COMPUTER LITERACY TEACHING OBJECTIVES FOR SECONDARY SCHOOL AS STATED IN PERIODICAL LITERATURE: 1980-2004

by

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ABSTRACT

COMPUTER LITERACY TEACHING OBJECTIVES FOR SECONDARY SCHOOL AS STATED IN PERIODICAL LITERATURE: 1980-2004

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Purpose of the Study: The major purpose of this investigation was to prepare a recent chronological history and analysis of the objectives for teaching computer literacy in the secondary schools of the United States during the period 1980-2004 as reflected by objective statements in articles from selected professional periodicals.

Procedure: The 1980-2004 period was divided into two subperiods on the basis of major historical events. Selected professional periodicals were searched for statements of objectives of secondary-level computer literacy teaching. These statements were cataloged into Knowledge, Process, Attitude and Interest, or Cultural Awareness categories. The resulting data were classified within and across the two subperiods according to the frequency of occurrence, category, authorship, and year.

Findings: The major findings of this investigation included the following:

1. The number of articles relating to objectives for teaching secondary-level computer literacy increased during the time of the study.

2. The number of articles by miscellaneous authors increased more significantly than articles by authors in higher education and secondary education from Subperiod One through Subperiod Two.

3. Authors in the miscellaneous category produced the least articles and statements in Subperiod One, while producing the most articles and statements in Subperiod Two.

4. Authors in the secondary education category produced the most articles and statements in Subperiod One, while producing the least articles and statements in Subperiod Two.

5. Statements in the Knowledge category were most frequent in the two subperiods.

6. A steady decrease in the importance of philosophical, sociological, and political aspects occurred across the study.

Conclusions: Based on the findings of this investigation, the following conclusions were made:

1. The objectives for teaching secondary-level computer literacy were influenced by historical events, especially the launching of the Soviet satellite Sputnik I, the Cold War, the creation and marketing of the microcomputer chip, and the advent of the Internet.

2. The most important objectives for secondary-level computer literacy teaching were major facts, principles, or fundamentals, and processes, skills, and techniques. The focus on these objectives is probably in response to the educational acquisition of rapidly evolving computer technology.

3. This is the first time in the series of objective studies that this investigation parallels that authors outside the field of education have produced the most articles during a subperiod. Authors in the miscellaneous category were often affiliated with computer software companies. This is perhaps the result of industry efforts to sell products to educational systems.

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The writer dedicates this dissertation to Dennis, who knows why.

CONTENTS

CHAPTER 1

INTRODUCTION

The launching of Sputnik I, an unmanned Soviet satellite, on October 4, 1957, signaled a crushing defeat in the United States of America-Union of Soviet Socialist Republics space race and stimulated national interest in educational reform. Thus began what has been called the "golden age" of education, and major national efforts were made to reform education in America (National Science Foundation, 1994).

It is difficult to recapture the sense of paranoia and self doubt that Sputnik I created in Americans. The Soviet Union had ushered in a new era, taking a huge technological leap ahead of the United States. Sputnik I led to the creation of the National Aeronautics and Space Administration (NASA) and major increases in government spending on scientific research and development. In 1957, Congress increased the funding for the National Science Foundation (NSF) to $134 million, nearly tripling the budget of the previous year (National Science Foundation, 2005). During 1958, the Pentagon's Defense Advanced Research Projects Agency initiated the Advanced Research Projects Administration Network (ARPANET), which would be the predecessor to the internet, to better facilitate communication within the defense industry. "New math" was a name given to a new set of teaching practices introduced to the U.S. shortly after the launch of Sputnik I in order to boost scientific education and mathematical skills in the population (National Science Foundation, 2000).

Although, many of the problems in education were not recent, other new and different demands were changing the basic structure of training and learning. The advent of modern communication systems created an information-rich society. The new

emerging technologies were to become an important catalyst for rethinking education. Nobel Laureate, Herbert A. Simon (1971), observed that developments in science and information processing technologies had changed the meaning of the verb "to know." Instead of "having information stored in one's memory," the meaning was now the process of having access to information and knowing how to use it. The ensuing information explosion has greatly increased our understanding of the world around us. Simon (1971) early on noted that the growth and exploitation of information rests not only upon the ability of scientists to produce new knowledge, but also upon society's capacity to absorb and use it. Technology increases productivity but requires a more highly skilled work force with a broader education and a greater familiarity with the tools and theories of science. Competitiveness depends not only on the discovery of new innovations, but the speed at which that knowledge is transmitted through our educational systems to create highly skilled workers who can apply their knowledge.

Less than 15 years after Sputnik I, a company named Intel began marketing the first microprocessor (Intel, 2005, Para. 1), and by 1975, the Intel processor had become an essential part of the first commercially available computer, the Altair. The success of the processor and the increase in sales of microcomputers prompted IBM to enter the computer market with their version called the IBM-PC (an abbreviation of IBM Personal Computer) in 1981.

The 1980s saw the computer revolution well on its way. As a result of the increased availability of microcomputers in the homes of average Americans, educational institutions recognized a need to educate society in computer literacy. Colleges and universities were the first to offer computer literacy courses. Secondary schools soon

found that students matriculating to colleges and universities were not ready for the courses and thus began the first computer classes taught at the precollege level. It is in this context of the explosion in the use of computers in mainstream America that this study of computer literacy teaching objectives in secondary schools across the United States is proposed.

In 1972, Ogden began a series of studies to develop a history of teaching in the United States based on objective statements found within articles from selected periodical literature. Ogden's study was on secondary school chemistry, but his inquest was expanded and developed further by studies on biology by Ogden and Jackson (1974), physical education by Lock (1975), high school home economics by Vance (1976), high school foreign language by Huddleston (1976), high school reading by Fulton (1977), earth science by Roy (1979), college biology by Rand (1984), secondary school mathematics by McConnell (1986), college freshman English composition by Mills (1990), college music by Timberlake (1993), physics by Sehr (1993), secondary school science by Hemby (2000), secondary school physical education by Huff (2002), and college computer literacy by Graves (2005). The main purpose of this investigation was to identify and classify stated objectives that may have become operating guidelines for secondary school computer literacy teachers during the period of 1980-2004. With the advent of Computer Science as an academic field of study and Computer Literacy as an educational aim over the past 20 years, there has not been a study attempting to delineate objectives for the teaching of secondary computer literacy.

Statement of the Problem

The major problem addressed in this study was the lack of research attempting to

delineate objectives for the teaching of secondary-level computer literacy for any period of time. In order to develop a recent history of secondary-level computer literacy teaching in the United States, there is a need for existing data. This study is a continuation of the series of studies by Ogden, Jackson, Lock, Roy, Mills, Sehr, Hemby, Huff and others, but parallels that of Graves in that it focuses only on selected periodical literature pertaining to the study of secondary-level computer literacy for the period 1980-2004.

Purposes of the Study

The major purpose of this investigation was to prepare a recent chronological history and analysis of the objectives for teaching computer literacy in the secondary schools of the United States during the period 1980-2004 as reflected by objective statements in articles from selected professional periodicals. Data were catalogued according to the following criteria:

1. Frequency of articles.
2. Frequency of statements in articles.
3. Number and percent of statements.
4. Specific type of objective.

Additionally, statements were further catalogued into one of the following categories:

1. Knowledge.
2. Process.
3. Attitude and Interest.
4. Cultural Awareness.

The resulting data were categorized across and within subperiods according to

(a)Frequency of occurrence, (b)Category, (c)Authorship, and (d)Year.

Research Questions

Data obtained from reading professional periodicals were analyzed, tabulated, and evaluated in an attempt to answer the following questions:

1. What is the frequency of articles concerned with the objectives of teaching secondary-level computer literacy found in selected periodical literature categorized according to year and authorship within each subperiod and across all subperiods?
2. What is the frequency, rank, and percent of statements concerned with the objectives of teaching secondary-level computer literacy found in selected periodical literature categorized according to year, category, and authorship within each subperiod and across all subperiods?
3. What is the frequency and rank of each Knowledge statement concerned with the teaching of secondary-level computer literacy found in selected periodical literature categorized according to year and type within each subperiod and across all subperiods?
4. What is the percent of Knowledge statements concerned with the teaching of secondary-level computer literacy found in selected periodical literature categorized according to type and authorship within each subperiod and across all subperiods?
5. What is the frequency and rank of each Process statement concerned with the teaching of secondary-level computer literacy found in selected periodical literature categorized according to year and type within each subperiod and across

all subperiods?

6. What is the percent of Process statements concerned with the teaching of secondary-level computer literacy found in periodical literature categorized according to type and authorship within each subperiod and across all subperiods?

7. What is the frequency and rank of each Attitude and Interest statement concerned with the teaching of secondary-level computer literacy found in selected periodical literature categorized according to year and type within each subperiod and across all subperiods?

8. What is the percent of Attitude and Interest statements concerned with the teaching of secondary-level computer literacy found in periodical literature categorized according to type and authorship within each subperiod and across all subperiods?

9. What is the frequency and rank of each Cultural Awareness statement concerned with the teaching of secondary-level computer literacy found in selected periodical literature categorized according to year and type within each subperiod and across all subperiods?

10. What is the percent of Cultural Awareness statements concerned with the teaching of secondary-level computer literacy found in periodical literature categorized according to type and authorship within each subperiod and across all subperiods?

11. What is the rank of each type of objective statement concerned with the teaching of secondary-level computer literacy found in selected periodical literature categorized according to frequency, percent of occurrence, and

authorship within each subperiod and across all subperiods?

Significance of the Study

The investigation parallels and broadens a series begun by Ogden in chemistry (1972), Ogden & Jackson in biology (1974), Roy in earth science (1979), Sehr in physics (1993), and Hemby in secondary science (2000). These studies developed a synopsis of secondary school science instruction in the United States by classifying objective statements from selected periodical literature over selected time periods from 1918-1992. Lock (1975), Vance (1976), Huddleston (1976), Fulton (1977), Woodard (1982), Rand (1984), Garin (1984), McConnell (1986), Mills (1990), Timberlake (1993), Huff (2002), and Graves (2005) used similar procedures and methodology to analyze other areas of academic curriculum instruction. Although the study closely parallels that of other authors, particularly Graves, it focuses on objective statements pertaining to secondary-level computer literacy instruction during the time period 1980-2004.

Method of Procedure

This study identified and classified goals, aims, or objectives for teaching secondary-level computer literacy using the method of content analysis. All issues of the selected journals were examined for articles discussing secondary-level computer literacy teaching. Articles containing such information were re-examined by applying the article/objective selection criteria. Articles meeting the criteria were referenced on a classification sheet designed and first used by Roy (1979) and successfully utilized by others since its development. Articles were classified according to the author's occupation, objective class, and subperiod. Objective statements were quoted on the classification sheet. One classification sheet was completed for each article selected.

The data were classified, tabulated, and analyzed across two subperiods according to the dictates of each study question. The results are presented in both written analysis and table formats.

Definition of Terms

Except for those listed below, all of the terms used in this investigation adhere to their generally accepted meanings.

Authorship

This term refers to an occupational classification of the authors of articles obtained. The major groupings are those used by Ogden (1972), Ogden & Jackson (1974), Roy (1979), Woodard (1982), Rand (1984), Mills (1990), Sehr (1993), Hemby (2000), Huff (2002), and Graves (2005). Authors are grouped according to the teaching occupation of secondary education, higher education, and miscellaneous.

Category

This term refers to any one of the four objective statement groups defined by Hemby (2000), Huff (2002), Mills (1990), Ogden (1972,), Ogden & Jackson (1974), Ogden & Pella (1974), Rand (1984), Roy (1979), Sehr (1993), and Woodard (1982) as (a)Knowledge objectives, (b)Process objectives, (c)Attitudes and interest objectives and (d)Cultural Awareness objectives.

Secondary-level education

Secondary-level Education refers specifically to 7th grade through 12th grade. Secondary education usually includes general, technical, vocational, or college preparatory classes.

Computer literacy

The term computer literacy has been attributed to Andrew Molnar, director of the Office of Computing Activities at the National Science Foundation in, 1972 (Houghton Mifflin Company, 2005). Computer literacy includes an understanding of computers and related systems. It also includes a working vocabulary of computer and information system components, the fundamental principles of computer processing, and a perspective for how non-technical people interact with technical people. It does not deal with how the computer works (digital circuits), but it does imply knowledge of how the computer does its work (calculate, compare, and copy). It requires a conceptual understanding of systems analysis and design, application programming, systems programming, and datacenter operations. It also implies hands-on ability to work the operating systems (Windows, Mac, Linux) and common applications such as spreadsheets, word processors, database programs, personal information managers (PIMs), e-mail programs, and Web browsers. To be computer literate, one must be able to define information requirements effectively and have an understanding of decision support tools, such as query languages, report writers, spreadsheets, and financial planning systems.

Most important objectives

These objectives are those indicated by a minimum of 12.5% appearance in periodical literature during any one subperiod (Hemby, 2000; Huff, 2002; Huddleston, 1976; Mills, 1990; Ogden, 1972; Ogden & Pella, 1974; Rand, 1984; Roy, 1979; Sehr, 1993; Vance, 1976; Woodard, 1982). The figure represents 1.5 times the 8.33% figure that would be observed if all twelve objectives were cited with equal frequency. The intention in designating a group of objectives as "most important" is to allow the

convenience of discussing those objectives most frequently found during any one subperiod.

Objectives

Objectives are stated outcomes, goals, or aims of instruction put forward by the authors of selected articles (Hemby, 2000; Huddleston, 1976; Huff, 2002; Mills, 1990; Ogden, 1972; Ogden, 1974; Ogden & Jackson, 1974; Ogden & Pella, 1974; Rand, 1984; Roy, 1979; Sehr, 1993; Vance, 1976; Woodard, 1982).

Period

This period refers to the aggregate time span included in this study and is understood to be the years from 1980 through 2004, inclusively.

Subperiod

Subperiod represents either of two overlapping time units within the period defined in this study and marked by selected events in the social, political, or educational history of the United States. The subperiods are 1980-1995 and 1993-2004.

Type

This term refers to any of the 12 subcategories of objective statements as defined by Hemby (2000), Huff (2002), Mills (1990), Ogden (1972), Ogden & Jackson (1974), Ogden & Pella (1974), Roy (1979), Sehr (1993), and Woodard (1982).

Selected Journals

As a result of an email questionnaire sent to secondary computer literacy teachers, the following journals were identified as those most commonly read and were utilized as data sources for the study:

1. *Electronic School.*

2. *Journal of Research on Technology in Education.*

3. *Journal of Technology Education.*

4. *Technology and Learning.*

5. *Tech Trends.*

6. *T.H.E. Journal.*

Limitations and Delimitations

The limitations and delimitations of the investigation were as follows:

1. The study was confined to the years 1980 to 2004 inclusively.

2. The study examined objectives for teaching secondary-level computer literacy only.

3. The study utilized only selected computer-related periodical literature written between 1980 and 2004 in a search for answers to questions posed by the investigator.

