In November of that year, the Board of Trustees was made aware of the need of Computer Science for access to a minicomputer of its own. This purchase was delayed until the overall needs of the University were made known via a computer requirements study launched some months before. The aim of this study was to analyze the administrative and academic computing needs of the University. In the meantime, interim rental of a computer system was arranged for Computer Science.

The minutes of the December 2, 1982 meeting of the Board of Trustees reports the initiation of a 3-5 year plan of study to be completed by May of 1983, which was to concentrate on two areas of immediate attention: 1) equipment needs for Computer Science and 2) administrative computing needs. The purchase of a DEC (Digital Equipment Corporation) VAX 11/750 with at least 15 terminals enabling curriculum development of the Computer Science operating systems courses was approved, and $175,000 was allocated for the first phase of the installation. A Management and Computer

Science Club was organized in 1982 and attracted a large number of students, and the Board of Trustees, at its December 8, 1982 meeting, heard the President of Widener University say, "As was true last year, this is a pragmatic young generation. They are looking at nursing, engineering, business and computer science" (p. 65).

A discussion of Computer Center management was carried out in the January 13, 1983 meeting of the Board of Trustees. Until the early 1980s, administration of computing services to the University was handled by one person reporting to, first, the Vice President of Administration and, later, to the Vice President of Finance. It was recommended in 1983 that SCT Corporation assume the role of management of all computing needs on campus. A three-year contract with this group was approved at the February 2, 1983 meeting. SCT provided all the employees and took full responsibility for the management of computing services at the University.

In the meantime, the administrative computing needs of Widener University were still being studied. In April of 1983 the Board of Trustees approved the purchase of a PRIME MODEL 850 with Datatel Colleague

Administrative processing system software to take over all administrative areas of University computing needs. It was installed in June of that year, and training on the software commenced that summer for Computing Center staff members. The Burroughs 6930, being free of the administrative load was now able to shift its emphasis to academic needs, and it was recognized that the use of microcomputers might altogether obviate its need very soon. "Technological advances in microcomputers, together with decreasing prices, may make it possible to satisfy academic needs with micros in the future" (Board of Trustees, April 7, 1983, p. 12).

The Board of Trustees meeting in September of 1983 reported the installation of three new microcomputer laboratories at the University: one on the Delaware campus at Brandywine college and two on the Pennsylvania campus, one in Kirkbride Hall and the other in Kapelski Learning Center. Each was equipped with eight microcomputers and one printer. SCT developed seminars for both faculty and students to teach them how to use the new equipment. In addition, a faculty resource center was set up in the Computer Center, to be used exclusively by faculty for learning and research purposes.

The fall of 1983 also saw the installation of the high-level programming language PASCAL on the Burroughs 6930 for academic purposes. The President of the University announced at the October 13, 1983 meeting of the Board of Trustees: "1983 has been an exciting year at Widener with regard to computing. Much progress has been made in many areas, due primarily to the Board of Trustees making available the resources for these improvements."

The academic year 1985-1986 saw the School of Arts and Sciences institute four tracks within its major in Computer Science: Computer Science, Computer Information Science, Mathematics, and Engineering.

And, in May of 1985, students in the School of Engineering produced a senior project entitled "085 Microprocessor Status Indicator and Controller." This research aided DuPont Company engineers in trouble shooting and repair of their photo-processing equipment, permitting them to diagnose problems that occur in the development of computer-controlled equipment. The result was tested at DuPont and saved the company $100,000 of in-house work.

There was a reorganization of Computer Science in 1986 to include a core curriculum with separate

specializations in Computer Information Systems, Mathematics, Engineering, and the current generic Computer Science curriculum. There was a fire in the University's theatre and Computer Science Laboratory on Providence Avenue that year as well. It resulted in a new Computer Science Laboratory housed in Kirkbride.

Majors in Computer Science had more course selections during the 1988-1989 academic year, specifically CSCI 151 and CSCI 152 (Introduction to Computer Science I and II) for computer science majors and CSCI 131 (Introduction to Computers) for nonmajors.

The next year Computer Science found itself being totaling restructured. A new Cabletron Transceiver for the VAX ethernet network in the computer science laboratory was added, plus 4 Sun 4/60 workstations for LISP and UNIX programming. These additions greatly enhanced Computer Science courses. And, at the same time, the College of Arts and Sciences demonstrated its dedication to the use of the computer as a tool by requiring that all undergraduate courses "provide students with the basic skills of writing, critical thinking, and a mathematical/computer competency" (The President's Report 1989-1990, p.8).

