AN ABSTRACT OF THE THESIS OF

Chin-Yen David Lin for the degree of Doctor of Philosophy

in Vocational Education presented on June 12, 1986

Title: A Study of the Factors That Influence Industrial Education Instructors to Use Computers

Redacted for Privacy

Abstract approved: Warren N. Suzuki

The purposes of this study were to identify factors that influence industrial education teachers to use computers in their instruction and to explain the relationships among these factors. For the purposes of this study, the term "to use computers" meant use of computers in one or more of the following aspects: computer-assisted instruction, computer-managed instruction, a utility, and/or as course content.

Based on a theory proposed by Fishbein and Ajzen, the subjects' intentions to use computers were regarded as indicators of actual use. This factor was in turn predicted by four other factors: attitude, subjective norm, belief, and normative belief. Two additional factors, computer literacy and accessibility, were suggested as influencing the belief and normative belief toward using computers. A causal model was presented to indicate these relationships.

Questionnaires were mailed to 210 randomly selected Oregon secondary industrial education teachers during March of 1986. The response rate was 80.1 percent. The internal consistency reliability coefficients of factors ranged from .82 to .92. Multiple regression and partial correlation were employed to verify the proposed causal model.

It was concluded that industrial education teachers' intentions to use computers were influenced by their attitudes and their perceptions of the opinions of others (subjective norms) toward their using computers. Their attitudes were influenced by subjective norms and their beliefs toward using computers; and their subjective norms were influenced by related normative beliefs. Their beliefs and normative beliefs toward using computers were influenced by their knowledge of computers and the perception of accessibility to computer systems. Changing computer literacy, accessibility and opinions of significant others were found to be three means for encouraging industrial education teachers to use computers. In this study, the most influential significant others were educational experts. Computer hardware was perceived accessible only if located in the teachers' office, laboratory or classroom.

A Study of the Factors That Influence Industrial Education Instructors to Use Computers

by

Chin-Yen David Lin

A THESIS

submitted to

Oregon State University

in partial fulfillment of
the requirments for the degree of

Doctor of Philosophy

Completed June 12, 1986

Commencement June 1987

APPROVED:

Redacted for Privacy

Associate Professor of Vocational Education in charge of major

Redacted for Privacy

Chair of the Department of Vocational and Technical Education

Redacted for Privacy

Dean of Graduate School

Date thesis is presented June 12, 1986

Typed by Chin-Yen David Lin for Chin-Yen David Lin

ACKNOWLEDGEMENTS

This research was made possible by the assistance of many people. Particuarly, I want to express my sincere appreciation to Dr. Warren Suzuki, my major professor, for his guidance, encouragement and help throughout my graduate study. I thank him for his patience, and the many hours he spent with me.

I wish to thank Dr. Sam Stern for his advice and support during the past years. His kindness, insights and allowing me to use his resource are appreciated.

I am grateful to the other members of my doctoral committee, Dr. Margaret Moore, Dr. Hubert Wubben, and Dr. Ray Harren, for their time and advice which made improved this study. Additional thanks go to Dr. Jane Liedtke, a former member of my doctoral committee, for providing information related to the theoretical foundation for this study.

I wish to thank the faculty and staff in my department for their encouragement and friendship, without which my study and this endeavor would have been more difficult. I am also grateful to Ms. Lu-Tzen Ju for her help in preparing the survey mailing.

Finally, I deeply appreciate my parents and my family for their love, support, and understanding throughout the past years.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

A Study of the Factors That Influence Industrial Education Instructors to Use Computers

I. INTRODUCTION

The purpose of this study was to identify the factors that influence secondary industrial education instructors to use computers in their instruction. Furthermore, this study proposed to explain the relationships among these factors.

Background

Computers have been used in schools as teaching tools since the early 1950's. These early computers were massive, unreliable, and expensive. A number of research projects were conducted during the 1960's and 1970's on the use of computers in the public school system, but these were limited because costs and problems of availability of computers prevented their widespread use. Use was mostly limited to universities (Post, 1985). In the early 1970's "silicon chip" technology began to alleviate the cost and availability problems. In the fall of 1977, Radio Shack announced the availability of the TRS 80, Model I, computer for $600. About 100,000 of these computers were sold in one year, and the computer revolution was underway (Levy, 1983; Zahniser, Long & Nosman, 1983).