4. The study is not intended to be a complete history of secondary-level computer history or even computer literacy education.

5. The study reflected the natural bias of the editors of the respective journals in their selection of articles for publication.

6. The study does include letters to the editor found in the selected periodicals.

Assumptions

For purposes of this study, these assumptions are made:

1. The use of the periodical literature selected furnished a relatively accurate representation of the opinions held concerning the objectives for teaching secondary-level computer literacy.

2. The writers who express themselves with regard to the teaching of secondary-level computer literacy are qualified and knowledgeable enough to do so.

3. Other teaching professionals could replicate the study.

Organization of the Remainder of the Study

The major purpose of this study was to prepare a chronological history and analysis of the objectives for teaching secondary-level computer literacy in the United States during the period 1980 through 2004 as reflected by objective statements in articles from selected professional periodicals. The results are reported in the chapters of the dissertation in the form of narrative and accompanying tables. Chapter 1 provides an overview of the study. Chapter 2 is a review of the literature. Chapter 3 outlines the procedure of the study. Chapters 4 and 5 report the results of the investigation for each of the subperiods. Chapter 6 consists of a complete summary and findings of the data collected for the 1980-2004 period.

CHAPTER 2

REVIEW OF THE LITERATURE

The purpose of this investigation was to prepare a recent history and analysis of the objectives for teaching computer literacy in the secondary schools of the United States during the period 1980-2004 as reflected by objective statements in articles from selected professional journals. This chapter provides an overview of the history of computing and the origins of computing in education.

Secondary-Level Computer Literacy: Historical Perspective

Introduction-Ancient Roots of Computing, 1600

To gain a complete understanding of the emergence of secondary-level computer literacy courses in the United States, one must first comprehend the history of computers and the birth of computing as a field of study. Computing as known today developed from three areas of study--science, business/accounting, and mathematics--but humanity has used devices to aid in computation for millennia. One of the earliest devices of computation was the Chinese abacus. The abacus is a device used for addition and subtraction and the related operations of multiplication and division. Labeled by many Western writers as the earliest calculating machine in the world (Young, 2004), the stimulus for the abacus came when the Chinese people desired a way to accurately compute their military, financial, and medicinal records (Young, 2004). Other early references to computing can be found in Rawlinson's 1994 translation of the Greek writer Herodotus. Herodotus attributed the rise of geometry to the Egyptian's need to resurvey their lands every year after the Nile flood to determine the taxes to be levied. "From the practice, I think, geometry first came to be known in Egypt, whence it passed to Greece."

(Rawlison, 1994, Para. 22). Others such as Price (1959, p. 60, and 1961, p. 12) claimed that arithmetic computing "arose out of the practical needs of the very mercantile-oriented Babylonians." Price furthered his position by mentioning the discovery of an ancient Greek navigational computer by divers off the coast of an Aegean Island in 1900. Price was convinced that this discovery (which dated to approximately 65 BCE) proved that computing was born out of the need to navigate as well as the need to fully account for business transactions. The mathematical origins of computers can be found by looking at the work of Baron von Napier, the Laird of Merchiston. His invention of the logarithms in 1614 was a cornerstone in mathematics and, much later, in computer programming (Cajori, 1893). This groundbreaking work was followed by Blaise Pascal's invention of the first mechanical calculating machine for addition and subtraction in 1642 (Diderot, 1976). Gottfried Leibniz expanded Pascal's work with the Leibniz wheel. Archibald (1941) noted that Leibniz's work surpassed Pascal's, because it could completely compute addition, subtraction, multiplication, and division automatically. Archibald (1941, p. 28) also noted that Leibniz believed his wheel would "free men from slavery by the automation of dull but simple tasks." Goldstine (1972, p. 28) also noted that the Leibniz wheel was "still in use in some machines" in the early 1970s.

The Pioneering of Modern Computing, 1600-1930

Goldstine's (1972) expansive exploration of the history of computers focused on 1600 as the starting point for the epic history of the modern computer. Most modern computer literacy texts credit Charles Babbage, the creator of the difference engine (in 1823) and the analytical engine (in 1827), as the first pioneer of computing (Martin and Norman (1970). Even though these engines were never built to full scale, they are still

considered the first modern computing machines. Morrison and Morrison (1961) noted that Babbage was one of the founding members of the Royal Astronomical Society and later was named Lucasian Professor of Mathematics at Cambridge. In this dual role, Babbage represented both the scientific and the mathematic divisions of early computer development.

Goldstine (1972) identified the next major event in the development of the modern computer as occurring in 1889, when Herman Hollerith patented his census tabulating machine, which used both punch cards and electricity to perform its operations. The U.S. government bought the machine to handle the profusion of data from the decennial census mandated by the U.S. Constitution. Hollerith later formed the Tabulating Machine Company to produce punched-card equipment for both government and private businesses. According to Belden and Belden (1962), under Thomas J. Watson's effective leadership, the Tabulating Machine Company was transformed into the International Business Machines Corporation (hereinafter IBM) in 1924. IBM helped pioneer information technology and revolutionized the way organizations, enterprises, and people operate in modern society (Belden and Belden, 1962).

Wartime Stimulus to Modern Computing, 1930-1950

The outbreak of international hostilities prior to the second World War intensified the need for advancements in modern computing. Considered by Yates (1997, p. 11) as "the father of computer science," Alan Turing, a British scholar in 1936 presented a paper titled, "On Computable Numbers," which described a machine that computed without human intervention. In 1938, Turing began working for the British government in the effort to break German wartime codes. At the start of World War II, it took British

intelligence 3 months to break a single code. Turing's work with the British government resulted in machines that were able to break German codes in less than 15 minutes (Mershawn, 2003).

According to Belden and Belden (1962), another important contributor to modern computers, Howard Aiken of Harvard University, obtained a $500,000 grant from IBM to develop a general purpose computer for the scientific community. As a Lt. Commander in the naval reserve, Aiken worked on a dissertation in mathematics that required an abundance of calculations and decided to build a computer that would do the computations for him. The navy and IBM became partners in the joint project. The Mark I was designed by Aiken, created at IBM, shipped to Harvard in February 1944, and formally introduced on August 7, 1944 (Wikipedia, n.d.). The main advantage of the Mark I was that it was fully automatic--it did not require human intervention once started. The Mark I was the first fully automatic computer and, according to Cohen (2001) "marked the beginning of the era of the modern computer." Grace Hopper, assigned to Aiken's research team at Harvard, was known in the field of computing as the "first computer programmer" (Mershawn, 2003, p. 2-6). Hopper converted the mathematical formulas for firing tables into a series of instructions for the computer to follow. Those instructions were then translated into binary code, in effect programming the computer to perform the same computations quickly and many times over, thereby saving valuable time. In 1946, Grace Hopper published a book, *A Manual of Operations for the Automatic Sequence Controlled Calculator*, and in 1952, Hopper wrote a program that freed software developers from having to write repetitive binary code, effectively making her the inventor of the first computer "compiler." Such innovations greatly reduced the

man-hours needed to facilitate the use of computers and gave rise to the nickname "Amazing Grace." Hopper went on to create Common Business Oriented Language (COBOL), the first user-friendly business software program, which is still in use today (Mershawn, 2003).

Computing devices similar to the Mark I were obtained from IBM for a joint project between the U.S. Army Ordnance Center and School at the Aberdeen, Maryland, Proving Ground and the Moore School of Electrical Engineering at the University of Pennsylvania. The goal of this project was to create firing and bombing tables for the U.S. Army on the eve of World War II, tables that according to Weik (1961) required vast numbers of arduous calculations. To speed up the table development process, Physicist John Maulchy and Electrical Engineer John Presper Eckert developed the Electronic Numerical Integrator and Calculator (ENIAC). Although, ENIAC was developed specifically to compute ballistic tables, one of its first assignments was performing computations for the Manhattan Project. Mershawn (2003) noted the military's pursuit of waging war was the primary stimulus for advancement in computer technology during this time. By 1946, ENIAC was able to successfully develop bombing and artillery tables. This one device was able to do in seconds what previously had taken hundreds of people months to complete manually. The Achilles heel of the ENIAC was, as Parker (1984, p. 24) stated, the fact that "every time the operators wanted to do a new series of computations, they had to rewire and reset switches--a process that could take several hours to complete." According to Berkhoff (cited in Nash, 1990, p. 65),

> after the war ended in 1945, a new era began to dawn for scientific computing. Resources previously devoted to urgent wartime needs were now liberated and

allocated to basic science. In particular, the U.S. Navy Department and the Atomic Energy Commission decided to continue to support the development of computers and scientific computation on a longer-range basis.

While Aiken was developing the Mark I and Maulchy and Eckert were creating ENIAC, Atanasoff and Berry developed and patented a computing machine for the solution of linear algebraic equations at Iowa State University that was completed in 1937. Von Neumann and Goldstein (1947) credits Atanasoff and Berry with storing electrical charges in a circuit by using Leyden jars, thus creating the first electronic digital computer. This early work was used by von Neumann to develop his own ideas about storing programs within a computer. Bell and Newell (1971) noted that a series of reports von Neumann wrote and sent to the Library of Congress served in many ways as the blueprint for the modern computer. Bell and Newell (1971) also noted that these reports included a very detailed discussion of how a computer should be organized and built as well as how to program it. Paul Armer (Feigenbaum & Feldman, 1963) was the first person to credit non Neumann with developing the stored-program concept, thus giving birth to software. In 1950, von Neumann advocated the use of computers to calculate numerical weather predictions (Nash, 1990).The computer was becoming a high priority for both government needs and civilian uses.

The Creation of Computing as a Discipline, 1950-1970

By the 1950s, public recognition of computers was increasing. Belden and Belden (1962, p. 199) noted that by 1953, the IBM 650 had sold over 1000 units, thus making it "the first widely used computer system." Additionally, Goldstine (1972, p. 330-331) noted, "prior to this system [the 650,] universities built their own machines,

either as copies of someone else's or as novel devices." After the 650 was mass marketed, the existence of such a large group of computers made it desirable to have common programs and programming techniques. Grace Hopper had already laid most of the groundwork for these common programs and programming techniques. According to Sammet (1969), IBM introduced Formula Translation (FORTRAN). Like COBOL, FORTRAN is a scientific computational language. It was introduced in 1957 and soon became the most widely used higher level programming language within the scientific and mathematics community. COBAL was the first programming language to use English-like phrases, thus making it the most widely used programming language for business (Parker, 1984).

The increased efficiency of modern computing led to the first job losses as a result of the advent of computers. As manual tasks were computerized, many people began to fear the intrusion of computers in the business world. Graves (2005) explained this fear by comparing it to the 1957 movie, *Desk Set,* which establishes conflict between the two leading characters: Richard Sumner (Spencer Tracy) and Bunny Watson (Katherine Hepburn). Watson was afraid that Sumner's Emirac, the new company computer would make her job obsolete. After some clever sabotage in the climax of the movie, Sumner reveals the fact that the computer is designed to assist rather than replace the personnel in Watson's department. Public mistrust of computers was virtually dissolved with the launch of *Sputnik I* on October 4, 1957. After Sputnik I, the public feared that the Soviet's ability to launch Sputnik I also translated into the capability to launch ballistic missiles that could carry nuclear warheads from Europe to the United States. Computers were seen as necessary to American security, rather than as a threat to job security.

As the decade of the 1960s emerged, the United States was experiencing major changes. With the success of the Russian space program and the election of John F. Kennedy as the 35th President of the United States, the changes taking place in America would be substantial on the country as a whole but on computing in particular. The impact was illustrated by the failure of early NASA rocket tests. Cortright (1975, p. 7) explained that the nation needed newer, faster computers to "get rockets off the ground." Much needed rapid advances in computer software, hardware, and infrastructure allowed NASA to overcome these early setbacks and ultimately launch Alan Shephard's sub-orbital flight on May 5, 1961. In his May 35, 1961, address to the nation following Shephard's flight, President Kennedy challenged the U.S. to land a man on the moon and return him to earth safely within the decade (Mershawn 2003). Congress responded by funding the Moon Program. NASA began purchasing state of the art computer technology. As the Mercury, Gemini, and Apollo programs evolved, NASA required more and more computing power. These programs further stimulated the advancement of modern computing.

Major changes were occurring in the business community as well. The ability of the modern computer to manage large amounts of data inspired a young man named H. Ross Perot. Norton (1999, Para. 1) explained, in 1962, Perot borrowed $1,000 dollars from his wife and began a small Dallas, Texas, based business known as EDS or Electronic Data Management Services. Perot wanted to provide electronic data management services to customers, allowing them to focus on their businesses. Perot bought time on a computer owned by Southwestern Life Insurance and began contracting data management services to corporations. Norton (1999, Para. 2) noted that Perot's

company was eventually bought out by General Motors (GM) in 1984 for $2.5 billion, "the largest sum ever paid for a computer services company."

The increased use of computers also had a negative side that emerged during the late 60s. According to Graves (2005), in April 1968, computer crime made headlines in *The Wall Street Journal.* The article was about a programmer who had programmed a computer to transfer money from a brokerage firm to his own personal accounts. Electronic theft and forgery charges rose as more businesses became computerized. Martin and Norman (1970) indicated that besides theft of monies, theft of privacy became a major issue during this time. Martin and Norman(1970) also noted that the *Ruggles Report* of April 1965 called for the federal government to establish a federal data center. The idea of a national data bank to manage private information on United States citizens alarmed many Americans. Privacy issues became a point for debate among citizens and resulted in congressional hearings (Martin & Norman, 1970).

It is within this atmosphere of increasing computer public awareness and distrust that the first computer literacy courses were adopted in American education. Colleges and universities began to identify computer literacy needs in the educational realm. Younger generations would have to be taught to use computers in order to become viable employees in the work force. From an educational perspective, the world of work had entered an era of change. This U.S. News and World Report cover story, "Jobs of the Future" (1985, pp. 40-48), identified the increasing number of opportunities, as new fields emerged in the workplace that utilized computer technology. Shane (1987, p. 80) stated, "current teaching and degree programs no longer are adequate to prepare students for a diminishing number of jobs." In 1985, *Time Magazine* "Schooling for Survival"

reported that corporate annual expenditures for training and education had reached $40 billion--two thirds of the total college and university annual budgets in the United States. As the business community forged ahead in providing training to equip workers with necessary skills, the American education systems began to respond by initiating computer literacy courses.

The University of California at Irvine began one of the first courses of this nature. Stanley Rothman, a sociology and public policy professor, believed that courses that taught the basics of computing to build a strong technical foundation for this country were needed (Rothman & Mosmann, 1972). Besser (1993) stated that computer literacy was seen as an essential skill needed in a working world dominated by the use of computers.