It is interesting to note that in the spring of 1989, Dr. Nathaniel Kornfield from the School of Engineering was, after 26 years of teaching at Widener University, granted emeritus status. His area of research was in the field of digital computer design and production. His was the first emeritus status granted by the Board of Trustees to a retired faculty member.

Widener University - the 1990s. By the 1990s, most colleges and universities across America were safely ensconced in computer technology. The microcomputer was everywhere. Not only did students have access to a microcomputer in the classroom but very often in several laboratories within several academic disciplines as well as the library and dormitory. The microcomputers were usually networked and very often cabled to a mainframe, which provided access to a plethora of software as well as the World Wide Web and electronic mail. In fact, many aspiring college students asked about computer access before asking about tuition!

The discipline of Computer Science became very popular in many universities and colleges. And, the

use of a computer as a tool was integrated into almost every undergraduate displine of study offered.

Computer Science as a division of the College of Arts and Sciences continues at Widener University, although it is not as popular a major field of study as it was in the 1980s. After experiencing a sharp decline in the late 1980s and early 1990s, it is beginning to revive. The Computer Science laboratory, now housed in Kirkbride, has, since the 1993-1994 academic year, housed 12 486 Personal Computers storing the graphical user interface Windows as well as course-specific software. It continues to house 12 Sun workstations as well as several laser printers and a robot. Computer Science students receive good instruction within their major field of study and enjoy an option to complete a co-operative work experience. To date, all graduates are employed within their fields of expertise.

Summary

Figure 4.4 (Embracing Computer Technology at Widener University) is a visual summation of computing and technology trends at Widener University. The illustration is organized chronologically and in

decades during which dramatic changes occurred. Each decade is discernible from the others in terms of specific issues and developments that were explored and embedded.

The following general statements serve as a summary of events and experiences as they unfolded and as technology was integrated with the curriculum.

1. Widener University's faculty, staff, and administration embraced computer technology, emulating higher education in the United States.

2. The faculty and administration of Widener University appear devoted to the concept of a liberal arts-based education and displayed little argument with the inclusion of computer technology within its framework, recognizing its place.

3. The Widener University curriculum evolved to reflect computer technology as both an intellectual and an instrumental pursuit.