The relatively inexpensive computer is changing the attitudes of many educators, and the use of computers in schools is becoming increasingly widespread throughout the country. According to Buxton and Taitt (1982, p. 157): "Five years ago there were no microcomputers in schools. Three years ago there were thousands, mostly in high school. Next year we will be counting them in hundreds of thousands at all levels." The National Center for Education Statistics (1982) reported that 101,987 microcomputers were available in public schools in the 1981-82 school year. Another survey conducted in the spring of 1983 indicated that there were 343,000 microcomputers in 57,900 schools, an increase of 185 percent over 1982 (Ingersoll & Smith, 1984). This number was expected to increase 100 percent in 1984 and soar to 1.6 million by 1985 (Emmett, 1983).

Most people believe that the computer age has arrived. Few educators today doubt that the United States is rapidly shifting from an industrial society to an information society, and that the final impact of this shift will be more profound than the nineteenth century shift from an agricultural society to an industrial society (Schmidt, 1984). The computer is identified as the basis for this shift from an industrial to an information society (Molnar, 1983). Over time, humans have created various tools to extend their physical and mental capabilities. As computers can extend human's mental capabilities for almost unlimited purposes, computer technology is regarded as the most significant new tool that humans have ever used in their cultures (Buxton & Taitt, 1982).

The actual number of computers used nationally in industrial education is unknown. However, some studies reported the use of computers in industrial education regionally or in its related educational field. For example, 37 percent of trade and industrial teachers in Pennsylvania indicated that computers were availiable in their programs during 1983-84 school year; however, all of them indicated their schools had computers (Yuen, 1985). A survey of principals in the Southern Association of Colleges and Schools in 1982 found that 38.2 percent of the computers in schools were used in vocational education (Beach & Vacca, 1985). Another survey of 475 public schools in small rural areas in the United States found that the 26.4 percent of computers were used in vocational education (Baker, 1985).

Today computers are used in industrial education for various purposes. According to the literature, most are used for computer-assisted instruction (CAI) and computer-managed instruction (CMI) (Schmidt, 1984; Stern & Liedtke, 1984; Tolman & Allred, 1984). Two other areas of use are as a utility and as course content (Greene, 1982; Schmidt, 1984). In CAI, students interact with information and stimulus materials presented on monitors through computers. CAI programs include (1) tutorials, (2) drill and practice, (3) discovery, (4) simulation, and (5) instructional games (Stern & Liedtke, 1984). The advantages of CAI may include the following: (1) student control of learning pace, (2) individualization of instruction, (3) opportunity for remedial instruction, and (4) motivation or increasing interest in learning (Chambers & Sprecker, 1983; Tolman & Allred, 1984; Zahniser, Long & Nosman, 1983).

In CMI, information is collected and processed to enable instructors to provide the best learning environment for students. The basic difference between CAI and CMI is in the recipient of computer outputs. In CAI, the recipient is the student; in CMI, it is the teacher (Tolman & Allred, 1984). Computer-managed instruction may include testing students, grading of tests, and keeping of records.

Computers may also be viewed as utilities for industrial education administrators and teachers. Word processing programs may be used by administrators and instructors to develop teaching materials, curriculum, or correspondence. Data-base management and accounting programs may be used to keep personnel files, financial records, and supply and equipment inventories. Since statistical programs are available for some personal computers, some institutions now use microcomputers to analyze their research data (Greene, 1982). Furthermore, personal computers can be linked to a mainframe or can communicate with other personal computers by telephone lines. This makes the information transmission from one institution to another much faster than the traditional mailing method. Educators today can develop their articles with their own computers and submit them to the computers of journal editors via phones. Editors can then provide feedback to authors in a very short period of time. There will be fewer typographical errors, faster notification of acceptance and faster return of revised articles for approval (Schwerkolt, 1985).

The computer itself may provide course content for several clusters in industrial education programs. Today in the world of work, computers are used as a necessary tool to solve problems and to manipulate and store information. For example, computer-aided design has been widely applied in the graphics industry, computers can help to design PC boards in the electronics industry, and robots and numerically-controlled machines are commonly used by industry (Lazean, 1984; Lindauer & Bruemmer, 1984; Schmidt, 1984). Also, labor market predictions estimate that four of six fastest growing job fields for the 1980's are expected to be in the computer industry (Carey, 1981; Cole & Hannafin, 1983), and robots could replace up to three million workers in the manufacturing industry during the 1990's (Condon, 1983). Future workers will need skills for installing, programming, monitoring and repairing robots or computers. Thus, for many reasons, industrial education students must gain expertise in the computer field. Currently, the study of computers or robots has been suggested for several clusters as subject material items by the Oregon Department of Education (1985a, 1985b, 1985c).

Statement of the Problem

It is only within the last five years that public schools have adopted computer technology on a large scale. Many educators have reported and discussed problems that inhibited the full implementation of computers for instruction in a school system. Their opinions could be categorized into four areas: (1) teacher training, (2) software and curriculum development, (3) hardware availability, and (4) funding problems.