According to Rothman & Mosmann (1972), by the early 1970s, computer literacy courses were being taught at several leading colleges and universities across the nation. The explosion in the growth of computer literacy courses coincided with the increasing cost effectiveness of computer technology. Martin and Norman (1970, p. 10-11) stated that in 1955, "one dollar bought 100,000 program instructions." By 1970, the same dollar bought over 100 million program instructions.

Parker (1984, p. 34) explained the benefits of "the world's first minicomputer...Digital Equipment Corporation's PDP-8." "At $20,000, this rugged machine represented a small fraction of the cost of mainframes of its day, and it could be installed almost anywhere" (Parker, 1984, p. 34). In 1968, the Computer Science Corporation became the first software company listed on the New York Stock Exchange as a result of IBM's unbundling of its software (Johnson, 1998). This move allowed

more software companies to emerge in the computer industry. The Advanced Research Projects Administration Network (ARPANET), predecessor to the internet, was established in 1969 by the U.S. Department of Defense. The creation of ARPANET was a U.S. reaction to the USSR's launch of Sputnik in 1957. As Waldrop (2001) noted, the ARPANET started out as a novel idea to network computers together into a single network spanning the continent by J.C.R. Licklider of the U.S. Department of Defense. Licklider believed that "using computers as the medium, the new form of communication would facilitate American ability to implement information during the Cold War" (Waldrop, 2001, p. 176-177). The repercussions of Licklider's idea were destined to revolutionize modern humankind. Not only had Licklider "brought the computer from the back room to the desktop but changed the course of science and culture" (Waldrop, 2001, p. 176-177).

The Microcomputer Revolution, 1970-1980

The Cold War was not only the stimulus for the pioneering of the internet, but also the primary motivating factor in the space race. The United States space program created an ever-increasing need for smaller computer information systems. NASA began utilizing Large-Scale Integration Chips, known as LSI chips, in U.S. spacecrafts (Parker, 1984). Burton (1976, p. xv-xvi) explained that "while computer chips produced in 1965 contained approximately 1000 circuits, [the LSI] chips of 1970 contained as many as 15,000." The success of the microprocessor inspired a revolution that Parker (1984, p. 35) dubbed "the microcomputer revolution." By 1972, Intel's 8080 microprocessor chip was marketed (Intel, 2005, Para. 3). The Intel 8080 microprocessor had the ability to operate a complete computer system in its entirety. Inspired by the potential of the

microprocessor, Micro Instrumentation and Telemetry Systems (MITS) in Albuquerque, New Mexico, began marketing the world's first microcomputer, the Altair 8800, for $400. According to Parker (1984, p. 35), "the 8800 was a very crude device that had no keyboard, no monitor, no permanent memory, and no software." The Altair was sold as a kit, requiring buyers to virtually build the machine themselves. After completion, users had to code their own programs in machine language into the computer. Despite the cumbersome process required to assemble and use the Altair, over 4,000 machines were ordered in the first three months. Results from user feedback suggested that MITS hire someone who could make the computers more user friendly. The person chosen for the task of installing Beginner's All-Purpose Symbolic Instruction Code (BASIC) programming language on the 8800 was a Harvard Freshman named Bill Gates. His success with this endeavor resulted in Gates leaving Harvard to establish Microsoft Corporation (Parker, 1984).

Beginning in April 1976, the Apple I computer was sold as the first fully assembled personal computer. Working out of a garage, Steve Wozniak and Steve Jobs originally created the Apple computer for their own personal use. The Apple I was an innovative machine for its time, but due to the lack of graphics and sound capabilities, it was discontinued in 1977 and replaced by the Apple II. Apple II's success came mostly from *VisiCalc*, which was the world's first spreadsheet package. Wozniak's open design and the Apple's multiple expansion slots permitted a wide variety of third party devices to expand the capabilities of the machine. The Apple II became the most widely used computer in American public schools. The Apple II was easy to operate and is considered the first user-friendly computer (Macmothership.com, 1999).

With the wide availability and affordability of microcomputers came major changes in the education systems during the 1970s. In 1972, the Carnegie Commission on Higher Education published a report, named *The Fourth Revolution.* Molnar (1973, p. 277) explained that the title was originated from Eric Ashby's observation that there have only been four major revolutions in education. The first revolution occurred when "education shifted from parents teaching children in the home to teachers [teaching] children in a school." The second revolution was when "the written word was adopted as a tool." The third revolution came about with the invention of the printing press. The fourth and final revolution was brought about by the invention of "electronics, in particular, the development of the radio, television, and computers." This fourth revolution was a dilemma for many Americans, as they grappled to comprehend the massive impact that electronics were having on humankind.

The end of the decade saw a rise in the acceptance of computers into the world of education. According to Worth (1977), it was now a known and understood essential that computer literacy courses should be taught in American schools. As Molnar expressed in 1979: "[t]here is a need to foster computer literacy...A nation concerned with its social needs and economic growth cannot be indifferent to the problems of literacy. If we are to reap the benefits of science-driven industries, we must develop a computer literate society" (Molnar, 1979, p. 277). Education reformers began to call for computer literacy courses for the nation's public schools. In 1983, The U.S Department of Education identified computer skills as a needed core curriculum component for secondary schools (Shane, 1987).

CHAPTER 3

PROCEDURES OF THE STUDY

The major goal of this study was to identify and classify objectives for teaching secondary-level computer literacy in secondary schools in the United States during the period 1980-2004 as reflected by objective statements in articles from selected professional periodicals. The following procedures were used throughout the course of the research.

1. Selection of subperiods.
2. Sources of data.
3. Categories and objective types.
4. Cataloguing system.
5. Treatment of the data.

Selection of Subperiods

The 1980-2004 period was divided into two subperiods on the basis of selected events in the social, economic, political, or educational history of the United States. Significant discoveries or inventions in the field of secondary-level computer literacy are also discussed in each subperiod. As in the previous studies, some overlapping of the two subperiods was planned to allow for the gradual transformation characteristic of historical change. The subperiods for this study were as follows:

1. Subperiod One (1980-1995)

   The first subperiod begins in 1980 with the election of Ronald Reagan as President of the United States. It ends in 1995 with the release of the *Windows 95* Operating System by the Microsoft Corporation.

2. Subperiod Two (1992-2004)

The second subperiod begins with the end of George H.W. Bush's presidential term in 1992. It ends in 2004 with the election of incumbent George W. Bush as President of the United States.

Sources of Data

To obtain a representative view of the stated aim or objectives for the teaching of secondary-level computer literacy, six professional journals were utilized. The journals and their dates of publication are stated below.

1. *Electronic School (1987-2002).*
2. *Journal of Research on Technology in Education (1980-2004).*
3. *The Journal of Technology Education (1989-2004).*
4. *Technology and Learning (1991-2004).*
5. *Tech Trends (1980-2004).*
6. *T.H.E. Journal (1980-2004).*

Journals were selected on the basis of their wide circulation among secondary-level computer literacy teachers. It is believed that these periodicals are representative of the leading national organizations concerned with the teaching of secondary-level computer literacy.

Electronic School is an award-winning technology magazine for K-12 school leaders, and was published from 1987 to 2002 as a print and online supplement to *American School Board Journal*, in cooperation with the Institute for the Transfer of Technology to Education (ITTE): Education Technology Programs, a program of the

National School Boards Association.

Journal of Research on Technology in Education (JRTE) is a peer-reviewed quarterly publication formerly titled *Journal of Research on Computing in Education.* It focuses on articles that report on original research, system or project descriptions and evaluations, synthesis of the literature, assessments of the state of the art, and theoretical or conceptual positions that relate to educational computing. International in scope and thorough in its coverage, the theoretical and conceptual articles in JRTE define the state of the art and future horizons of educational computing. The Journal of Research on Technology in Education audience includes teachers, teacher educators, technology coordinators, educational policy makers, and industry leaders.

The Journal of Technology Education provides a peer-reviewed forum for scholarly discussion on topics relating to technology education. Articles focus on technology education research, philosophy, and theory.

Technology & Learning is a national publication for education technology leaders. Formerly titled *Classroom Computer Learning,* it is the magazine educators turn to for information on integrating computer and related technologies into the classroom.

Tech Trends is a publication for practitioners in the educational communication and technology field. As such, its major purposes are to provide a vehicle for the exchange of information among professional practitioners concerning the management of media and programs, the application of educational technology principles and techniques to instructional programs, corporate and military training, and any other kinds of information that can contribute to the advancement of knowledge of practice in the field.

T.H.E. Journal has been providing peer-reviewed articles, special reports,

thematic issues, commentary, software and courseware reviews, product reviews, and news on all aspects of using technology in education aimed at professionals in education, computing, industry training, and manpower development for over 30 years.

Categories and Objective Types

The following four categories and related objective types paralleling those of Ogden (1972, p. 16-19), Ogden & Jackson (1974, p. 13-16), Roy (1979, p. 19-27), Woodard (1982, p. 20-28), Mills (1990, p. 23-35), Sehr (1993, p. 18-21), Hemby (2000, p. 21-25), and Huff (2002, p. 17-21) were identified:

1. *Knowledge* objective statements are those that advocate student attainment of factual or conceptual material for its own sake or for its functional value and those that stress knowledge and skills basic to the study of secondary-level computer literacy. Types of objectives in this grouping are listed as follows:

A. Major facts, principles, concepts, or fundamental objective statements stress knowledge for the sake of knowledge or its relation to the understanding of secondary-level computer literacy. Examples of objective statements that fall in this type of category include getting at a body of knowledge, embracing the fundamental facts (Morgan, 1969), and knowledge of principles as a prerequisite to the successful practice of "enquiry" (Gagne, 1963, p. 149).

B. Application of secondary-level computer literacy to daily life objective statements tie the application or use of major facts, principles, concepts, or fundamentals of computer literacy to real life situations. Emphasis is placed upon the utility of the knowledge for its own sake. Examples of the application function include emphasizing affective as well as cognitive features of computer literacy; learning computer software

packages and achieving effectiveness by using them in every day life; and the ability to use the major generalizations of computer literacy to make rapid computations, to reason, to recall, to amend, to explore, and to create (Taylor, 1981, p.8).

C. Study skill objectives accent knowledge and skills necessary for the study of computer literacy and successful completion of other secondary-level courses. This includes nomenclature, vocabulary, logical reasoning ability, mathematical ability, keyboarding skill, and study habits. Objectives that fit into this category include the ability to read analytically, to communicate clearly, and to solve simple logic problems.

2. *Process* objectives are those that convey an understanding and use of the methods and techniques of secondary-level computer literacy. Statements such as these focus upon critical thinking, problem solving, classification, logic, application of programming methodology, experimentation, and life-long learning. Types of objectives in this grouping are as follows:

A. Methods of thinking objective statements stress the development of critical thinking and problem solving activities. They do not identify the various processes involved but do state, in general, that critical thinking and problem-solving abilities are the desired results. Objectives include observing, using space-time relationships, using objective data for the solution of computer related problems, and translating data into information (Mason & Blanchard1979) (Schouest & Thomas, 1978).

B. Process, skills, and techniques objectives are much more specific than those mentioned in the previous grouping. They deal specifically with the various techniques involved in employing the processes and methods of computer programming, computer based research, and application software usage. Examples include the ability to

analyze the steps in the programming method, the ability to keyboard at least 30 words per minute, evaluating and interpreting Internet search results, and understanding the various processes required for secondary-level computer literacy.

C. Research and creativity objective statements deal with developing the capacity to do research. They focus upon the student in an attempt to take students into situations that expand their intellectual powers and promote originality. Examples that fit into this group include acquiring clear ideas about the role of observations, the use of creativity in the decisions, and utilizing computer-based research techniques (Sawhill, 1980).

3. *Attitude and interest* objective statements are those concerned with developing an appreciation for the contributions and nature of the computer industry, desirable attitudes involving computer literacy, and lasting professional and vocational interest in students. Types of objectives in this grouping are as follows:

A. Attitudes and appreciation objective statements convey a willingness of the individual to use a scientific method of solving problems in everyday life. They focus upon the formation of good thinking habits, including the ability and inclination to recognize a problem, to consider evidence, to suspend judgment, and to change an opinion. Examples of objectives illustrating this type grouping include the development of skills, attitudes, and habits of mind that promote an understanding of the societal impact of computers and potential abuses of increased data storage capacity (Logsdon, 1980).

B. Interest and career development objective statements involve the development of both career and non-career interest. Pursuits of this type reflect a

willingness to read about developments in computer literacy, encourage hobbies and leisure activities, and open new areas of interest (Anderson Consulting, 1989), and awareness of the many aspects of computer literacy, both as a vocation and in vocations (Pyburn, 1986).

C. The nature of computer literacy and computer science professionals objective statements are concerned with the attainment of a realistic concept of the nature of computer literacy and computer science professionals. Central to this objective type are statements concerning the ethics and standards of the computer industry and those who make it function. Examples of this category include an understanding of the role of the computer industry, computer systems personnel, the contributions of computer educators, and how the computer fits into the organization as a whole (McLean & Kappelman, 1992).

4. *Cultural awareness* objective statements deal with the inner workings of computer literacy and society or the cultural implications of computer literacy for society. They differ from Attitude and Interest objectives in that they deal with cultural groups rather than individuals as independent entities. Objective types within this category are as follows:

A. Aesthetic aspect statements express the human, creative, cultural, and social networking aspects of computer literacy. Examples of this objective type include how organizations and individuals use computers and the resulting impact upon workflow and leisure time (Rothman & Mossman, 1972).

B. Philosophical, sociological, and political objective statements deal with the impact of society on computer literacy and how governmental policy affects computer

usage. Examples that fit into this grouping include helping students further their development of basic life philosophies and values and the potential social, legal, and political impact of the ever evolving use of computers in society.

C. Economic aspect objective statements show how advances in computer efficiency and usage influence economic development. Statements focus upon the economic implications of discoveries and innovations in computer literacy; the improvement of the standard of living; and the possibility of a fuller, richer, and more comfortable life through the impact of computer literacy on society.