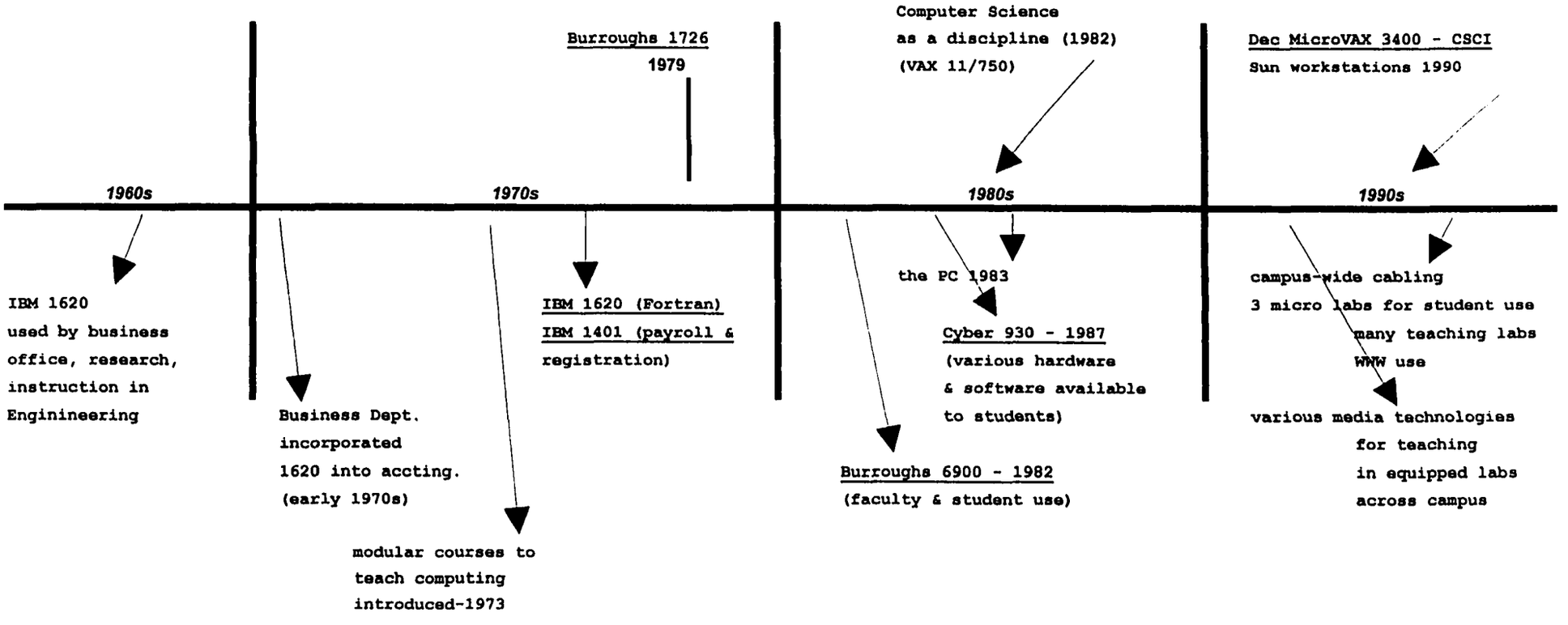

Figure 4.4

CHAPTER V

Conclusions, Implications, Recommendations

Introduction

The Widener University Transition Advisory Committee on Academic Computing, which met on June 22 of 1995, had a vision.

> The Committee sees the university as a community of scholars extended and interconnected by means of Information Technology. All faculty, students, and administration should be part of this interconnection, wherever their locations. Scholars should be connected to the University from dormitory rooms, classrooms, laboratories, offices, library, and homes. Academic advisors should have on-line access to the files of their advisees and should register students for courses by computer. Software used for teaching purposes should be shared across the campus network to minimize

> costs and conserve valuable resources. Faculty members should use Information Technology to full advantage for maximum teaching effectiveness (Final Report of the Transition Advisory Committee on Academic Computing, p. 6).

Every facet of the University is going to be affected; and every facet of the University will have to lend support, both monetarily and philosophically. The fiscal support will be astronomical; the time it will take will require patience from everyone involved; the technical expertise will be exhaustive. There will be a desperate need for outstanding leadership in this endeavor. And, leadership demands support.

Widener University, over the past four decades, has begun the process of integrating computer technology into its liberal education curriculum as both a discipline of study and as an instrument of learning. The University community found this

integrative process to be a difficult one. Several issues of ongoing discussion arose as a result.

The University had to struggle with its commitment to general education while overcoming problems of how to integrate the computer into the curriculum. Once its commitment to a liberal education was firmly resolved, new questions of decision making and maintenance appeared. Many questions and possible solutions have evolved over the years, with many faculty and administrative staff working to solve them. Venezsky's prophesy certainly came true:

> ...computers will continue to flow onto the campus through the front gate, the back gate, the chimney, and through the coal chute. They will nestle into every corner and cubby hole they can find, chew up a little more silage each year, stir up a little trouble here and there, but leave the foundation intact and the house standing a little straighter than before" (Venezsky, p. 69).

The computer was integrated into Widener

University's curriculum just as it was integrated into the curricula of higher education throughout America, slowly at first; and, then, at a phenomenal rate. The School of Engineering recognized its value as a research tool early in the 1960s and, then, introduced it to students as a tool later in that decade. Science became intrigued shortly thereafter. Soon, every School/College of the University began to recognize its potential as a tool for instruction, learning, research, and intellectual labor.

As the knowledge of its potential grew, administration demanded its capabilities as well. Soon, the entire educational community demanded its power. With the advent of the personal computer/workstation, demand for the superior processing power of the mainframe decreased. Soon, administrative personnel as well as faculty wanted their own PCs. Student demand increased dramatically with the arrival of word processing software. And, as

a plethora of more sophisticated software became available, student demand increased.

The price of the computer dropped as its processing power increased, and now it is truly ubiquitous. What claimed no place in the University budget just 40 years ago now demands almost half of it.

Its influx raised some difficult questions of maintenance, oversight, decision making, and educational value but also helped to improve educational excellence while maintaining the universal vision of a general education of merit.

Historical Summary

Synopsis of Computing Technology at Widener University

The School of Engineering at Widener University began using a computer for research purposes in the 1960s with the purchase of the IBM 1620. Students were soon given access to it, and the University very soon thereafter (1970s) required a computer component in each of its major courses of study.

By the end of the decade, the IBM 1620 was showing signs of overload, so IBM 1401 was purchased in the 1970s to be used for administrative purposes--payroll and registration. The Burroughs 6900, purchased in the early 1980s, was replaced by a series of Burroughs mainframes for academic purposes. These were considered by many faculty to be academically inappropriate because they did not support PASCAL, time-sharing, and many software packages.