A computer is only a machine; it is inanimate as an instructional tool until teachers utilize it in instruction or operate it as part of their jobs. Although nine out ten college- or university-level schools of education gave prospective teachers some preparation in computers during 1983-84 (U.S. Department of Education, 1986), most industrial education teachers who are in service now were trained in the world of typewriters, cut-away models, video-tapes, or overhead projectors. They may lack experience with computers. Studies investigating the use of computers in public school in different parts of the country similarly found that only about one-third of instructors had taken some kind of computer training, and fewer were actual users (Anderson, 1984; Beach & Vacca, 1985; Chen & Rafi, 1984; Ingersoll & Smith, 1984; Luehrmann, 1980; Tolman & Allred, 1984). It has been assumed that teachers need to be trained to know about computers; therefore, the level of computer literacy needed by all teachers has been a widely discussed issue during the past five years. Many models have been developed for implementing different suggestions about computer literacy for teachers. However, there has been no commonly accepted model since many educators suggest that the level of computer literacy for teachers should vary according to different teaching areas (Seidel, Anderson & Hunter, 1982).

Because of the variations in computer systems in public schools and the diverse needs of instruction which result, software companies have not viewed schools as a primary market. Relatively little software has been developed solely for educational purposes. Many instructors complain that they cannot find appropriate programs for their teaching, and it is difficult to use the ones that are commercially available (MacPhail-Wilcox, 1983). Some school districts have attempted to solve this problem by developing the instructional programs with their own staffs. However, the development of effective programs is time consuming and very expensive. For example, one school district reported that it took 350 hours for the development team to script, program, and revise a typical half-hour lesson (Garton, Reed, Reed & Steven, 1984). However, the ratio between preparation time and teaching time is expected to decrease once the development team became familiar with the developmental processes.

Although the numbers of computers purchased by public schools have increased annually, computers are not equitably distributed to all schools. Survey data show that schools in more affluent areas have more computers than those in poorer areas. It is therefore not surprising that white students usually spend more time with school computers than do minorities. Also, more male than female students use computers in schools (Anderson, 1984; Anderson, Welch & Harris, 1984; Lautenberg, 1984; Sanders, 1984). In today's labor market, the unemployment rates for females, the poor, and minority persons are much higher than for other groups (Sherman, 1984). These findings of unequal accessibility to computers imply that the gaps in unemployment rates among these groups will increase after students leave school since their ability to process information and to use the new technology are keys to future employment.

The numbers of computers have increased more than 100 percent annually in public schools since 1980 (Melmed, 1984). There were about 340,000 computers available in 1983, and 700,000 in 1984. The estimated cost for each set of computers averaged $1,000. The expenditure for hardware was $700 million in 1984. The estimated software and maintenance costs were 20 percent and 15 percent of unit purchase price, respectively (Pressman & Rosenbloom, 1984). The total estimated cost was $850 million in 1984 and 1.7 billion in 1985, representing large capital outlays for school systems. Some educators argue that if schools appropriately adopt CAI and CMI methods, the ratio of student to teacher could be increased from 18:1 to 23:1, representing an annual savings of $9.1 billion in teachers' salaries (Melmed, 1984). However, no empirical evidence supports this argument.

Computers in public schools are an innovation for education. Any innovation, from introducing a new concept to an organization until the concept is accepted by the organization, needs to go through certain stages. Cory (1983) has proposed a four-stage model of development for full implementation of computers for instruction in a school system:

Stage I - Getting on The Bandwagon.

Stage II - Confusion.

Stage III - Pulling It All Together.

Stage IV - Full Implementation.

He argued that:

> It is impossible for a school system to know what to do with computers until its own faculty and staff know what computers can do, and it is not possible for them to know what the potential really is until they've purchased enough hardware, used enough software, and spent enough time learning to really understand what the possibilities are. (p. 11)

Cory also listed some factors that affect the speed of transition from one stage to the next. These factors included: (1) commitment of the school superintendent and school board, (2) enthusiam of principal and teachers at each school, (3) community pressure or encouragement, (4) availability of trained educators, and (5) leadership on the state and national level. Woelfel and Haller (1971) used the term "significant others influence" (SOI) to describe the pressure or encouragement from those people who are important to a person. These factors listed by Cory seem to bear out the importance of SOI to the use of computers by instructors.