Cataloguing System

The time period 1980-2004 was divided into two subperiods, and throughout both subperiods, the study classified the articles and statements as follows:

1. Frequency of articles
    - A. By year
    - B. By author
2. Frequency of statements in articles
    - A. By year
    - B. By author
3. Percent of statements
    - A. By type
    - B. By author
    - C. By rank
4. Specific type objective
    - A. Knowledge objectives

a. By year

b. By author

c. By frequency

B. Process objectives

a. By year

b. By author

c. By frequency

C. Attitude and interest objectives

a. By year

b. By author

c. By frequency

D. Cultural awareness objectives

a. By year

b. By author

c. By frequency

Treatment of Data

The treatment applied to the data derived from this investigation paralleled, for the most part, that employed by Hemby (2000), Huddleston (1976), Huff (2002), Mills (1990), Ogden (1972), Ogden & Jackson (1974), Rand (1984), Roy (1979), Sehr (1993), Vance (1976, p. 22-23), and Woodard (1982). In this respect, treatment of the data included the following:

Selection of Data

Following the pattern established by Roy (1979), all issues of the journals listed in the

sources of data were read for the relevant articles dealing with statements of secondary-level computer literacy. Articles were selected for inclusion on the basis of the following criteria:

1. It is an expression of opinion or the result of formal research activity (Roy, 1979).

2. The objective statements are stated explicitly and not implied; they are readily apparent (Roy, 1979).

3. The article is concerned with computer literacy instruction at the secondary level.

4. The article is not an editorial, letter to the editor, book review, or a convention report (Roy, 1979)

5. The article is not a committee report or a critique of a committee report (Sehr, 1993).

The above criteria were those chosen by Ogden (1972), Ogden & Jackson (1974), Roy (1979), Mills (1990), Sehr (1993), Hemby (2000), Huff (2002), and Graves (2005) in their studies. Articles not meeting all criteria were excluded from this investigation. Articles that met all criteria were read carefully and the statements obtained were duplicated in the author's exact wording on page 2 of the classification sheet. Other specific information recorded included the following: (a) name of author(s), (b) title of article, (c) name of publication, (d) volume number or month of publication, (e) issue number or month of publication, (f) page reference of article, (g) date (year) of publication, (h) categorization of author(s), (i) categorization of subperiod(s), (j) categorization as research or nonresearch-oriented, (k) catalog of objective category, and

(l) catalog of objective type.

Classification of Statements

As in the previously mentioned studies, the selected journals were read, and the identified objective statements were examined with regard to general purpose. The statements were then catalogued according to any or all four broad categories. Within these major categories, the statements were further catalogued into category types as previously defined. To avoid conflict in word meanings across time, the author's intent was catalogued rather than the investigator's interpretation.

Surviving articles were catalogued further according to author's occupation. Major groupings used were those used in the previous studies of Ogden (1972), Ogden & Jackson (1974), Roy (1979), Mills (1990), Sehr (1993), Hemby (2000), Huff (2002), and Graves (2005). The major occupational groupings are identified as follows:

1. "Higher Education," which includes college or university teachers, college or university administrators, junior college teachers, retired members of the above, and students seeking to obtain a doctoral degree.

2. "Secondary Education," which contains classroom teachers, school administrators, subject matter supervisors, consultants, retired members of the above, and students seeking to obtain master's degrees.

3. "Miscellaneous," which encompasses all authors identified as holding occupations other than those listed in the previous categories at the time of publication or those for whom no occupation is given.

Analysis of Data.

The data obtained were tabulated and analyzed using the method of content

analysis in an attempt to answer the questions within and across both subperiods that were presented in this study. In summary, these questions were answered:

1. What were the frequencies of articles and statements?
2. What was the distribution of objectives within each category?
3. Which objectives were "most important"?
4. What major educational groups, i.e. authorship, were involved with the writing of articles concerned with the objectives of secondary-level computer literacy teaching, and did those groups agree or disagree in their outlook as indicated by frequency rankings?

The final results of the analysis were presented by means of table format and narrative description. The format used for the presentation of tables conformed to that developed by Ogden (1972) and modified by Huddleston (1976), Vance (1976), Roy (1979), Woodard (1982), Rand (1984), Mills (1990), Sehr (1993), and Hemby (2000).

Summary

This chapter has presented the procedures used in the study of the objectives for teaching secondary-level computer literacy in the United States during the 1980-2004 period. Chapters 4 and 5 report the results of the investigation for each of the subperiods. Chapter 6 consists of a tabular summary and findings with regard to the data collected for the total study.

CHAPTER 4

SUBPERIOD ONE, 1980-1995

The 1980s and 1990s were decades of national renewal, military expansion, additional space exploration, and government deregulation. Ronald Reagan was elected as the 40th President of the United States in 1980. Immediately after taking office, Reagan began implementing the *Strategic Defense Initiative* (SDI), a plan to protect the United States from Soviet nuclear missiles via a space-based interception system. This plan also helped to stimulate the space shuttle program and was instrumental in renewing and equipping the U.S. military. Reagan's laissez-faire economic policies revived economic growth in many areas of the economy, especially the computer industry.

During the period from 1980-1995, the computer industry grew in two different but parallel areas, software and hardware. Johnson (1998, p. 36-43) explained, in the late 1960s, "IBM's unbundling [of the software from its hardware] helped legitimize the concept of paying for software." This unbundling effort was a major breakthrough for development companies trying to meet the needs of mainframe, minicomputer, and microcomputer users. Grad (2002, p. 64) noted that by the 1980s "many software companies had entered the [fledgling] personal computer (PC) market." IBM's entry into the market in 1981 was a major boost for the microcomputer industry.

In 1976, Dolotta et al. (p. 61) had observed,

> [t]he general idea of providing home data processing capabilities to the general public has been a topic of speculation for several years. The social value of home data processing is potentially enormous in terms of education applications alone; if entertainment, games, and other

applications are also considered, this social value is augmented by commercial desirability.

By 1981, the social and commercial desirability of microcomputers was apparent, as the industry rapidly increased sales, and companies like Apple Computer Corporation rapidly expanded and released computers such as the Mac for personal use. Parker (1984, p. 43) noted that IBM's personal computer (PC) was a "highly successful product that immediately cut into the sales of the Apple II" and other popular computers. Parker noted that the PC's success was attributed to the business industry taking microcomputers seriously once IBM became a major contributor to the industry.

In 1981, the demand for software dramatically increased due to the utility and affordability of the microcomputer. Firms such as Microsoft Corporation, WordPerfect Corporation, and Lotus Development Corporation worked overtime to develop software for the new microcomputer market. McLean and Kappelman (1992, p. 150) also observed that by 1990 businesses were reporting "significant contributions from spreadsheet, office automation, personal support, and communications-type applications." Additional developments in the computer networking field led to the advent of software for PCs to communicate and share data. The development of networking computers allowed users to link multiple computers together, which expanded the average PC user's ability to access information. Educators began to acknowledge the increased desirability of the use of PCs for educational purposes.

In 1985, Apple Computer initiated a collaboration with public schools, universities, and research agencies. The program, Apple Classrooms of Tomorrow (ACOT), began in seven classrooms that represented a cross section of America's

elementary and secondary schools. The goal was to study how the routine use of computers in classrooms would change teaching and learning. ACOT's research demonstrated that the introduction of technology into classrooms can significantly increase the potential for learning, especially when it is used to support collaboration, information access, and the expression and representation of student's thoughts and ideas (Macmothership, 1999).

The early years of this subperiod found the country divided among those who believed that computers were the way of the future and those who were not yet persuaded. Bitter (1983, p. 22) felt strongly that "computer literacy should be included in teacher certification requirements." Molnar (1979, p. 283) agreed that "there is a national need to foster computer literacy...A nation concerned with its social needs and economic growth cannot be indifferent to the problems of literacy. If we are to reap the benefits of science-driven industries, we must develop a computer literate society." There were those who disagreed with these thoughts such as Davis (1983, p. 59) who argued that:

> Mandates for [computer literacy] courses often ambiguously include both awareness of the role of computers in society and skills in basic programming. The vacuousness of the mandates is matched only by the exaggeration of their need. Surely, everyone need *not* learn to program a computer in order to use a computer or be aware of its uses.

By 1984, both sides of the issue had come together to believe in three basic categories for computing competency that Gillespie (1981, p. 173) had devised:

> 1. All students [should have] a basic understanding of computers and how to use them;

2. Industrial training in conjunction with university curricula [is critical] to meet the growing demand for competent personnel in all aspects of computing; and

3. Computer literacy for the general public [should] include assessing the computer's impacts on society.

Computer literacy courses were developed to provide knowledge and understanding of computer systems. Frates & Moldrup (1983, p. 7-8 identified what this body of knowledge and understanding should include:

1. Computer organization (hardware concepts).
2. Procedures and algorithms for processing information.
3. Capabilities and limitations of computers.
4. A History of computing and computers.
5. A hands-on experience.
6. The potential threat of computer abuse.
7. A perception of the societal impact of computers.
8. Both current and future uses of computers.

With these guidelines in place the growth of computer literacy as an educational subject was rapid and resulted in educational innovations.

The use of electronic communication devices was one such innovation that helped education significantly. Swartz, Schuller, and Chernowet (1984, p. 40-41) noted the educational use of "modems,...microcomputers,...and electronic communication networks through which [students] can tap into large scale information bank, electronic mail, and teleconferencing systems." Early educational computing networks such as Bitnet, Listserv, and the Defense Department's ARPANET led to the development of the

internet in the early 1990s. By the end of this subperiod in 1995, Moschovitis, Poole, Schuyler and Senft (1999, p. 154) reported that "over 25 million [people were using] the internet and [usage was] doubling every year and a half."

Analysis of Data

Question 1. What is the frequency of articles concerned with the objectives of teaching secondary-level computer literacy found in selected periodical literature categorized according to year and authorship within this subperiod?

An analysis of Table 1 shows that 53 articles concerned with the objectives for teaching secondary-level computer literacy were written during the years 1980-1995, with an average of 3.46 articles per year for the 15 years. No articles were written in 1980 and 1981. Only one article was written each year in 1983, 1987, and 1991. The yearly range of articles for the remaining years varied from a low of two in 1993 to a high of nine in 1995.

Authors in secondary education contributed the most articles, followed by the higher education authors and miscellaneous authors. One article was co-authored by higher education and secondary authors. One article was co-authored by higher education and miscellaneous authors.

Question 2. What is the frequency of statements concerned with the objectives of teaching secondary-level computer literacy found in selected periodical literature categorized according to year and authorship within this subperiod?

Table 2 shows a total of 153 statements of objectives were found in the 53 articles written during the subperiod. The mean number of statements per article was 2.94. During the 15 years of the subperiod, the mean number of objective statements by the

combined authorship was 10.2 statements per year.

Authors in secondary education contributed 59 statements (38%) with authors in the higher education category contributing 50 (33%). Authors in the miscellaneous category contributed 44 statements (29 %). Four statements were co-authored by higher education and secondary education authors. Three statements were co-authored by higher education and miscellaneous writers.

Question 3. What is the frequency, rank, and percentage of statements concerned with the objectives of teaching secondary-level computer literacy found in selected periodical literature categorized according to year, category, and authorship within this subperiod?

Table 3 shows statements of objectives of secondary-level computer literacy according to year, category, and authorship. Statements in the Process category were the most frequent with a total of 58 or 38%. These were followed closely by 57 Knowledge statements, which represented 37% of the total. There were also 21 Cultural Awareness statements (14%) and 17 Attitude and Appreciation statements (11%).

Of the 59 statements attributed to secondary education authors, 23 were Process statements (39%), 21 were Knowledge statements (36%), 9 were Cultural Awareness statements (15%), and 6 were Attitude and Awareness statements (10%). Authors in the higher education category favored Process statements, with a total of 22 (44 %) of their total of 50 statements. These were followed by 14 Knowledge statements (28%), 9 Attitude and Appreciation Awareness statements (18%), and 5 Cultural Awareness statements (10%). Miscellaneous authors contributed 44 statements. Knowledge statements were the most common with 22 (50%), followed by 13 Process statements (29%). Cultural Awareness statements were mentioned 7 times (16%), and Attitude and

Awareness statements were mentioned 2 times (4%).

Questions 4 and 5. What is the rank, frequency, and percentage of each Knowledge statement concerned with the teaching of secondary-level computer literacy found in selected periodical literature, categorized according to year, type, and authorship within this subperiod?

Tables 4 and 5 are numerical and percentage classifications of 57 Knowledge objectives for the first subperiod. The three types of Knowledge objectives are major facts, principles, or fundamentals; application of computer literacy to daily life; and study skills. The most frequently cited objective was major facts, principles, and fundamentals with 31 objective statements (54.3%). The next most frequently mentioned objective was applications of computer literacy to daily life with 19 statements (33.3%). The objective cited most infrequently was study skills with only 7 statements (12.2%). Miscellaneous authors contributed the majority of the Knowledge statements (38.5%). Secondary authors contributed 37%, and higher education authors contributed 25%. Four statements were co-authored by higher education and secondary education authors.

Question 6. What are the frequency, rank, and percentage of each Process statement concerned with the teaching of secondary-level computer literacy found in selected periodical literature categorized according to year and type within this subperiod?

Tables 6 and 7 are numerical and percentage classifications of 59 Process objective statements. Process objectives are divided into three types: methods of thinking; processes, skills, and techniques; and research and creativity. The most frequently cited objectives were processes, skills, and techniques with and methods of thinking with 22 statements each (37.0%). There were 15 research and creativity

statements (25.8%). Authors in secondary education made the most statements with 23 (37%). Higher education authors contributed 22 statements (35%), and miscellaneous authors contributed 13 statements (21%).

Questions 8 and 9. What are the frequency, rank, and percentage of each Attitude and Interest statement concerned with the teaching of secondary-level computer literacy found in selected periodical literature categorized according to year and type within this subperiod?

Tables 8 and 9 are numerical and percentage classifications of 17 Attitude and Interest objective statements. Attitude and Interest objectives are divided into three types: attitudes and appreciations: nature of computer literacy and computer literacy professionals; and interest and career development. The most frequently cited objective was attitudes and appreciations with 12 statements (70.5%). The next objective most often cited was interest and career development with 4 statements (17.6%). Authors in higher education made the most statements with 9 (57.9%). Secondary education authors contributed 6 statements (35.2%) each. Miscellaneous authors contributed 2 statements (11.7%). Three statements were co-authored by higher education and miscellaneous.

Questions 10 and 11. What is the rank, percentage, and frequency of each Cultural Awareness statement concerned with the teaching of secondary-level computer literacy found in selected periodical literature categorized according to year and type within this subperiod?

Tables 10 and 11 are numerical and percentage classifications of 21 Cultural Awareness objective statements. Cultural Awareness objectives are divided into three types: aesthetic aspects, philosophical, sociological, and political aspects; and economic

aspects. With 12 statements (57.1%), philosophical aspects were the most frequently cited objectives. The next objective most often cited was aesthetic aspects with 6 statements (28.5 %). There were 3 economic aspect statements (14.2%). Authors in secondary education made the most statements with 9 (42.8%). Miscellaneous authors contributed 7 statements (33.3%), and higher education authors contributed 5 statements (23.8%).

Question 12. What is the rank of each type of objective statement concerned with the teaching of secondary-level computer literacy found in selected periodical literature categorized according to frequency, percent of occurrence, and authorship within this subperiod?