These Burroughs machines were replaced by the Cyber in 1987. Although the Cyber provided a variety of software, online manuals and *help* facilities, it did not fulfill the academic needs of the School of Engineering adequately. As a result, Engineering initiated its own independent, personal computer-equipped laboratories in the 1980s. This led to other departments and Schools of the University doing the same, eventually equipping these laboratories with local area networks to enhance their use.

By 1984, when the personal computer was able to fulfill the hardware and software needs of every facet of the university, use of the mainframe declined. Several general-purpose student laboratories and classroom/teaching laboratories, equipped with networked personal computers for student use of a large variety of course-related software as well as access to the mainframe for research, statistical, Internet, and electronic mail purposes, came into being.

The 1990s introduced a dramatic increase in the use of computer technology for multimedia purposes (instruction and presentation), electronic mail, Internet and World-Wide Web research, statistical manipulation, and long-distance learning. Widener University is currently installing campus-wide cabling for the purpose of providing network access from all buildings on campus, including student dormitories, to the Cyber mainframe. Every student, faculty, administrator, and staff person will have access to all software, the Internet, the Library, and electronic

mail from any personal computer on campus by the fall of 1997.

As Widener University integrated the computer into its curriculum; and as administration became dependent upon its technology, it became necessary to coordinate the repair and maintenance of this valuable equipment. In the early 1970s, a technical person was hired to supervise the activities of the mainframe computer, helping students with research, completing administrative tasks, and making necessary repairs and/or adjustments to the equipment. This person was responsible for academic as well as administrative tasks relative to the mainframe and reported directly to administration. The practice of employing a technical director responsible for both academic and administrative computing needs, who reported directly to administration (first, to the Vice President of Administration; then, to the Vice President of Finance) went on for the better part of the decade. By the end of the decade, this task, very apparently, became too

much for only one person to handle, although many faculty reported to me that the employee of the moment tried very hard to please everyone. So many faculty were disgruntled, however, that many Schools/Colleges began supporting their own independent computer laboratories.

SCT Corporation was hired in the early 1980s to assume the task of servicing campus computer needs. By this time, the personal computer had arrived. Both academic and administration were using the PC as well as the mainframe heavily. More attention was needed. The SCT contracted was not renewed in 1986, and its employees were hired by the University to form Computing Services, both Academic and Administrative. Still, many faculty feel that support to academia has not been adequate. Computing Services staff has been reorganized many times and, at present, is top-heavy with administrative computing personnel and understaffed with academic personnel. As a result, a Joint Technology Advisory Committee was formed in 1995

to research future comprehensive support for academic studies and research. The University, in order to acquire greater control of its computer facilities, is searching for a chief technology officer to manage both administrative and academic provisions of information technology to the University. This person will report directly to the President of the University.

The automation of Wolfgram Memorial Library began in 1984, first with automation of acquisitions using an IBM XT, followed by the purchase of Innovacq (a fully integrated computerized library system used for fund accounting, serials and monographic acquisitons, and serials control), LePac (a laser database system to replace the card catalog), a computerized periodical listing and, finally, a new on-line University library system linking the catalog, serials, acquisitions, circulation, and other functions together in one system. This system continues to be upgraded yearly and is, of course, accessible from any classroom or general-purpose computer laboratory on campus.

Widener University now operates with a fully automated library, a revised computing services operation, and computing technology which emulates that of other colleges and universities across the nation.

Issues Related to Integration of Computing and the Liberal Arts Curriculum at Widener University

The absorption of computer technology within the curriculum at Widener University spanned several decades. During that time, there were several issues which surfaced as a result of the desire to maintain a liberal education curriculum while integrating computer technology into it.

Retention of the Liberal Arts

Widener University had, as did other liberal-arts based colleges and universities, a struggle after World War II and on into the 1960s to retain a liberal education curriculum because of the push toward the elective-system based curriculum, one rich in elective courses rooted within a major course of study. There was a large influx of students during this time, and

they all wanted to graduate directly to a career. It was felt that a liberal-arts based education was not a practical one. The larger state universities attracted many career-oriented students because they tended to cater to student desire to have a wide range of elective courses from which to choose.

Widener University was still Pennsylvania Military College until the late 1960s and continued to educate a great many engineers. The College persevered in the Liberal Arts philosophy despite the strong and contradictory currents in the 1960s. When a Middle States team visited in the early in 1968, it recommended that a major effort be made to revitalize the liberal arts.