Research on investigating attitudes of instructors has indicated that a great proportion of teachers support the use of computers in their schools, if not in their classrooms (Golladay, 1977; Lumsden & Norris, 1985; Nasman, 1982; Parker & Widmer, 1983; Rueckert, 1985; Yuen, 1985). For example, seventy-six percent of trade and industrial teachers in Pennsylvania during 1984 indicated that they would like to use a computer in their work (Yuen, 1985); and a greater proportion (89 percent) of teachers in Texas indicated that they would like to attend in-service training on computers (Lumsden & Norris, 1985). Robardey (1972) examined the relationship between attitudes and several independent variables with respect to CAI. He found a significant and positive relationship between knowledge of CAI and attitudes toward CAI. However, other factors may also influence instructors' attitudes toward computers. A greater proportion of teachers displayed positive attitudes toward computers than those who have taken some kinds of training about computers. On the other hand, although about 82 percent of secondary teachers reported availability of computers (Ingersoll & Smith, 1984), only a small proportion (33 percent) of them have used computers in schools. However, only a few of them may be considered "regular users" (Anderson, 1984). The reasons are unclear for the apparent discrepancy between the proportions of teachers who want to use computers and those who actually use them.

Very little research has been reported regarding factors which may encourage or discourage teachers in the adoption of computer technology. Factors which have been proposed are: (1) lack of knowledge and experience with computers (Nasman, 1982; Robbat, 1985; Thomas, 1985a), (2) cost (Atkinson, 1984; Thomas, 1985b), (3) software and hardware availability (Anderson, 1984; Atkinson, 1984; Bradford, 1985; Nasman, 1982; Snelbecker & Stepansky, 1985), (4) influence of significant others (Cory, 1983; Hamilton, 1985; Martin, 1985; Robbat, 1985; Zartman, 1984), and (5) personal attitudes (Bradford, 1985; Lumsden & Norris, 1985; Stevens, 1980; Yuen, 1985). None of these studies, however, clearly established the influence of the factors on use of computers. Furthermore, these studies treated variables as being independent of each other; they did not attempt to identify relationships among variables or factors, or to establish how each variable accounted for its part of total variance. In particular, little attention was given to the role of attitude formation and change in influencing teachers to use computers in their work. Therefore, this study asked the following questions: what factors will influence industrial education instructors to use computer technology? In particular, how do attitudes, costs, knowledge and experience, software availability, and influence of coercion encourage or discourage teachers in use of computers? Finally, what are the relationships among these factors?

Significance of the Problem

Computers may be used by industrial education in four areas: CAI, CMI, as a utility, and as course content. Studies have identified the advantages for each area. Students need to know about computers in order to be familiar with their work world and get jobs. Educators need to use computers in order to manage programs more efficiently. The evidence that is available indicates that computers have not been adequately implemented by industrial education programs.

Currently, the public expects computers to be taught in school (Lichtman, 1979; Molnar, 1983; Parker & Widmer, 1983); instructors' attitudes toward computers are positive (Beach & Vacca, 1985; Rueckert, 1985); and computers are relatively available in schools (Anderson, 1984; Ingersoll & Smith, 1984). Instructors are still the critical element for successful integration of computers into the school systems. Therefore, it is important to encourage industrial education instructors to use computers in one or more aspects of their jobs. In order to facilitate this use, it is necessary to identify the factors that may influence industrial education instructors to use computers in their jobs.

As discussed earlier, little research has addressed this problem, and most of it has treated variables as independent of each other. Research also has not recognized the importance of instructors' attitudes. This study is a multivariate study which may provide a better understanding of how these factors influence each other, and in particular, the role of attitudes in encouraging the use of computers.

Delimitation

This study addresses the application of computers by secondary industrial education teachers only. Although the factors that influence the use of computers, such as attitudes, cost, and hardware availability, may be common to all educational areas at all levels, including all areas and levels at this time could lead to a highly complicated methodology. Competency in computer literacy should differ among the different types of school personnel (Moore, 1986; Poirot, Taylor & Powell, 1983). Furthermore, the use of computers as course content will vary among the areas and levels. As an example, application of computers in industrial education will be different than in business education. The specifications of these different sets of competencies and content areas could result in a very long and highly expensive data collection process.

Definition of Terms

1. Industrial Education -- Education and training in the industrial technologies. It includes trade and industrial education, and industrial arts.