An examination of Tables 12 and 13 shows the objective statement mentioned most often was major facts, principles, or fundamentals with 31 of the 153 total statements (20.26%). The second most mentioned were processes, skills, and techniques with 22 of the 153 total statements (14.37%). The third most mentioned objective type was methods of thinking with 21 statements (13.72%). Higher education authors ranked methods of thinking as their first objective statement. Secondary and miscellaneous authors ranked the major facts, principles or fundamentals objective statement as their first choice.

Subperiod Summary

During the period from 1980 through 1995, the computer industry experienced massive growth. Increased functionality, user-friendliness, and affordability stimulated the computer market. The need for a computer literate society emerged as American businesses and homes acquired computers.

businesses and homes acquired computers.

During this period, 53 articles containing 153 objective statements were published concerning secondary-level computer literacy. Of these, 23 were researched-orientated with 57 objective statements. Secondary education authors contributed the most articles with (36.5%) during this time period. Secondary authors were also responsible for contributing the most objective statements with a total of 59 (38.0%). Higher education authors contributed 50 statements (33.0%). Higher education authors ranked methods of thinking as their first objective statement. Secondary education and miscellaneous authors ranked the major facts, principles or fundamentals objective statement as their first choice.

Table 1

Numerical Classification of 53 Articles Concerned with the Objectives of Secondary-Level Computer Literacy Found in the Periodical Literature Catalogued by Year and Authorship: 1980-1995

Year	Number of Articles*	Higher Education	Secondary Education	Miscellaneous
1980	0	0	0	0
1981	0	0	0	0
1982	1	0	0	1
1983	9	4	4	1
1984	4	0	1	3
1985	3	1	2	0
1986	4	1	1	2
1987	1	1	0	0
1988	4	3	1	0
1989	4	3	0	1
1990	3	0	3	0
1991	1	1	1	0
1992	3	2	1	0
1993	2	2	0	0
1994	5	0	1	4
1995	9	0	4	5
Total	53	18	19	17

*NOTE: Difference is a function of multiple authorship

Table 2

Numerical Classification of 153 Statements Concerned with the Objectives of Secondary-Level Computer Literacy Found in the Periodical Literature Catalogued by Year and Authorship: 1980-1995

Year and Authorship	Higher Education	Secondary Education	Miscellaneous	Total
1980	0	0	0	0
1981	0	0	0	0
1982	0	0	1	1
1983	12	22	0	34
1984	0	13	7	20
1985	3	5	0	8
1986	7	2	14	23
1987	3	0	0	3
1988	3	0	0	3
1989	6	0	0	6
1990	3	0	0	3
1991	1	0	0	1
1992	5	0	0	5
1993	3	0	0	3
1994	4	1	10	15
1995	0	16	12	28
Total	50	59	44	153

Table 3

Numerical and Percentage Classification of Statements of Objectives of Secondary-Level Computer Literacy Found in the Periodical Literature Catalogued According to Category, Year, and Authorship: 1980-1995

		Authorship																			
		Higher Education					Secondary Education					Miscellaneous					All Authors				
Year	Category	Knowledge	Process	Attitude	Cultural	Total	Knowledge	Process	Attitude	Cultural	Total	Knowledge	Process	Attitude	Cultural	Total	Knowledge	Process	Attitude	Cultural	Total
	1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1982	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0
	1983	5	3	1	3	11	5	12	2	3	22	0	0	0	0	0	10	15	3	6	34
	1984	0	0	0	0	0	5	2	2	4	13	3	2	0	2	7	8	4	2	6	20
	1985	1	2	0	0	3	3	1	0	1	5	0	0	0	0	0	4	3	0	1	8
	1986	3	2	1	1	7	2	0	0	0	2	6	2	2	4	14	11	4	3	5	23
	1987	0	2	1	0	3	0	0	0	0	0	0	0	0	0	0	0	2	1	0	3
	1988	2	1	0	0	3	0	0	0	0	0	0	0	0	0	0	2	1	0	0	3
	1989	2	2	1	1	6	0	0	0	0	0	0	0	0	0	0	2	2	1	1	6
	1990	1	2	0	0	3	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
	1991	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
	1992	0	4	1	0	5	0	0	0	0	0	0	0	0	0	0	0	4	1	0	5
	1993	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3
	1994	0	0	4	0	4	0	0	1	0	1	7	3	0	0	10	7	3	5	0	15
	1995	0	0	0	0	0	6	8	1	1	16	6	5	0	1	12	12	13	1	2	28
Percentage		28%	44%	18%	10%	100%	22%	39%	10%	15%	100%	50%	29%	4%	16%	100%	37%	38%	11%	14%	100%
Grand Total		14	22	9	5	50	21	23	6	9	59	22	13	2	7	44	57	58	17	21	153

Table 4

Numerical Classification of 57 Statements of Knowledge Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literacy Catalogued by Type and Year: 1980-1995

Rank	1	2	3	
Statement	Major Facts, principles, or fundamentals	Application of computer literacy to daily life	Study skills	Total
1980	0	0	0	0
1981	0	0	0	0
1982	0	0	0	0
1983	6	3	1	10
1984	5	2	1	8
1985	3	1	0	4
1986	6	3	2	11
1987	0	0	0	0
1988	1	1	0	2
1989	1	1	0	2
1990	1	0	0	1
1991	0	0	0	0
1992	0	0	0	0
1993	0	0	0	0
1994	4	3	0	7
1995	4	5	3	12
Grand Total	31	19	7	57

Table 5

Numerical and Percentage Classification of 57 Statements of Knowledge Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Type and Authorship: 1980-1995

	All Authors		Higher Education		Secondary Education		Miscellaneous	
Objective Type Statement	Total	Percentage of 56	Total	Percentage of 14	Total	Percentage of 21	Total	Percentage of 22
Major facts, principles, or fundamentals	31	54.3%	7	50.0%	11	52.0%	13	59.0%
Application of computer literacy to daily life	19	33.3%	5	35.7%	8	38.0%	6	27.0%
Study skills	7	12.2%	2	14.2%	2	9.0%	3	13.0%
Total*	57	99.5%	14	99.9%	21	99.0%	22	99.9%

*Difference is a function of rounding

Table 6

Numerical Classification of 59 Statements of Process Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Type and Year: 1980-1995

Rank	1	2	3	
Statement	Processes, Skills, and Techniques	Methods of Thinking	Research And Creativity	Total
1980	0	0	0	0
1981	0	0	0	0
1982	0	1	0	1
1983	9	3	3	15
1984	3	0	1	4
1985	1	2	0	3
1986	1	2	1	4
1987	1	0	1	2
1988	0	1	0	1
1989	0	1	1	2
1990	0	2	0	2
1991	0	1	0	1
1992	1	3	0	4
1993	2	1	0	3
1994	3	0	1	4
1995	1	5	7	13
Grand Total	22	22	15	59

Table 7

Numerical and Percentage Classification of 59 Statements of Process Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Type and Authorship: 1980-1995

All Authors			Higher Education		Secondary Education		Miscellaneous	
Objective Type Statement	Total	Percentage of 59	Total	Percentage of 22	Total	Percentage of 23	Total	Percentage of 13
Processes, skills, and techniques	22	37.0%	9	40,0%	7	30.4%	6	46.1%
Methods of thinking	22	37.0%	11	50,0%	7	30.4%	3	23.0%
Research and creativity	15	25.8%	2	9.0%	9	39.0%	4	30.7%
Total*	59	99.0%	22	99.0%	23	99.8%	13	99.8%

*Difference is a function of rounding

Table 8

Numerical Classification of 17 Statements of Attitude and Interest Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Type and Year: 1980-1995

Rank	1	2	3	
Statement	Attitudes and Appreciations	Interest and Career Development	Nature of computer literacy education and computer science professionals	Total
1980	0	0	0	0
1981	0	0	0	0
1982	0	0	0	0
1983	2	1	0	3
1984	2	0	1	3
1985	0	0	0	0
1986	2	1	0	3
1987	0	0	1	1
1988	0	0	0	0
1989	1	0	0	1
1999	0	0	0	0
1991	0	0	0	0
1992	0	1	0	1
1993	0	0	0	0
1994	4	0	0	4
1995	1	0	0	1
Grand Total	12	3	2	17

Table 9

Numerical and Percentage Classification of 17 Statements of Attitude and Interest Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Type and Authorship; 1980-1995

All Authors			Higher Education		Secondary Education		Miscellaneous	
Objective Type Statement	Total	Percentage of 17	Total	Percentage of 9	Total	Percentage of 6	Total	Percentage of 2
Attitudes and appreciations	12	70.5%	6	66.6%	4	66.6%	2	100.0%
Nature of Computer literacy education and computer science professionals	2	11.7%	1	11.1%	1	16.6%	0	0.0%
Interest and career development	3	17.6%	2	22.1%	1	16.6%	0	0.0%
Total*	17	99.8%	9	99.8%	6	100%	2	100.0%

*Difference is a function of rounding

Table 10

Numerical Classification of 21 Statements of Cultural Awareness Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Type and Year: 1980-1995

Rank	1	2	3	
Statement	Philosophical, Sociological, and Political aspects	Aesthetic aspects	Economic aspects	Total
1980	0	0	0	0
1981	0	0	0	0
1982	0	0	0	0
1983	4	2	0	6
1984	3	1	2	6
1985	1	0	0	1
1986	3	1	1	5
1987	0	0	0	0
1988	0	0	0	0
1989	0	1	0	1
1990	0	0	0	0
1991	0	0	0	0
1992	0	0	0	0
1993	0	0	0	0
1994	0	0	0	0
1995	1	1	0	2
Grand Total	12	6	3	21

Table 11

Numerical and Percentage Classification of 21 Statements of Cultural Awareness Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Type and Authorship: 1980-1995

All Authors			Higher Education		Secondary Education		Miscellaneous	
Objective Type Statement	Total	Percentage of 21	Total	Percentage of 5	Total	Percentage of 9	Total	Percentage of 7
Economic aspects	3	14.2%	0	0.0%	0	0.0%	3	42.0%
Philosophical, sociological, and political aspects	12	57.1%	4	80.0%	5	55.5%	3	42.0%
Aesthetic aspects	6	28.5%	1	20.0%	4	44.4%	1	14.0%
Total*	21	99.8%	5	100%	9	99.9%	7	100%

*Difference is function of rounding

Table 12

Statements of Objectives of Secondary-Level Computer Literacy Found in Periodical Literature According to Frequency of Occurrence: 1980-1995

Rank	Objective Type Statement	Total	Percentage
1	Major Facts, principles, or fundamentals	31	20.2%
2	Processes, skills, and techniques	22	14.3%
3	Methods of Thinking	21	13.7%
4	Application of Computer literacy to daily life	19	12.1%
5	Research and Creativity	15	9.8%
6	Philosophical, sociological, and political aspects	12	7.8%
7	Attitude and appreciations	12	7.8%
8	Study Skills	7	4.5%
9	Aesthetic aspects	6	3.9%
10	Interest and Career development	3	1.9%
11	Economic aspects	3	1.9%
12	Nature of computer literacy education and computer science professionals	2	1.3%
	Total	153	100%

Table 13

Statements of Objectives of Secondary-Level Computer Literacy Found in Periodical Literature According to Frequency of Occurrence and Authorship: 1980-1995

	Higher Education		Secondary		Miscellaneous	
Objective Statement Type	**Rank**	**Percentage of 50**	**Rank**	**Percentage of 59**	**Rank**	**Percentage of 44**
Major facts, principles, or fundamentals	3	14.0%	1	18.6%	1	29.5%
Application of computer literacy to daily life	5	10.0%	2	13.5%	2	13.6%
Study skills	7	4.0%	6	3.3%	5	6.8%
Methods of thinking	1	22.0%	3	11.8%	5	6.8%
Processes, skills, and techniques	2	18.0%	3	11.8%	2	13.6%
Research and creativity	6	4.0%	2	15.2%	3	9.0%
Attitudes and appreciations	4	12.0%	5	6.7%	6	4.5%
Interest and career development	7	4.0%	7	1.6%	8	2.2%
Nature of computer literacy education and computer science professionals	8	2.0%	7	1.6%	8	0.0%
Aesthetic aspects	8	2.0%	5	6.7%	7	2.2%
Philosophical, sociological, and political aspects	6	8.0%	4	8.4%	5	6.8%
Economic aspects	9	0.0%	8	0.0%	5	6.8%
Total*		100.0%		99.25%		101.0%

*Difference is a function of rounding

CHAPTER 5

SUBPERIOD TWO, 1992-2004

The dawn of the 21st century brought about many changes. This subperiod began with the change in presidency, from George H.W. Bush to Bill Clinton. The election illustrated a significant move from the older generation to the new "Baby Boomer" generation (Brokaw, 2004, p. 2). Moschovitis, Poole, Schuyler and Senft (1999, p. 152) described the 1992 presidential election as the "first election in history to make use of electronic computer networks for direct communication with voters." Communication was becoming state of the art with inventions such as the pager, cellular phone, and electronic mail. This subperiod also saw a rise in "user friendliness of PC's [sic] via the introduction of the Graphical User Interface by [both Apple computer's Macintosh computer and] the release of Windows 3.1" (Microsoft, 2005, Para. 17) by Microsoft Corporation. Other releases of Graphical User Interface-driven operating systems by both Microsoft and Apple contributed to the ease of use of microcomputers. Trimble (2001, p. 58) noted in 2001 that typing on a "word processor on a PC [was being replaced by] voice dictation directly into the word processor."

During this subperiod, Computer Science (which includes a study of computer literacy) emerged as its own field of study. Alavi and Carlson (1992, p. 46) observed that "as fields of research or professional practice evolve, they become objects of interest and study themselves." Authors such as Impagliazzo and Campbell-Kelly (1999, p. 5) were advocating "adding computer history" to computer literacy courses. Impagliazzo and Campbell-Kelly observed that "history [contributes] new dimensions to courses, forces students to reflect on past events, and conceptualizes their academic studies of

computing" (p. 6). Bill Gates (1996, p. 10) encouraged the creation of "Connected Learning Communities" so "schools could connect all the constituent groups [to assist] in the educational process." At the close of this subperiod Moschovitis et al. (1999, p. 277) stated that "the explosive growth of the internet...indicated a [need for a] balance between [technical systems] knowledge and management and organizational knowledge."

Analysis of Data

Question 1. What is the frequency of articles concerned with the objectives of teaching secondary-level computer literacy found in selected periodical literature categorized according to year and authorship within this subperiod?

An analysis of Table 14 shows that 78 articles concerned with the objectives for teaching secondary-level computer literacy were written during the years 1992-2004, with an average of six articles per year for the 13 years. The yearly range of articles varied from a low of two in 1993 to a high of 10 in 1996 and 2002.

Authors in the miscellaneous category contributed the most articles followed by higher education and secondary education authors. Two articles were co-authored by higher education and miscellaneous authors.