When the Team revisited Widener College in 1978, the present core curriculum of 12 credits each in humanities, the social sciences, and science/technology being required for graduation was in place. In addition, basic English composition was also a graduation requirement. The Middle States Team

commended the College for its effort in the rejuvenation of the liberal arts

As student numbers dropped dramatically in the 1980s, Widener University remained determined to strengthen its liberal education curriculum. Every School/College at the University regularly reviewed and revised its general education curriculum.

In 1985 a task force on University structure was created which reorganized the University into the eight Schools/Colleges which constitute it today. The task force also rededicated the University to the liberal arts by rewriting its Mission Statement and goals to reflect just that. These remain virtually the same as originally stated in the 1985-1986 Undergraduate Bulletin of Widener University.

The faculty of Widener University are constantly adding to the liberal arts electives available to students, broadening their scope and content. Arts and Sciences faculty meetings have been the forum for many debates among members about retaining the liberal arts

base without cluttering it with technical or so-called instrumental electives. Many of my study participants, who are staunch technology users, mentioned their dedicated commitment to the general education curriculum. Based upon this, this researcher believes that the future of Widener University, whatever it may bring, will always be firmly based within a general education curriculum.

The Integration of the Computer into the Curriculum

During the 1980s, as the personal computer became more and more popular with faculty and students, its integration within the curriculum became a major source of discussion and experimentation within the various Schools/Colleges.

Engineering had already introduced its students to use of the IBM 1620 during the 1960s. By the 1970s almost every course in its curriculum included a computer component. In fact, Engineering faculty engineered the purchase of this mainframe computer and made use of it so successfully for research and

instructional purposes that faculty from physics, mathematics, business, and liberal arts began to show an interest. The Business Department introduced use of the IBM 1620 into its accounting curriculum in the early 1970s. Students from other disciplines were eventually permitted to take courses using this new technology, but the courses were still based within the physics and mathematics department. As the 1970s progressed, a new slate of required six-week modular courses was inaugurated into the curriculum for all freshmen. The purpose of these modular offerings was to enable students to acquire a purposeful awareness of technology. One of the first modular courses offered was *Computers and Computing*, its purpose being to acquaint students with the use of the computer for scientific and business problem solving. This modular course was followed by various others dealing with computers and technology.

Modular course offerings were terminated in 1981 in favor of courses which provided more hands-on

computer experience for students in all disciplines. The personal computer provided so many software programs for student use, the most practical of which was word processing, that the University found it wiser to permit the various disciplines to make room within each of the curricula for student use of the technology. Since the explosion of the personal computer onto the scene, the rest has been history.

Widener University has experimented with many ways of blending computers into the curriculum--offering courses to learn how to use the computer for course work, using the computer for classroom instruction and demonstration, or simply requiring students to use one of the available microcomputer laboratories to learn how to correlate computer use with the course knowledge base. Some Schools/Colleges require students to take a computer literacy course, such as CSCI 101 Introduction to PCs, at some time during their sojourn at the University; other Schools/Colleges expect students to become acquainted with the skill as they progress

through coursework. There are very few remaining course offerings at Widener University that do not require computer literacy of some degree, whether it be research, data entry, or simply keyboarding with word processing software. Every School/College of Widener University lists computer literacy as a skill necessary for graduation. And this skill has been successfully absorbed into all undergraduate academic curricula without compromising the liberal education knowledge base required for graduation.

The Mainframe

Another issue which necessarily appeared with the integration of the computer into the liberal education curriculum was the necessary mainframe computer and how its purchase and/or lease was going to be decided. The decision to purchase the very first mainframe computer (IBM 1620) was made solely by the School of Engineering in the early 1960s. It was also maintained by Engineering. A new Dean of Engineering was hired for the express purpose of integrating this machine into

the curriculum. In the late 1960s and early 1970s, it became apparent that the IBM 1620 could not support all the demands being placed upon it by both administration and academics, so the decision to purchase a another machine to share the load was made. Between then and now, several Burroughs mainframes were bought, used, and eventually rejected because they did not provide adequate support for emerging programming lanuguages, software applications, engineering needs, statistical programs, or other academic or business applications. The Cyber 930, purchased in the 1980s, still does not make everyone concerned happy. There were and still are many arguments about who should ultimately make the decision for such an expensive purchase. This was particularly true in the 1970s and 1980s. Many of the faculty this researcher interviewed talked extensively about this, and many of the persons this researcher used for context interviews did the same. The majority of these people believed that the decision for these purchases was taken out of their hands completely, even