2. Trade and Industrial Education -- Education and training for entering, maintaining employment in, or upgrading to "(a) any craft, skilled trade, or semiskilled occupation that directly functions in the designing, producing, processing, fabricating, assembling, testing, modifying, maintaining, servicing, or repairing of any product or commodity; and (b) any other occupation, including service occupations that are not covered above, which is usually considered to be technical, or trade and industrial in nature." (The U.S. Office of Education, 1966, p. 46)

3. Industrial Arts -- "A program of instructional and laboratory experiences which provides basic education . . . related to the industrial and technological aspects of life and offers opportunities to gain insight into production, recreation and consumerism . . . [and making] wiser and more valid educational, career and lifestyle choices." (American Industrial Arts Association, 1980, p. 3)

4. Computer -- "A device designed for the input, storage, manipulation, and output of symbols (digits, letters, punctuation). It can automatically follow a step-by-step set of instructions to manipulate information." (Stern & Liedtke, 1984, p. 66) There are three classes of computers: mainframe

computer, minicomputer, and microcomputer. All three classes of computers include the same basic components, capabilities and functions. The distinctions among these three classes of computers are becoming less clear as technological advancements are implemented. For the purposes of this study, no distinction will be made among classes of computers.

II. REVIEW OF RELATED LITERATURE

Since the act of using a computer is the performance of a behavior, there is substantial evidence to support the speculation that the attitudes of instructors toward using computers are important factors. However, there is no clear understanding of the interaction between these attitudes and computer use.

The purpose of this chapter is to review theories of attitude formation and change, suggest utilization of the theory of reasoned action, identify factors that may influence the use of computers by industrial education instructors, and finally, propose a causal model to indicate the relationships among factors that may influence industrial education instructors to use computers in one or more aspects of their jobs.

Attitude and Behavior

There are as many definitions of attitude as there are theories of attitude. The definitions of attitude have varied with the development of attitude theories. In the nineteenth century, the study of "attitude" meant the study of "social psychology" (Ajzen & Fishbein, 1980). In the 1930's and 1940's, different definitions of attitude stressed particular viewpoints which included attitude as a mental set or disposition, as readiness to act, as learned nature, and from its use as a phychologically evaluative tool (Allport, 1935; McGuire, 1969; Oskamp, 1977). Since the 1950's more comprehensive definitions have been proposed. For example, Ajzen and Fishbein

(1980, p. 6) defined attitude as a learned predisposition to respond in a consistently favorable or unfavorable manner with respect to a given object.

Many theories regarding attitude change have been proposed. Well known are the balance theory (Heider, 1946), the cognitive dissonance theory (Festinger, 1957), the congruity model (Osgood & Tannenbaum, 1955) and the expectancy-value model (Rosenberg, 1956). Each theory has its contributions and its limitations (Fishbein & Ajzen, 1975; Oskamp, 1977).

A historical concept of attitude states that there are three components: (1) a cognitive component which consists of the ideas and beliefs about the attitude object; (2) an affective component which refers to the feelings and emotions that one has toward the object; and (3) a behavioral component which consists of one's action tendencies toward the object (Krech, Crutchfield & Ballachey, 1962; McGuire, 1969; Rosenberg, Hovland, McGuire, Albelson & Brehm, 1960).

Using this concept, social scientists assumed that attitudes could be used to explain human behavior since they viewed the behavioral component as part of the attitude. The first use of the attitude concept to explain social behavior could be credited to Thomas and Zmaniecki (1918) who viewed attitudes as individual mental processes that determined a person's actual and potential responses. With few exceptions, this view went unchallenged until the late 1960's. For example, Krech, Crutchfield and Ballachey (1962) stated that:

> [Human's] social actions - whether the actions involve religious behaviors, ways of earning a living, political activity, or buying and selling goods - are directed by his attitudes. (p. 139)

LaPiere (1934) probably was the first researcher to question the relationship between attitude and behavior. In the early 1930's, when racial prejudice was at a high level in the United States, LaPiere traveled with a young foreign-born Chinese couple around the country. The traveling party was served at 250 establishments and rejected at only one. Six months later, LaPiere wrote to these establishments which they had visited asking whether they would accept Chinese as guests in their establishments. Only one of the 128 replies said "yes," 118 replied "no," and the other nine said that "it would depend on the circumstances." The same questionnaire was also sent to 128 similar businesses which they had not visited, and exactly the same distribution of answers was found. LaPiere therefore concluded that verbal measures of attitudes may not necessarily be consistent with behavior. However, this conclusion was not supported by other studies of that time because of the lack of valid techniques for the measurement of attitudes. More recently, several studies have reported similiar findings to those reported by LaPiere (Fishbein & Ajzen, 1974; Krech, Crutchfield & Ballachey, 1962; Wicker, 1969). Wicker (1969) who reviewed 30 studies dealing with the relationship between attitude and behavior concluded that "in most cases verbal measures of attitude were only slightly related or were even unrelated to the expected behaviors." (p. 69) Very often, the correlation coefficients for the relationship between attitude and behavior were as low as .2 to .3 (Ajzen & Fishbein, 1977; Krech, Crutchfield & Ballachey, 1962; Oskamp, 1977; Wicker, 1969).