Question 2. What is the frequency of statements concerned with the objectives of teaching secondary-level computer literacy found in selected periodical literature categorized according to year and authorship within this subperiod?

Table 15 shows a total of 308 statements of objectives were found in the 78 articles written during the subperiod. The mean number of statements per article was 3.94. During the 13 years of the subperiod, the mean number of objective statements by the combined authorship was 23.69 statements per year.

Authors in higher education contributed 113 statements (36.6%), with authors in the miscellaneous category contributing 131 (42.5%). Authors in the secondary education category contributed 64 statements (20%). Eight statements were co-authored by higher education and miscellaneous authors.

Question 3. What is the frequency, rank, and percentage of statements concerned with the objectives of teaching secondary-level computer literacy found in selected periodical literature categorized according to year, category, and authorship within this subperiod?

Table 16 shows statements of objectives of secondary-level computer literacy according to year, category, and authorship. Statements in the Process category were the most frequent with a total of 124 or 40%. These were followed closely by 123 Knowledge statements, which represented 39.9% of the total. There were also 33 Attitude and Awareness statements (10.7%) and 28 Cultural Awareness statements (9%).

Of the 113 statements attributed to higher education authors, 41 were Process statements (36.2%), 14 were Attitude and Interest statements (12.3%), 42 were Knowledge statements (37.1%), and 16 were Cultural Awareness statements (14.1%). Authors in the miscellaneous category favored process statements, with a total of 56 (42.7%) of their total of 131 statements. These were followed by 55 Knowledge statements (41.9%), 12 Attitude and Interest statements (9.1%), and 8 Cultural Awareness statements (6.1%). Secondary education authors contributed 64 statements. Knowledge statements were the most common with 26 (40.6%), followed by 25 Process statements (39%). Attitude and Awareness statements were mentioned 8 times (12.5%), and Cultural Awareness statements were mentioned 5 times (7.8%).

Questions 4 and 5. What is the rank, frequency, and percentage of each Knowledge

statement concerned with the teaching of secondary-level computer literacy found in selected periodical literature, categorized according to year, type, and authorship within this subperiod?

Tables 17 and 18 are numerical and percentage classifications of 123 Knowledge objectives for the second subperiod. The three types of Knowledge objectives are major facts, principles, or fundamentals; application of computer literacy to daily life; and study skills. The most frequently cited objective was major facts, principles, and fundamentals with 56 objective statements (45.5%). The next most frequently mentioned objective was applications of computer literacy to daily life with 46 statements (37.3%). The objective cited most infrequently was study skills with 21 statements (17%). Miscellaneous authors contributed the majority of the Knowledge statements (44.1%). Higher education authors contributed 34.1%, and secondary education authors contributed 21.1%. Four statements were co-authored by higher education and miscellaneous authors.

Question 6 and 7. What are the frequency, rank, and percentage of each Process statement concerned with the teaching of secondary-level computer literacy found in selected periodical literature categorized according to year and type within this subperiod?

Tables 19 and 20 are numerical and percentage classifications of 124 Process objective statements. Process objectives are divided into three types: methods of thinking; processes, skills, and techniques; and research and creativity. The most frequently cited objective was processes, skills, and techniques with 49 statements (39.8%). The next objective most often cited was Research and Creativity with 40 statements (32.2%). There were 35 methods of thinking statements (28.2%). Authors in

the miscellaneous category made the most statements with 56 (45.1%). Higher education authors contributed 41 statements (33%), and secondary education authors contributed 27 statements (21.7%). Two statements were co-authored by higher education and miscellaneous authors.

Questions 8 and 9. What are the frequency, rank, and percentage of each Attitude and Interest statement concerned with the teaching of secondary-level computer literacy found in selected periodical literature categorized according to year and type within this subperiod?

Tables 21 and 22 are numerical and percentage classifications of 33 Attitude and Interest objective statements. Attitude and Interest objectives are divided into three types: attitudes and appreciations, nature of computer literacy education and computer science professionals, and interest and career development. The most frequently cited objective was attitudes and appreciations with 18 statements (54.5%). The next objective most often cited was interest and career development with 14 statements (42.4%). There was one nature of computer literacy education and computer science professionals statement (3%). Authors in the miscellaneous category made the most statements with 16 (48.4 %). Higher education authors contributed 10 statements (30.3%), and secondary education authors contributed seven statements (21.2%). One statement was co-authored by higher education and miscellaneous authors.

Questions 10 and 11. What is the rank, percentage, and frequency of each Cultural Awareness statement concerned with the teaching of secondary-level computer literacy found in selected periodical literature categorized according to year and type within this subperiod?

Tables 23 and 24 are numerical and percentage classifications of 28 Cultural Awareness objective statements. Cultural Awareness objectives are divided into three types: aesthetic aspects; philosophical, sociological, and political aspects; and economic aspects. With 15 statements (53.5%), philosophical, sociological, and political aspects were the most frequently cited objectives. The next objective most often cited was economic aspects with eight statements (28.5%). There were five aesthetic aspect statements (17.8%). Authors in higher education made the most statements with 17 (60.7%). Miscellaneous authors contributed eight statements (28.5%), and secondary education authors contributed four statements (14.2%). One statement was co-authored by higher education and miscellaneous authors.

Question 12. What is the rank of each type of objective statement concerned with the teaching of secondary-level computer literacy found in selected periodical literature categorized according to frequency, percent of occurrence, and authorship within this subperiod?

An examination of Tables 25 and 26 shows the objective statement mentioned most often was major facts, principles, or fundamentals with 56 of the 308 total statements (18.1%). The second most mentioned were processes, skills, and techniques with 49 of the 308 total statements (15.9%). The third most mentioned objective type was application of computer literacy to daily life with 46 statements (14.9%). The fourth most mentioned objective type was research and creativity with 40 statements (12.9%). Higher education authors ranked major facts, principles, or fundamentals as their first objective statement. Secondary education authors ranked application of computer literacy to daily life as their first choice. Miscellaneous authors ranked the processes,

skills, and techniques objective statement as their first choice. Higher education and secondary education authors ranked research and creativity as their second choice.

Subperiod Summary

The period from 1992 through 2004 saw the advent of significant data communication advances and increased accessibility to vast amounts of stored information for American consumers. The release of Graphical User interface-driven operating systems contributed to increased ease of computer usage. The field of computer literacy became an accepted member of the educational family.

During this subperiod, 78 articles containing 308 objective statements were published concerning secondary-level computer literacy. Of these, 43 were research-oriented with 112 objective statements. Miscellaneous authors contributed the most statements with 42.5% during this time. Higher education authors were responsible for 113 statements (36.6%). Secondary education authors contributed 64 statements (20.7%). Higher education authors ranked major facts, principles, or fundamentals as their first objective statement. Secondary education authors ranked application of computer literacy to daily life as their first objective statement. Miscellaneous authors ranked the processes, skills, and techniques objective statement as their first choice.

Table 14

Numerical Classification of 78 Articles Concerned with the Objectives of Secondary-Level Computer Literacy Found in the Periodical Literature Catalogued by Year and Authorship: 1992-2004

Year	Number of Articles*	Higher Education	Secondary Education	Miscellaneous
1992	3	2	1	0
1993	2	2	0	0
1994	5	0	1	4
1995	9	0	4	5
1996	10	1	2	7
1997	6	1	4	5
1998	8	4	1	3
1999	3	3	1	0
2000	4	1	0	3
2001	6	4	0	2
2002	10	2	7	2
2003	8	4	0	4
2004	4	3	0	1
Total	78	27	21	32

*Difference is a function of multiple authorship.

Table 15

Numerical Classification of 308 Statements concerned with the Objectives of Secondary-Level Computer Literacy Found in the Periodical Literature Catalogued by Year and Authorship: 1992-2004

Year and Authorship	Higher Education	Secondary Education	Miscellaneous	Total
1992	5	0	0	5
1993	3	0	0	3
1994	4	1	10	15
1995	0	17	12	29
1996	1	6	25	32
1997	1	9	10	20
1998	21	4	26	51
1999	8	6	0	14
2000	4	0	10	14
2001	24	0	8	32
2002	12	21	6	39
2003	16	0	17	33
2004	14	0	7	21
Total	113	64	131	308

Table 16

Numerical and Percentage Classification of Statements of Objectives of Secondary-Level Computer Literacy Found in the Periodical Literature Catalogued According to Category, Year, and Authorship: 1992-2004

Authorship																					
		Higher Education					Secondary Education					Miscellaneous					All Authors				
Year	Category	Knowledge	Process	Attitude	Cultural	Total	Knowledge	Process	Attitude	Cultural	Total	Knowledge	Process	Attitude	Cultural	Total	Knowledge	Process	Attitude	Cultural	Total
	1992	0	4	1	0	5	0	0	0	0	0	0	0	0	0	0	0	4	1	0	5
	1993	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3
	1994	0	0	4	0	4	0	0	1	0	1	7	3	0	0	10	7	5	3	0	15
	1995	0	0	0	0	0	6	8	1	1	16	6	5	0	1	12	12	13	2	2	29
	1996	1	0	0	0	1	3	3	0	0	6	12	8	3	2	25	16	11	3	2	32
	1997	0	0	1	0	1	3	3	3	0	9	3	4	3	0	10	6	7	7	0	20
	1998	8	8	2	3	21	2	2	0	1	5	13	8	2	2	26	23	18	4	5	51
	1999	2	5	0	1	8	1	4	0	1	6	0	0	0	0	0	3	9	0	2	14
	2000	1	0	0	3	4	0	0	0	0	0	3	7	0	0	10	4	7	0	3	14
	2001	12	7	3	2	24	0	0	0	0	0	1	6	0	1	8	13	13	3	3	32
	2002	9	1	0	2	12	11	5	3	2	21	2	4	1	0	7	21	10	4	4	39
	2003	6	6	2	2	16	0	0	0	0	0	5	8	2	2	17	11	14	4	4	33
	2004	3	7	1	3	14	0	0	0	0	0	3	3	1	0	7	6	10	2	3	21
Percentage*		37%	36%	12%	14%	99%	40%	39%	12%	7%	99%	41%	42%	9%	6%	99%	39%	40%	10%	9%	100%
Grand Total		42	41	14	16	113	26	25	8	5	64	55	56	12	8	131	123	124	33	28	308

* Difference is a function of rounding

Table 17

Numerical Classification of 123 Statements of Knowledge Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literacy Catalogued by Type and Year: 1992-2004

Rank	1	2	3	
Statement	Major Facts, principles, or fundamentals	Application of computer literacy to daily life	Study skills	Total
1992	0	0	0	0
1993	0	0	0	0
1994	4	3	0	7
1995	4	5	3	12
1996	8	8	0	16
1997	1	1	4	6
1998	9	10	4	23
1999	3	0	0	3
2000	2	1	1	4
2001	3	6	4	13
2002	13	6	1	20
2003	7	3	1	11
2004	2	3	1	6
Grand Total	56	46	21	123

Table 18

Numerical and Percentage Classification of 123 Statements of Knowledge Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by type and Authorship: 1992-2004

	All Authors		Higher Education		Secondary Education		Miscellaneous	
Objective Type Statement	Total	Percentage of 123	Total	Percentage of 42	Total	Percentage of 26	Total	Percentage of 53
Major facts, principles, or fundamentals	56	45.5%	17	40.2%	9	34.6%	26	47.2%
Application of computer literacy to daily life	46	37.3%	15	35.7%	12	46.1%	20	36.3%
Study skills	21	17.0%	10	23.8%	5	19.2%	9	16.3%
Total*	123	99.8%	42	99.9%	26	100.0%	55	99.8%

*Difference is a function of rounding

Table 19

Numerical Classification of 124 Statements of Process Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Type and Year: 1992-2004

Rank	1	2	3	
Statement	Processes, Skills, and Techniques	Methods of Thinking	Research And Creativity	Total
1992	1	3	0	4
1993	2	1	0	3
1994	3	1	1	5
1995	0	5	8	13
1996	9	0	2	11
1997	3	2	2	7
1998	8	4	6	18
1999	3	2	4	9
2000	2	3	2	7
2001	5	4	4	13
2002	5	2	3	10
2003	5	2	7	14
2004	3	6	1	10
Grand Total	49	35	40	124

Table 20

Numerical and Percentage Classification of 124 Statements of Process Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Type and Authorship: 1992-2004

	All Authors		Higher Education		Secondary Education		Miscellaneous	
Objective Type Statement	Total	Percentage of 124	Total	Percentage of 41	Total	Percentage of 27	Total	Percentage of 56
Processes, skills, and techniques	49	39.8%	12	29.2%	8	29.6%	29	51.7%
Methods of Thinking	35	28.2%	13	31.7%	7	25.9%	15	26.7%
Research and Creativity	40	32.2%	16	39%	12	44.4%	12	21.4%
Total*	124	100.2%	41	99.9%	27	99.9%	56	99.8%

*Difference is a function of rounding

Table 21

Numerical Classification of 33 Statements of Attitude and Interest Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Type and Year: 1992-2004

Rank	1	2	3	
Statement	Attitudes and appreciations	Interest and career development	Nature of computer literacy education and computer science professionals	Total
1992	0	1	0	1
1993	0	0	0	0
1994	3	0	0	3
1995	1	1	0	2
1996	0	2	1	3
1997	4	3	0	7
1998	2	2	0	4
1999	0	0	0	0
2000	0	0	0	0
2001	2	1	0	3
2002	1	3	0	4
2003	3	1	0	4
2004	2	0	0	2
Grand Total	18	14	1	33

Table 22

Numerical and Percentage Classification of 33 Statements of Attitude and Interest Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Type and Authorship; 1992-2004

	All Authors		Higher Education		Secondary Education		Miscellaneous	
Objective Type Statement	Total	Percentage of 33	Total	Percentage of 10	Total	Percentage of 7	Total	Percentage of 16
Attitudes and Appreciations	18	54.5%	7	70.0%	0	0.0%	11	68.7%
Nature of computer literacy education and computer science professionals	1	3.0%	0	0.0%	0	0.0%	1	6.2%
Interest and career Development	14	42.4%	3	30.0%	7	100.0%	4	25.0%
Total*	33	99.9%	10	100.0%	7	100.0%	16	99.9%

*Difference is a function of rounding

Table 23

Numerical Classification of 28 Statements of Cultural Awareness Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Type and Year: 1992-2004

Rank	1	2	3	
Statement	Philosophical, sociological, and political aspects	Economic aspects	Aesthetic Aspects	Total
1992	0	0	0	0
1993	0	0	0	0
1994	0	0	0	0
1995	1	0	1	2
1996	1	1	0	2
1997	0	0	0	0
1998	2	2	1	5
1999	2	0	0	2
2000	1	1	1	3
2001	2	1	0	3
2002	2	1	1	4
2003	3	1	0	4
2004	1	1	1	3
Grand Total	15	8	5	28