though they participated in the discussions. The purchase of the first Burroughs, for example, was discussed for months. The decision for its purchase was made over the summer by administration, with little or no input from those faculty who had been involved with the earlier discussions of that purchase. These people felt that the decision was made by administration based solely upon the price quote made to the University by Burroughs. There were several successive Burroughs machines bought during that decade, and they all presented scholastic problems. Many faculty members felt that Business Administration was given greater voice in the decision-making simply because their needs could be fulfilled as well as those of the University, excluding academics, with a Burroughs purchase. The Burroughs machines were known for their business application orientation. This issue, of course, initiated the advent of independent laboratories for the Schools/Colleges at the University. Surprisingly, no mention was made of the

Cyber purchase; some faculty seemed to be satisifed with that particular mainframe. That is possibly because the decision for its purchase was made by a University-wide group of computer-knowledgeable and high-end user persons. And, of course, independent discipline-oriented laboratories and the PC made the need for a mainframe much less critical than before. (One also must take into account that mainframe computers had massive amounts of processing power by this time and could handle so many more tasks than was possible even a few years before.)

Computing Services

The next issue which naturally followed was the maintenance and direction of computer technology on campus. Who was going to assume responsibility for this powerful and expensive resource? Administration and academics both needed supervision. Individuals had been hired in the early stages of computing at Widener University to maintain equipment and supervise administrative and faculty use of the mainframes. Not

too many people were needed at that time because the use of the mainframe by administration and students was not too heavily demanded, although demand was increasing at a rapid rate. When the personal computer hit the University campus and dependence upon the technology grew, it became necessary to provide a staff of people to oversee its management and maintenance as well as that of the mainframe.

In the early 1980s the data processing facility, which had overlooked the maintenance of the mainframes as well as other computing services across campus, was reorganized into three areas: Data Center Operations, Academic Computing Services, and Management Information Systems. This organization serviced both the Pennsylvania campus and the Delaware campus. Terminals were made available to students and faculty; and the staff of Academic Computing began offering workshops and seminars for the use of hardware and many software application packages. In 1987 an Academic Computing Needs Analysis was initiated to plan for the future of

computing growth on campus. Computing needs were escalating at such a rapid rate that something had to be done.

Many administrative and faculty offices had personal computers There were three new student computing laboratories and several new teaching computer laboratories. It became necessary to provide service, maintenance, and support for administration as well as faculty.

The University terminated its contract with Computer Technology Corporation (SCT) and employed its staff on campus. Widener University Computing Services--Academic and Administrative--began. At this point, it became possible to divide and coordinate attention between the needs of administrative computing and those of faculty and students.

Local Area Networks were installed in the student personal computer laboratories, providing students with a profusion of software for PC use. Computing Services escalated efforts to publish hand-outs on various

software packages so that students, faculty, and staff could learn how to use the personal computers to help themselves. It also provided hands-on training workshops for faculty and staff. The Widener University campus became a technology center for IBM, providing faculty, staff, and students with an IBM sales program. Students, faculty, and staff were able to purchase the IBM PC series and software at discounted prices as well as acquire service for it all. Many people took advantage of this to purchase their own PCs for home use. (One is reminded, however, that the price of the personal computer at that time was still quite prohibitive, running around $4,000. The cost, of course, hindered its purchase by many.) There were still many complaints about computing services and some confusion as to what its exact duties were and to whom its personnel should report.

With the advent of today's comunications possibilies and capabilities, the scope of what this group must oversee has become unworkable. Many faculty

feel that Administrative computing is receiving the spotlight and that Academic Computing is suffering because of it. It is definitely true that Academic Computing employs far fewer persons that Administrative Computing does. These employees are dedicated and hardworking but are having a very difficult time spreading themselves around. Blending computer technology, now information technology, into any educational curriculum poses a lot of maintenance and upgrade quandaries. Who buys it, takes care of it, teaches it, and keeps up with it? Who is in charge? What should be the role and visibility of faculty in decisions made by this group of persons. Should it be advisory, collaborative, oversight, or coordination? This issue is most probably in the forefront of discussions at many other colleges/universities throughout the country. Many of these questions may be answered satisfactorily with the employment of a Vice President for Information Technology.

The Problem of Computing and its Place Within the Organizational Structure

Because the use and development of computer technology in higher education evolved so quickly and because a collegial administrative structure often yields disagreements, it was only natural that the integration of computing, as with many other changes at Widener University or any other University, for that matter, did not take place without struggle.