Although the inconsistency between attitude and behavior had been reported, many phychologists still viewed attitude as the predisposition of behavior and stated that attitudes therefore could be used to explain people's behaviors. Researchers attempted to prove this view by two approaches. First, some researchers focused on identifying the methodological problems of prior research that failed to find strong relationships between attitude and behavior. They (Ajzen & Fishbein, 1977; Dillehay, 1973; Oskamp, 1977; Weber & Cook, 1972; Wicker, 1969) suggested that the low correlation coefficients found between attitude and behavior were due to measurement errors, bad sampling, or misinterpretation of attitude and behavior. For example, in LaPiere's experiment, there was no certainty that the data on attitude were provided by the same persons whose behaviors were observed earlier (Dillehay, 1973).

The second approach was to identify other factors that may influence the relationship between attitude and behavior by studying attitude formation. Several theories have been proposed for describing how attitude and other factors influence behavior. Among those were the pseudo-inconsistency theory (Campbell, 1963), the role of significant others (Woelfel & Haller, 1971), the theory of reasoned action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), and Triandis' model (Triandis, 1971). Each theory had its own "serious limitations and none has achieved general acceptance" (Oskamp, 1977, p. 12). Campbell's pseudo-inconsistency theory explained the reasons for inconsistency between attitude and behavior, but it did not deal with the formation of attitude. Woelfel and Haller's theory proposed that significant others were highly influential to the formation of attitude, but it did not describe the relationship between attitude and belief. Triandis's model was very similar to the Fishbein model; however, its structure was more complicated. Furthermore, Davidson (1974) applied both the Triandis and Fishbein models to investigate family planning behavior and concluded that the Fishbein model more accurately predicted behavior than did the Triandis model.

Theory of Reasoned Action

The ultimate goal of the Fishbein's theory of reasoned action was to predict and understand the individual's behavior. As discussed earlier, attitude was historically viewed as having three components: cognitive, affective, and behavioral. However, Fishbein and Ajzen (1972) had different views regarding the complexity of attitude. They suggested that the term "attitude" be reserved only for the affective component; the cognitive component they labeled as "belief;" and the behavioral component they labeled as "behavioral intention." The congruence between beliefs, attitudes, and behavioral intentions was not necessary. For Fishbein and Ajzen, "I like the Apple computer" (attitude) does not necessarily imply "the Apple computer is inexpensive" (belief), nor does it imply "I am going to buy the Apple computer" (behavioral intention). This viewpoint seemed to have both theoretical and empirical advantages over the historically tripartite view of attitude components (Oskamp, 1977, p. 61-66).

Fishbein first proposed a model for predicting whether people would perform a behavior in question (Fishbein, 1967a, 1967b). This model was continuously developed as the "Theory of Reasoned Action" (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). The basic assumption of this theory was that most social behaviors are under "volitional" control. According to this theory, a person's intention to perform a behavior is the immediate determinant of the action. A person's intention is a function of two basic determinants: one is personal in nature and the other reflects social influence. The personal determinant is termed the "attitude toward the behavior." Social influence is termed the "subjective norm." Multiple regression has been used to obtain the relative weights for these two components, the attitude toward the behavior and the subjective norm. This relationship is expressed by the following equation:

$$I = (A_{act})\,W_1 + (SN)\,W_2$$

where: I = intention to perform a behavior.

A_{act} = attitude toward the behavior.

SN = subjective norm.

W_1, W_2 = relative weights for A_{act} and SN.

An attitude toward an action is a function of belief. Belief have two subcomponents: "salient beliefs" toward the behavior in question and self evaluation of the outcomes of these salient beliefs. Fishbein and Ajzen suggested that belief is based on a person's knowledge and past experience. People may have thousands of beliefs, but only about ten beliefs are retrieved immediately when a person is asked about his/her feeling toward an object. Those immediately retrieved beliefs are named "salient beliefs." The relationship is expressed by the equation as follows:

$$\text{Attitude} = \sum \text{Belief} = \sum B_i \, e_i$$

where: B = a salient belief.

e = evaluation of outcome of a salient belief.

i = index of each salient belief.