Table 24

Numerical and Percentage Classification of 28 Statements of Cultural Awareness Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Type and Authorship: 1992-2004

	All Authors		Higher Education		Secondary Education		Miscellaneous	
Objective Type Statement	Total	Percentage of 28	Total	Percentage of 17	Total	Percentage of 4	Total	Percentage of 8
Economic aspects	8	28.5%	5	29.4%	0	0.0%	3	37.5%
Philosophical, sociological, and political aspects	15	53.5%	7	41.1%	3	75.0%	5	62.5%
Aesthetic	5	17.8%	5	29.4%	1	25.0%	0	0.0%
Total	28	99.8%	17	100.0%	4	100.0%	8	100.0%

Table 25

Statements of Objectives of Secondary-Level Computer Literacy Found in Periodical Literature According to Frequency of Occurrence: 1992-2004

Rank	Objective Type Statement	Total	Percentage
1	Major facts, principles, or fundamentals	56	18.1%
2	Processes, skills, and techniques	49	15.9%
3	Application of computer literacy to daily life	46	14.9%
4	Research and creativity	40	12.9%
5	Methods of thinking	35	11.3%
6	Study skills	21	6.8%
7	Attitudes and appreciations	18	5.8%
8	Philosophical, sociological, and political aspects	15	4.8%
9	Interest and career development	14	4.5%
10	Economic aspects	8	2.5%
11	Aesthetic aspects	5	1.6%
12	Nature of computer literacy education and computer science professionals	1	.3%
	Total	308	100%

Table 26

Statements of Objectives of Secondary-Level Computer Literacy Found in Periodical Literature According to Frequency of Occurrence and Authorship: 1992-2004

	Higher Education		Secondary Education		Miscellaneous	
Objective Statement Type	**Rank**	**Percentage of 113**	**Rank**	**Percentage of 64**	**Rank**	**Percentage of 131**
Major facts, principles, or fundamentals	1	15.0%	3	14.0%	2	19.8%
Application of computer literacy to daily life	3	13.2%	1	18.7%	3	15.2%
Study skills	6	8.8%	7	6.2%	7	6.8%
Methods of thinking	4	12.0%	5	10.9%	4	11.4%
Processes, skills, and techniques	5	10.6%	4	12.5%	1	22.1%
Research and creativity	2	14.1%	2	18.7%	5	9.1%
Attitudes and appreciations	7	6.1%	10	0.0%	6	8.3%
Interest and career development	11	2.5%	6	10.9%	9	3.0%
Nature of computer literacy education and computer science professionals	12	0.0%	11	0.0%	11	.7%
Aesthetic aspects	9	4.4%	9	1.5%	12	0.0%
Philosophical, sociological, and political aspects	8	6.1%	8	4.6%	8	2.2%
Economic aspects	10	4.4%	12	0.0%	10	2.3%
Total*		98.2%		98.0%		102.4%

*Difference a function of rounding

CHAPTER 6

SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This study identified and classified stated objectives that may have become operating guidelines for secondary school computer literacy teachers during the period of 1980-2004.

Findings Across Subperiods One and Two

The period of 1980-2004 saw rapid advancements in the field of computer science. Professionals in the field of computer literacy attempted to keep pace with evolving technology in order to delineate and define the objectives of computer literacy. An analysis of the results within and across the two subperiods reveals that the same four objective categories identified in the Ogden (1972) chemistry study, the Ogden & Jackson (1974) biology study, the Roy (1979) earth science study, the Woodard (1982) college freshman English study, the Mills (1990) college freshman English study, the Sehr (1993) physics study, the Hemby (2000) secondary school science study, the Huff (2002) secondary school physical education study, and the Graves (2005) college freshman computer literacy study were found applicable in the 1980-2004 secondary computer literacy investigation. All objective categories were found across both subperiods. Research questions for each subperiod were analyzed across both subperiods.

Question 1: Frequency of Articles Catalogued by Subperiod and Authorship Across Subperiods

An examination of Table 27 shows the number of articles increased from Subperiod One through Subperiod Two. Secondary education authors produced the most

articles during Subperiod One. Miscellaneous authors produced the most during Subperiod Two. The percentage of articles contributed by miscellaneous authors increased from 32.6% in Subperiod One to 41% in Subperiod Two. The percentage of articles produced by Secondary Education authors decreased from 36.5% in Subperiod One to 26.9% in Subperiod Two. Articles by Higher Education authors remained consistent with 34.6% from Subperiod One through Subperiod Two.

Question 2: Frequency of Statements Catalogued by Subperiod and Authorship Across Subperiods

The data presented in Table 28 show that the most frequent statements of objectives for teaching secondary-level computer literacy occurred in Subperiod Two. There was an increase in the number of statements from Subperiod One (153) through Subperiod Two (308). Authors in secondary education contributed the most statements in Subperiod One and the least statements in Subperiod Two. Miscellaneous authors contributed the least statements in Subperiod One and the most statements in Subperiod Two. Statements by higher education authors more than doubled from Subperiod One through Subperiod Two, although their relative percentage remained the same. Statements by secondary education authors increased only slightly from Subperiod One through Subperiod Two.

Question 3: Frequency, Rank, and Percentage of Statements Catalogued by Subperiod, Category, and Authorship Across Subperiods

Tables 29 and 30 show that statements in the Process category were most frequent in Subperiod One and Subperiod Two. Statements in the Knowledge category were the second most frequent in Subperiod One and Subperiod Two. The order of frequency for

the first subperiod was Process, Knowledge, Cultural Awareness, and Attitude and Interest. In the second subperiod, the order was Process, Knowledge, Attitude and Interest, and Cultural Awareness. Across the subperiods, the greatest change among the categories was a 4.7% decrease in Cultural Awareness objective statements as a factor of the total objective statements. Knowledge, and Process objective statements increased slightly as percentages of the total from the first subperiod through the second subperiod. In Subperiod One, secondary education and higher education authors ranked Process objectives as most abundant, while miscellaneous authors discussed Knowledge objectives more frequently. In Subperiod Two, miscellaneous authors discussed Process objectives more often, while higher education and secondary education authors cited Knowledge objectives more frequently.

During the time of the study, higher education authors placed an increased importance upon Knowledge, and Process objectives. Secondary Education authors increased their contributions of Knowledge, Process, and Attitude and Interest statements, while their discussion of Cultural Awareness objectives decreased. Miscellaneous authors increased emphasis on Process and Attitude and Interest topics during the study, while their focus on Cultural Awareness and Knowledge objectives declined. The greatest percentage change in a single category was the 12% increase in Process by miscellaneous authors.

Questions 4 and 5: Rank, Frequency, and Percentage of Knowledge Statements Catalogued by Subperiod, Type, and Authorship Across Subperiods

Tables 31 and 32 show that within the Knowledge, category the total objective statements of major facts, principles, or fundamentals ranked the highest in both

subperiods. The total number of Knowledge statements increased by 66 between Subperiod One and Subperiod Two. Authors in the higher education and miscellaneous categories consistently ranked major facts, principles, or fundamentals as most important during both subperiods. Authors in secondary education ranked major facts, principles, or fundamentals as most important during the first subperiod and application of computer literacy to daily life as most important during the second subperiod. Authors in the higher education and the miscellaneous categories consistently ranked application of computer literacy to daily life as second most important during both subperiods. All three author groups ranked study skills last in both subperiods.

Questions 6 and 7: Rank, Frequency, and Percentage of Process Statements Catalogued by Subperiod, Type, and Authorship Across Subperiods

An analysis of Tables 33 and 34 reveals that during both subperiods, authors in secondary education consistently wrote more about research and creativity, followed by processes, skills, and techniques, and then methods of thinking. Authors in higher education wrote about research and creativity the least in Subperiod One and increased to the most in Subperiod Two. Miscellaneous authors increased from having the least amount of Process objective statements in Subperiod One to having the most in Subperiod Two. There was a change in focus of objective statements between the two subperiods. The percentage change in objective statements throughout the two subperiods saw an increase in over 6% in research and creativity objective statements, while experiencing an 8% decrease in methods of thinking objective statements.

Questions 8 and 9: Rank, Frequency, and Percentage of Attitude and Interest Statements Catalogued by Subperiod, Type, and Authorship Across Subperiod

Analysis of Tables 35 and 36 indicates during both subperiods, authors in the miscellaneous category consistently ranked attitudes and appreciations first. Authors in the higher education category consistently ranked attitudes and appreciation first, followed by interest and career development next, and nature of computer literacy education and computer science professionals last during both subperiods.

The greatest change in total percentage across the two subperiods was interest and career development, with a 24.8% increase from Subperiod One through Subperiod Two. Attitudes and appreciations experienced a 16% decrease across the two subperiods. The largest percentage change across the two subperiods for a single objective in one author group was the 83% increase of interest and career development among secondary education authors.

Questions 10 and 11: Rank, Frequency, and Percentage of Cultural Awareness Statements Catalogued by Subperiod, Type, and Authorship Across Subperiods

An examination of Tables 37 and 38 shows that the philosophical, sociological, and political objective statements were discussed most by higher education and secondary authors across both subperiods. Authors in the higher education and the secondary education categories discussed aesthetic aspects the second most frequently during both subperiods.

The greatest increase occurred with a 29% rise in statements concerning Economic aspects written by higher education authors between the two subperiods. The greatest decrease occurred with a 39% drop in statements concerning philosophical, sociological and political aspects written by higher education authors between the two subperiods. A 20% drop in philosophical, sociological, and political aspects written by

miscellaneous authors was also revealed during the two subperiods.

Question 12: Rank of Statement Types Catalogued by Frequency, Percentage, and Authorship Across Subperiods

An examination of Tables 39 and 40 shows that the major facts, principles, or fundamentals objective statements were the most frequently discussed by the total author groups between both subperiods. All authors combined also discussed processes, skills and techniques as the second most frequently cited objectives throughout both subperiods. Authors in all three categories consistently discussed nature of computer literacy education and computer science professionals the least frequently throughout both subperiods.

Table 27

Numerical and Percentage Classification of Articles Concerned with the Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Subperiod and Authorship: 1980-2004

	Subperiod 1		Subperiod 2	
Authorship	**Number of Articles**	**Percentage**	**Number of Articles**	**Percentage**
Higher Education	18	34.6%	27	34.6%
Secondary Education	19	36.5%	21	26.9%
Miscellaneous	17	32.6%	32	41.0%
Total*	53	103.0%	78	102.0%

*Difference is a function of multiple authorship

Table 28

Numerical Classification of Statements Concerned with the Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Subperiod and Authorship: 1980-2004

Subperiod and Authorship	1	2
Higher Education	50	113
Secondary Education	59	64
Miscellaneous	44	131
Total	153	308

Table 29

Numerical Classification of Statements of Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Subperiod, Category, and Authorship: 1980-2004

Subperiod		1	2
Authorship	Category		
Higher Education	Knowledge	14	42
	Process	22	41
	Attitude and Interest	9	14
	Cultural Awareness	5	16
	Total	50	113
Secondary Education	Knowledge	21	26
	Process	23	25
	Attitude and Interest	6	8
	Cultural Awareness	9	5
	Total	59	64
Miscellaneous	Knowledge	22	55
	Process	13	56
	Attitude and Interest	2	12
	Cultural Awareness	7	8
	Total	44	131
All Authors	Knowledge	57	123
	Process	58	124
	Attitude and Interest	17	33
	Cultural Awareness	21	28
	Total	153	308

Table 30

Percentage Classification of Statements of Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Subperiod, Category, and Authorship: 1980-2004

Subperiod		1	2
Authorship	Category		
Higher Education	Knowledge	28.0%	37.1%
	Process	44.0%	36.3%
	Attitude and Interest	18.0%	12.3%
	Cultural Awareness	10.0%	14.1%
	Total	100.0%	99.6%
Secondary Education	Knowledge	35.5%	40.6%
	Process	38.9%	39.0%
	Attitude and Interest	10.1%	12.5%
	Cultural Awareness	15.2%	7.8%
	Total	100.0%	99.9%
Miscellaneous	Knowledge	50.0%	41.9%
	Process	30.0%	42.7%
	Attitude and Interest	4.0%	9.1%
	Cultural Awareness	16.0%	6.1%
	Total	100.0%	99.8%
All Authors	Knowledge	37.2%	39.9%
	Process	37.9%	40.2%
	Attitude and Interest	11.1%	10.7%
	Cultural Awareness	13.7%	9.0%
	Total*	99.9%	99.8%

*Difference is a function of rounding

Table 31

Numerical Classification of Statements of Knowledge Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Type, Subperiod, and Authorship: 1980-2004

	Authorship							
	All Authors		Higher Education		Secondary Education		Miscellaneous	
Objective Type Statement	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2
Major facts, principles, or fundamentals	31	56	7	17	11	9	13	26
Application of computer literacy to daily life	19	46	5	15	8	12	6	20
Study skills	7	21	2	10	2	5	3	9
Total	57	123	14	42	21	26	22	55

Table 32

Percentage Classification of Statements of Knowledge Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Type, Subperiod, and Authorship: 1980-2004

	Authorship							
	All Authors		Higher Education		Secondary Education		Miscellaneous	
Objective Type Statement	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2
Major facts, principles, or fundamentals	54.3%	45.5%	50.0%	40.4%	52.0%	34.6%	59.0%	47.2%
Application of computer literacy to daily life	33.3%	37.3%	35.7%	35.7%	38.0%	46.1%	27.0%	36.3%
Study skills	12.2%	17.0.%	14.2%	23.8%	9.0%	19.2%	13.0%	16.3%
Total*	99.5%	99.8%	99.9%	100.0%	99.0%	99.9%	99.9%	99.8%

*Difference is a function of rounding

Table 33

Numerical Classification of Statements of Process Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Type, Subperiod, and Authorship: 1980-2004

	Authorship							
	All Authors		Higher Education		Secondary Education		Miscellaneous	
Objective Type Statement	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2
Processes, skills, and techniques	22	49	9	12	7	8	6	29
Methods of thinking	21	35	11	13	7	7	3	15
Research and creativity	15	40	2	16	9	12	4	12
Total	58	124	22	41	23	27	13	56

Table 34

Percentage Classification of Statements of Process Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Type, Subperiod, and Authorship: 1980-2004

	Authorship							
	All Authors		Higher Education		Secondary Education		Miscellaneous	
Objective Type Statement	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2
Processes, skills, and techniques	37.9%	39.5%	40.0%	29.2%	30.4%	29.6%	46.1%	51.7%
Methods of thinking	36.2%	28.2%	50.0%	31.7%	30.4%	25.9%	23.0%	26.7%
Research and creativity	25.8%	32.2%	9.0%	39.0%	39.0%	44.4%	30.7%	21.4%
Total*	99.9%	99.9%	99.9%	99.9%	99.8%	99.9%	99.8%	99.8%