Computing Services at Widener University has been reorganized several times over the past fifteen years, never to the complete satisfaction of all concerned. Most recently, it was split into Computer Systems and Academic Computing departments. Computer Systems accommodates the campus network, administrative computing, computer maintenance, and certain purchasing functions. Academic Computing harbors responsibility for the mainframe (Cyber), the general purpose student laboratories, and consulting support for academic units. Of course, these responsibilities very often interface, particularly in relation to the campus

network and the mainframe. Many feel that these duties need to be better defined. Many faculty feel that academic computer support is not adequate and their voices are not heard when provision for this service is discussed.

The University has made a large monetary investment in the past three years (approximately $5 million) in computer technology, $2.5 million alone on the new cabling infrastructure. The University will spend another $750,000 in 1997-1998 for this infrastructure. In addition, there have been $850,000 in University-wide requests for computing technology for the academic year 1997-1998. This hardware and software requires supervision, maintenance, and upgrading as time goes on. A new technology chief will have his work cut out for him.

Many colleges/universities have experienced the same sort of history in integrating computer technology into their curricula. The computer, particularly the personal computer, took higher education by storm in

the 1980s. Keeping a handle on its evolution has not been easy. Most institutions of higher learning are just beginning to gain some measure of control. As technology transforms the classroom and how we learn, higher education in America and the world cannot help but change. The investment will be huge, but the returns will be worth it.

Recommendations

Changes in the processes used to manage computing technology herald a new and different set of challenges when full integration of computing and teaching and learning is under consideration. There have been a number of reports that have mentioned what these challenges will be.

The University is currently installing campus-wide cabling at the suggestion of the Joint Technology Advisory Committee formed by President Robert Bruce in December of 1995. This committee is made up of members of the faculty, administration, and staff of the University as a whole. This is an initial step in the

attainment of an enhanced campus-wide infrastructure to provide better data communications campus-wide, among campuses, and globally. This infrastructure was to be completed by the fall of 1997. Because the management and maintenance of this infrastructure will be vital, it will be necessary to maintain the Joint Technology Advisory Committee as well as other contributing subcommittees and forums. The uses of this communication foundation must be kept current and monitored at all times.

This cabling infrastructure will enable Widener University to attain its vision of educating for the future. Education for the future must integrate information technology. This will in large part determine Widener University's competitive standing in how it attracts and retains students. The quality of Widener's curriculum will be reflected as well by how much it makes use of the new technology.

In 1995 a Transitory Advisory Committee on Academic Computing was organized for the purpose of

making recommendations for the future of Widener University computing. Those recommendations included:

1. The creation of a position or committee whose responsibilities would include planning for future information and communications technologies for the entire University, including liaisons among all three campuses and the Library. Equal representation of administration and faculty should be included. This position might be a Vice President of Information Technology and should be able to put Widener University in a position of competitive advantage to other Schools/Universities.

2. A long range comprehensive plan should be developed to effectively organize and promote Information Technology; insure uniformity of resource quality across three campuses; insure technologically prepared graduates; deal with technological obsolescence; explore new technologies; expedite new technological applications in teaching and advising; continuously upgrade the technological development of

faculty and staff; finance the costs; and continuously measure progress and user satisfaction.

These recommendations were further delineated and defined. They were also adopted, the goal being "to use Information Technology to provide better education at a affordable cost."

Implications

Computer technology has helped to significantly improve education of all kinds and at all levels. It has empowered people of all ages to learn more easily, enjoyably, and successfully than ever before. The basic purpose of the personal computer--managing information to support thinking--certainly lends itself superbly to all educational institutions.

More and more teachers are becoming receptive to the idea of the contribution made by computer technology and now discuss how and when the technology should be used, how it can be paid for, and what new things they can learn about it to help them teach.

This is especially true at the college/university level. Excellence in higher education is being questioned, and the college student of today is curious to know what computer technology is available for his/her use before they commit to an institution of higher learning. Parents are also questioning whether colleges/universities are giving their children what they need to succeed in this Information Age. There is now a huge demand for a properly educated workforce in our country, persons who not only have good language, mathematical, and productivity skills but also know how to use technology.

Conclusion

In Chapter II of this discourse, this researcher addressed the questions of computer literacy/competence and the idea of distance learning. This researcher would like to comment further on these two concepts.