A subjective norm is determined by normative beliefs. Normative beliefs include two subcomponents. The first is the strength of the normative beliefs, a person's perceptions of what people who are important to him/her think regarding whether he/she should or should not perform the behavior in question. The second is self willingness to accept the advice and viewpoint of those people. This relationship is expressed by the following equation:

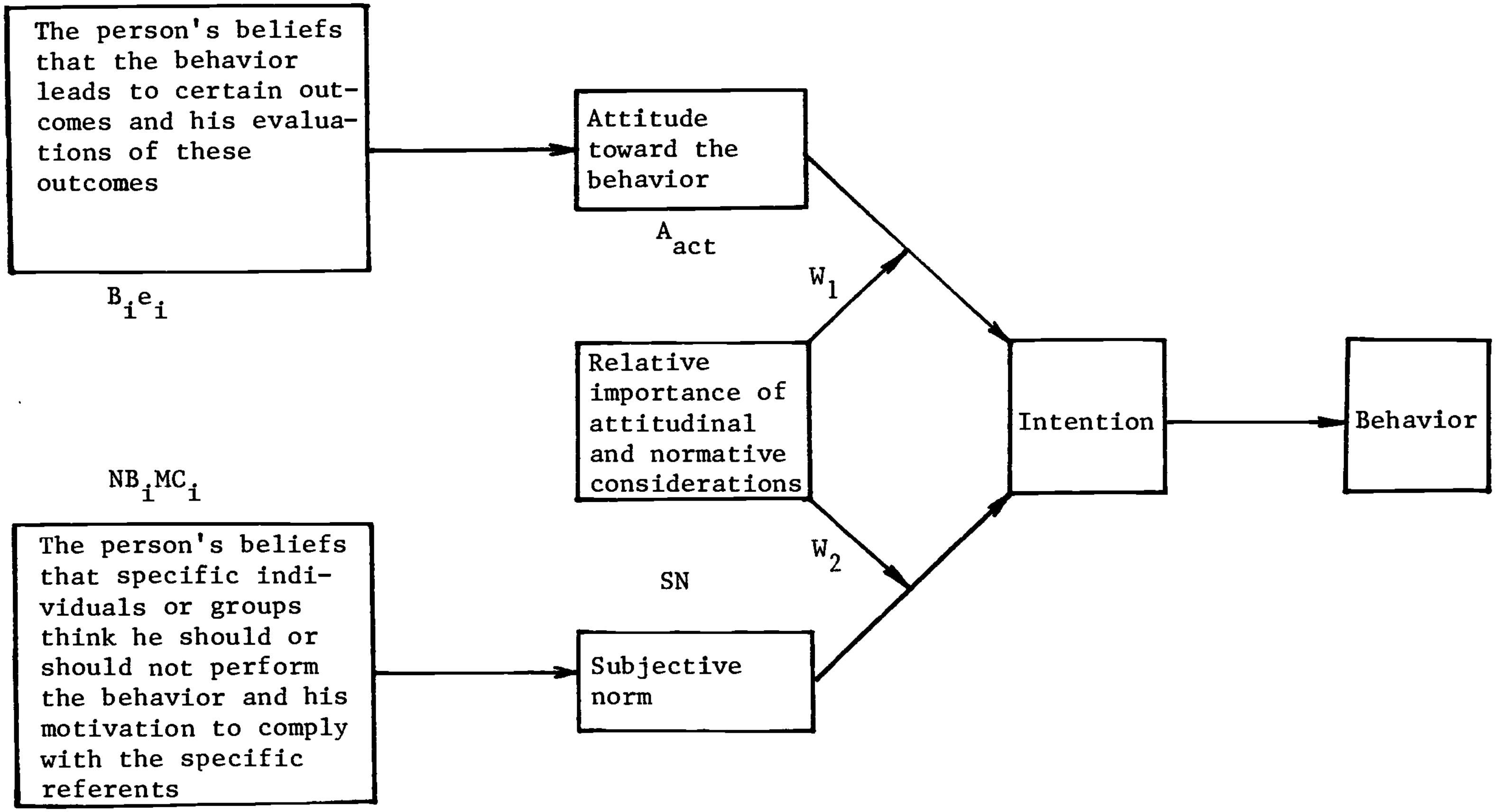
$$\text{Subjective Norm} = \sum \text{Normative Belief} = \sum NB_i \, MC_i$$

where: NB = strength of a normative belief.

MC = willingness to comply a normative belief.

i = index of each normative belief.

The Fishbein model is shown in Figure 1. It should be noted that the concepts of behavior, intention, and attitude in the Fishbein model are very specific as opposed to broader definitions in other theories. Fishbein and Ajzen (1975; Ajzen & Fishbein, 1980) suggested that an attitude, an intention and a behavior may include



Note: Arrows indicate the direction of influence.