*Difference is a function of rounding

Table 35

Numerical Classification of Statements of Attitudes and Interest Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Type, Subperiod, and Authorship: 1980-2004

	Authorship							
	All Authors		Higher Education		Secondary Education		Miscellaneous	
Objective Type Statement	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2
Attitudes and appreciations	12	18	6	7	4	0	2	11
Nature of computer literacy education and computer science professionals	2	1	1	0	1	0	0	1
Interest and career development	3	14	2	3	1	7	0	4
Total	17	33	9	10	6	7	2	16

Table 36

Percentage Classification of Statements of Attitudes and Interest Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Type, Subperiod, and Authorship: 1980-2004

	Authorship							
	All Authors		Higher Education		Secondary Education		Miscellaneous	
Objective Type Statement	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2
Attitudes and appreciations	70.5%	54.5%	66.6%	70.0%	66.6%	0.0%	83.3%	68.7%
Nature of computer literacy education and computer science professionals	11.7%	3.0%	11.1%	0.0%	16.6%	0.0%	0.0%	6.2%
Interest and career development	17.6%	42.4%	22.1%	30.0%	16.6%	100.0%	0.0%	25.0%
Total*	99.8%	99.9%	99.8%	100.0%	100.0%	100.0%	100.0%	99.9%

*Difference is a function of rounding

Table 37

Numerical Classification of Statements of Cultural Awareness Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Type, Subperiod, and Authorship: 1980-2004

	Authorship							
	All Authors		Higher Education		Secondary Education		Miscellaneous	
Objective Type Statement	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2
Economic aspects	3	8	0	5	0	0	3	3
Philosophical, sociological, and political aspects	12	15	4	7	5	3	3	5
Aesthetic aspects	6	5	1	5	4	1	1	0
Total	21	28	5	17	9	4	7	8

Table 38

Percentage Classification of Statements of Cultural Awareness Objectives of Secondary-Level Computer Literacy Teaching Found in Periodical Literature Catalogued by Type, Subperiod, and Authorship: 1980-2004

	Authorship							
	All Authors		Higher Education		Secondary Education		Miscellaneous	
Objective Type Statement	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2	Subperiod 1	Subperiod 2
Economic aspects	14.2%	28.5%	0.0%	29.4%	0.0%	0.0%	42.0%	37.5%
Philosophical sociological, and political aspects	57.1%	53.5%	80.0%	41.1%	55.5%	75.0%	42.0%	62.5%
Aesthetic aspects	28.5%	17.8%	20.0%	29.4%	44.5%	25.0%	14.0%	0.0%
Total*	99.8%	99.8%	100.-%	100.-%	100.0%	100.0%	100.0%	100.0%

*Difference is a function of rounding

Table 39

Numerical Ranking of Statements of Objectives of Secondary-Level Computer Literacy Found in Periodical Literature Catalogued by Type, Subperiod, and Authorship: 1980-2004

Rank by Subperiod		Objective Type Statement	Number of Statements by Subperiod	
1	2		1	2
1	1	**Major facts, principles, or fundamentals**		
		All Authors	31	56
		Higher Education	7	17
		Secondary Education	11	9
		Miscellaneous	13	26
2	2	**Processes, skills, and techniques**		
		All Authors	22	49
		Higher Education	9	12
		Secondary Education	7	8
		Miscellaneous	6	29
3	5	**Methods of thinking**		
		All Authors	21	35
		Higher Education	11	13
		Secondary Education	7	7
		Miscellaneous	3	15
4	3	**Application of computer literacy to daily life**		
		All Authors	19	46
		Higher Education	5	15
		Secondary Education	8	12
		Miscellaneous	6	20
5	4	**Research and creativity**		
		All Authors	15	40
		Higher Education	2	16
		Secondary Education	9	12
		Miscellaneous	4	12
6	8	**Philosophical, sociological, and political aspects**		
		All Authors	12	15
		Higher Education	4	7
		Secondary Education	5	3
		Miscellaneous	3	5

Table 39 (continues)

Rank by Subperiod		Objective Type Statement	Number of Statements by Subperiod	
1	2		1	2
7	7	**Attitudes and appreciation**		
		All Authors	12	18
		Higher Education	6	7
		Secondary Education	4	0
		Miscellaneous	2	11
8	11	**Aesthetic aspects**		
		All Authors	6	5
		Higher Education	1	4
		Secondary Education	4	1
		Miscellaneous	1	0
9	6	**Study skills**		
		All Authors	7	21
		Higher Education	2	10
		Secondary Education	2	5
		Miscellaneous	3	9
10	9	**Interest and career development**		
		All Authors	3	14
		Higher Education	2	3
		Secondary Education	1	7
		Miscellaneous	0	4
11	10	**Economic**		
		All Authors	3	8
		Higher Education	0	5
		Secondary Education	0	0
		Miscellaneous	3	3
12	12	**Nature of computer literacy education and computer science professionals**	2	1
		All Authors	1	0
		Higher Education	1	0
		Secondary Education	0	1
		Miscellaneous		

Table 40

Percentage Ranking of Statements of Objectives of Secondary-Level Computer Literacy Found in Periodical Literature Catalogued by Type, Subperiod, and Authorship: 1980-2004

Rank by Subperiod		Objective Type Statement	Percentage of Statements by Subperiod	
1	2		1	2
1	1	**Major facts, principles, or fundamentals**		
		All Authors	20.0%	18.1%
		Higher Education	4.5%	5.5%
		Secondary Education	7.1%	2.9%
		Miscellaneous	8.4%	8.4%
2	2	**Processes, skills, and techniques**		
		All Authors	14.3%	5.9%
		Higher Education	5.8%	3.8 %
		Secondary Education	4.5%	2.5%
		Miscellaneous	3.9%	9.4%
3	5	**Methods of thinking**		
		All Authors	13.7%	11.3%
		Higher Education	7.1%	4.2%
		Secondary Education	4.5%	2.2%
		Miscellaneous	1.9%	4.8%
4	3	**Application of computer literacy to daily life**		
		All Authors	12.4%	14.9%
		Higher Education	3.2%	4.8%
		Secondary Education	5.2%	3.8%
		Miscellaneous	3.9%	6.4%
5	4	**Research and creativity**		
		All Authors	9.8%	12.9%
		Higher Education	1.3%	5.1%
		Secondary Education	5.8%	3.8%
		Miscellaneous	2.6%	3.8%
6	8	**Philosophical, sociological, and political aspects**		
		All Authors	7.8%	4.8%
		Higher Education	2.6%	2.2%
		Secondary Education	3.2%	.9%
		Miscellaneous	1.9%	1.6%

Table 40 (continues)

Rank by Subperiod		Objective Type Statement	Percentage of Statements by Subperiod	
1	2		1	2
7	7	**Attitudes and appreciation**		
		All Authors	7.8%	5.8%
		Higher Education	3.9%	2.2%
		Secondary Education	2.6%	0.0%
		Miscellaneous	1.3%	3.5%
8	11	**Aesthetic aspects**		
		All Authors	3.9%	1.6%
		Higher Education	.6%	1.6%
		Secondary Education	2.6%	.3%
		Miscellaneous	.6%	0.0%
9	6	**Study skills**		
		All Authors	4.5%	6.8%
		Higher Education	1.3%	3.2%
		Secondary Education	1.3%	1.6%
		Miscellaneous	1.9%	2.9%
10	9	**Interest and creativity**		
		All Authors	1.9%	4.5%
		Higher Education	1.3%	.9%
		Secondary Education	.6%	2.2%
		Miscellaneous	0.0%	1.2%
11	10	**Economic**		
		All Authors	1.9%	2.5%
		Higher Education	0.0%	1.6%
		Secondary Education	0.0%	0.0%
		Miscellaneous	1.9%	.9%
12	12	**Nature of computer literacy education and computer science professionals**	1.3%	.3%
		All Authors	.6%	0.0%
		Higher Education	.6%	0.0%
		Secondary Education	0.0%	.3%
		Miscellaneous		

Summary of Findings

Based on an analysis of the results across both subperiods, the major findings of this investigation included the following:

1. The number of articles relating to objectives for teaching secondary-level computer literacy increased during the time of the study.

2. The number of articles by miscellaneous authors increased more significantly than articles by authors in the higher education and secondary education categories from Subperiod One through Subperiod Two.

3. Authors in the miscellaneous category produced the least articles and statements in Subperiod One, while producing the most articles and statements in Subperiod Two.

4. Authors in the secondary education category produced the most articles and statements in Subperiod One, while producing the least articles and statements in Subperiod Two.

5. Statements in the Knowledge category were most frequent in the two subperiods.

6. Nature of computer literacy education and computer science professionals objectives were consistently ranked as least important throughout the study.

7. During both subperiods, the most important objectives for secondary-level computer literacy instruction were major facts, principles, or fundamentals (from the Knowledge category). The second most important objective during both subperiods was processes, skills, and techniques (from the Process category). During the first subperiod,

the third most important objective was Methods of Thinking (from the Process category).

8. Authors in higher education were responsible for most of the research-oriented articles and statements throughout the study. Miscellaneous authors were responsible for the least.

9. A steady decrease in the importance of philosophical, sociological, and political aspects occurred across the study.

10. Increased emphasis was placed on research and creativity.

11. A noticeable affiliation between higher education authors and miscellaneous authors working together emerged.

Conclusions

Based on the findings of this investigation, the following conclusions were made:

1. The objectives for teaching secondary-level computer literacy were influenced by historical events, especially the launching of the Soviet satellite, Sputnik I, the Cold War, the creation and marketing of the microcomputer chip, and the advent of the Internet.

2. Authors from higher education wrote more research-oriented articles about the objectives for the teaching of secondary-level computer literacy than those in the other categories. This is probably a reflection of the training and preparation endemic to higher education authors as compared to secondary education and miscellaneous authors.

3. The most important objectives for secondary-level computer literacy teaching were major facts, principles, or fundamental, and processes, skills, and techniques. The focus on these objectives is probably in response to the educational acquisition of rapidly evolving computer technology.

4. This is the first time in the series of objective studies that an investigation demonstrated that authors outside the field of education have produced the most articles during a subperiod. Authors in the miscellaneous category were often affiliated with computer software companies. This is perhaps the result of industry efforts to sell products to educational systems.

5. A significant number of the secondary education authors were primarily occupied with computer assisted learning rather than computer literacy education as a separate entity.

Recommendations for Further Study

1. While researching this study, it became evident that a significant increase in articles by miscellaneous authors occurred. It is recommended that the affiliation of these authors with the computer industry be examined to determine a possible link between authorship and specific corporations.

2. During the course of this study, the author noticed a collaboration between higher education authors and miscellaneous authors affiliated with the computer industry. It is recommended that the role of higher education in promoting business interests be examined.

3. It is recommended that textbooks currently in use to teach secondary-level computer literacy courses be examined to determine stated objectives.

4. A significant number of secondary authors were primarily concerned with computer assisted learning rather than computer literacy education as a separate entity. It is recommended that articles about the objective of computer assisted learning in the secondary schools be examined.

5. During the course of this study, the author noticed a number of articles refuting the need for computer literacy education in the secondary school. It is recommended that these articles be examined and a study conducted to ascertain the merit of their argument.

6. It is recommended that articles about computer literacy objectives in the elementary school be examined.

7. Committee reports, editorials, book reviews, convention reports, and critiques of committee reports were beyond the scope of this study. It is recommended that they be examined to determine stated objectives for teaching secondary-level computer literacy.

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APPENDIX A

SUBPERIOD ONE SELECTED JOURNAL ARTICLES

Adams, J. (1984). Networked computers promote computer literacy and computer-assisted instruction. *T.H.E. Journal, 84,* 95-99.

Baker, G., Boser, R. A., & Householder, D. L. (1992). Coping at the crossroads: Societal and educational transformation in the United States. *The Journal of Technology Education, 4,* 110-119.

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APPENDIX B

SUBPERIOD TWO SELECTED JOURNAL ARTICLES

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APPENDIX C

ARTICLE CLASSIFICATION SHEET

Article/ Objective Selection Criteria	1. Article presents an expression of opinion and/or the result of formal research.	Yes No
	2. Objective statements are explicitly stated by author, not implied.	Yes No
	3. Article is concerned with teaching college freshman level computer literacy.	Yes No
	4. Article is not an editorial, letter to editor, book review, nor convention report.	Yes No
	5. Article is not a committee report nor a critique of a committee report.	Yes No

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Name of Author: _____

Name of Article: _____

Title of Publication: _____

Volume; Issue number, or month of publication: _____

Year of Publication: _____ Page Numbers: _____

Authorship:

H: Higher Education: college or university teacher or administrator, junior college teacher, retired member of the above, and doctoral student.

S: Secondary Education: classroom teacher, school administrator subject matter supervisor or consultant, retired member of the above, and student seeking a master's degree.

M: Miscellaneous: All authors holding occupations other than those listed above. _____

Objective Class

R. Research-oriented: Objectives based on empirical evidence.

N. Non research-Oriented: Objectives based on author's opinion. _____

Objective Category and Type Given in Total Numbers

(1) Knowledge Objectives:
- (a) Major facts, principles, or fundamentals _____
- (b) Applications of computer literacy to daily life _____
- (c) Study skills _____

(2) Process Objectives:
- (a) Methods of thinking _____
- (b) Process skills and techniques _____
- (c) Research and creativity _____

(3) Attitude and Interest:
- (a) Attitudes and appreciations _____
- (b) Interest and career development _____
- (c) Nature of computer literacy education and computer science professionals _____

(4) Cultural Awareness Objectives:
- (a) Aesthetic aspects _____
- (b) Philosophical, sociological, and political aspects _____
- (c) Economic aspects _____

Objective Statements
Page/line _____

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VITA

Karen Waugh was born in Denver City, Texas on June 17, 1956, the daughter of Iona Wagley and Allen Wagley. After graduating from Frankston High School, Frankston, Texas, in 1974, she moved to Europe and resided for several years. In 1987, she enrolled in Stephen F. Austin State University, Nagodoches, Texas. She received the Master of Arts degree in 1992. She taught history in Palestine High School, Palestine, Texas, for several years before becoming employed as an instructor of history and political science at Jacksonville Baptist College, Jacksonville, Texas. She served as Department Chairperson for the Social Sciences of Jacksonville Baptist College from 1996 to 1999. She was employed as an instructor of history and political science at Navarro College, Corsicana, Texas in 2000 and has continued in that position to the present. She is currently the Department Coordinator for the Social Sciences at Navarro College. In the fall of 1998, she entered the Graduate School of Texas A&M University-Commerce and was awarded the Doctor of Education degree with a major in Supervision, Curriculum, and Instruction-Higher Education in August of 2006. She is married to John Dennis Waugh of Corsicana. She has two sons, Jordan and Isaac, and one daughter, Alex.

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