There are many definitions for computer literacy. This researcher defines it as being able to use a computer to help oneself. Many colleges/universities

now have computer literacy statements and incorporate these declarations within their mission statements or graduation requirements. Widener University, to my knowledge, has no computer literacy/competency statement, although each School/College does state the need for computer skills as a requirement for graduation. The University should draft a computer literacy statement for approval by administration, faculty, and staff.

Distance learning will reach Widener University. Distance learning is being implemented widely throughout the academic community and with speed. When the cabling and setup of the new campus infrastructure is finished, the capability will be present. How Widener University chooses to implement it will be important to its mission and to its students. Its use as a competitive tool will be a wise decision, but its use as a budgetary tool to decrease costs would be a very unwise decision. Widener University students, for the most part, need human contact with a teacher.

Widener University's dedication to its students has firmly supported its mission for 175 years.

As with all decisions about information technology and its inclusion into the curriculum, decisions must be made carefully so as not to compromise the educational excellence for which Widener University is known.

Future study of this dissertation topic should proceed at timely intervals. It is very important that Widener University continue to remain current in the area of information technology if it is to retain its reputation for educational excellence through dedication to the individual student. Reasons for attending college are different today than they were forty years ago. Students do not choose a college based solely upon tuition and/or choice of major offerings. The majority of students today choose colleges based upon how much financial aid is available. And, many students will ask about computer access before asking about tuition or, most certainly,

about major areas of study. Once a student is enrolled, his/her evaluation of a major course of study very often revolves around how up-to-date that major's faculty and equipment are. A lack of the most current technology would most definitely cause a student to investigate transfer to another college/university which suits his/her needs. Every college/university, including Widener University, evaluates its retention statistics yearly.

Future scrutiny in this area should involve written surveys, on-site visits, and collaboration with other colleges/universities in the immediate area for the purpose of viewing what our competition has to offer in information technology. The same types of investigative procedures should take place with other competing colleges/universities in a timely manner. It is also very important that faculty, staff, and administration be supported in any research, training, or inquiry they may pursue in discipline-related information technology.

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Appendix A

Cover Letter

October, 1995

Dear Colleague:

I am conducting research for my doctoral dissertation. Will you be able to help me?

My dissertation will be an historical case study of the integration of computer technology with liberal education. You have received a consent form and a questionnaire. I plan to contact a smaller sample of faculty later for interviews.

If you decide to participate, please endorse the consent form as well as the preliminary survey. Return them to me, Nancy Poole, Science Division, Kirkbride 231, in the envelope provided.

Sincerely,

Nancy M. Poole, B.B.A, MS.Ed.

Appendix B

Consent Form

Consent Form

Please read this consent statement prior to participating in the research on computer technology and its inclusion within liberal education **No questionnaires will be used for research if a consent form is not also returned.** Should you decide to participate, please sign and date the consent form and remember to include it with the preliminary survey form in the envelope provided. All questionnaire findings will be reported anonymously and in aggregate form.

The purpose of this research is to describe, from an historical perspective, how computer technology was integrated with a liberal education curriculum.

The results may, at a later date, be published.

CONDITIONS TO CONSENT

I agree to be a participant in this study. All information will be confidential, unless I waive confidentiality.

Signed _____ Dated _____

Appendix C

Preliminary Survey Form

PRELIMINARY SURVEY FORM

Name _____(Optional) Department _____

School of Widener University _____ Year Hired _____

Courses Currently Taught at Widener University last two years.

Please list below the courses by number and name you have taught in the

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

1. Do you include computing in any courses you have taught in the past two years? Yes/No. Circle one. (Please give details.)

2. **Do you expect your students to learn any aspects of computing independently of class interaction? Yes/No Circle one. (Please explain.)**

3. **When did you first begin to incorporate computing into your courses.**

   _____ Approximate Year.

4. **Do you intend to include computing in any of the courses you expect to teach in the future? Yes/No Circle one. (Please give details.)**

Appendix D

Primary Interview/Survey

PRIMARY INTERVIEW/SURVEY

Interview Guide

The following topics will be used as part of our discussion. Thank you for your very generous cooperation.

What are your earliest recollections of computer technology as part of instruction at Widener University?

Could you describe your professional experiences using computers as part of your research and teaching?

Can you trace the history of your personal experiences as computer technology was integrated into the curriculum? How well did you think it fit? What would have some of the benchmarks, milestones, memorable events been? Why?

What are some of your memories of how other persons (to be discussed anonymously, of course) at Widener University were affected by the influx of computer technology into their research and curricula? How well did they think it fit?

What is your personal vision for the future of computer technology at Widener University?

Would you be willing to share your course syllabi with this researcher?

Y/N _____