Figure 1. Representation of the Relationships of Attitudes and Beliefs to Intentions and Behavior Based on the Ajzen and Fishbein (1980, p. 8) Model for a Theory of Reasoned Action.

up to four elements: action, target, context and time. For example, a teacher may intend to use (action) a computer (context) in his or her instruction (target) during this school year (time). For the purposes of comparision, attitude, intention or behavior must have elements in common. In this view, attitudes toward "computers" are different from attitudes toward "using computers" or attitudes toward "learning about computers." Therefore, attitudes toward "computers" cannot be used to predict the intention of "using computers" or "learning about computers." Fishbein and Ajzen (1974) criticized LaPiere's (1934) study because it did not include the same elements in the measures of attitude and behavior. Therefore, attitude failed to be consistent with behavior in that study.

Ajzen and Fishbein (1980, p. 247) believed that when appropriately measured, attitude and subjective norm were sufficient to predict intention. They suggested that additional variables external to the model, such as personality traits and demographic characteristics, can only influence behavioral intention and behavior indirectly by influencing either of the two components (attitude or subjective norm) or their relative weights.

Utilization of the Theory of Reasoned Action

The Fishbein's model provides us with a convenient way to predict and understand a person's behavior. In the past decade, Fishbein's model has been applied to many studies relating attitude and behavior. The behaviors investigated by these studies included consumer behavior (Ajzen & Fishbein, 1980; Mazis, Ahtola & Klippel, 1975), family planning (Ajzen & Fishbein, 1970; Davidson & Jaccard, 1975; Fishbein, Jaccard, Davidson, Ajzen & Loken, 1980; Jaccard & Davidson, 1972; Vinokur-Kaplan, 1978), teaching method (Liedtke, 1983), voting behavior (Fishbein & Coombs, 1974; Fishbein, Bowman, Thomas, Jaccard & Ajzen, 1980), weight loss (Sejwacz, Ajzen & Fishbein, 1980),and others (Davidson, 1974; Fishbein, Ajzen & McArdle, 1980; Sperber, Fishbein & Ajzen, 1980). Findings have been very consistent among studies; typically, the coefficients of the zero-order correlations between behavioral intention and overt behavior in these studies ranged from .55 to .90. Correlation coefficients for other variables in Fishbein's model, such as belief-attitude, attitude-intention, normative belief-subjective norm, and subjective norm-intention were generally greater than .50. Multiple correlation coefficients between behavioral intention and independent variables attitude and subjective norm ranged from .60 to .89. A criticism of the Fishbein model was voiced by Songer-Nocks (1976a, 1976b). She challenged the general utility of the model for prediction of intention and concluded that actual situational factors, such as competition or cooperation, must be taken into account. Fishbein and Ajzen (1976a, 1976b) argued that Songer-Nocks inappropriately used behavior instead of intention as the dependent variable and used improper statistical methods throughout data analyses; therefore, they maintained that it is difficult to draw conclusions from her findings.

Using the theory of reasoned action, therefore, the extent to which industrial education instructors will use computers in one or more aspects of their jobs should be predictable by their intentions to use them. The intentions to use computers should be a function of related attitudes and related subjective norms. The attitudes of instructors toward using computers should be influenced by their beliefs toward using computers. Their subjective norms are a function of their normative beliefs toward using computers in one or more aspects of their jobs.

Other Factors

In the Fishbein model, belief is the only factor that will influence a person's attitudes, and there is no relationship between subjective norm and attitude. As discussed in Chapter I, however, research seems to indicate that teachers have limited knowledge about computers but possess strong and positive attitudes toward computers in general. The Fishbein model seems insufficient to explain this situation if belief is the only component that influences attitude. Woelfel and Haller (1971) proposed a theory in which "self-reflexive activity" and "significant others" were viewed as two factors contributing to the formation of attitude. Stephens (1979) applied this concept to investigate vocational teacher-trainees' attitudes toward handicapped students. She suggested that significant others could directly influence teacher-trainee attitudes. The term "significant others" to Woelfel and Haller is similar to "subjective norm" in the Fishbein model. Early studies which applied the Fishbein model generally found that subjective norm correlated consistently with intention, but the regression coefficients were relatively small. These findings suggest that subjective norm may indirectly influence intention by way of attitude; that is, there may be a linkage between subjective norm and attitude. Although the existence of the linkage between subjective norm and attitude may not improve the prediction of behavioral intention, it may influence how the relative importance of normative belief and subjective norm are interpreted.

Ajzen and Fishbein (1980) proposed that changes in attitude or subjective norm resulted from changes in belief or normative belief, respectively. Belief and normative belief cannot be changed directly; they can only be changed through external factors that can be manipulated. Therefore, teachers' beliefs and normative beliefs about computer applications may be altered by providing them with new or additional information or capabilities related to computers. Information and capabilities are the substance of computer literacy.

Discussions about computer literacy first appeared in the literature in the mid-1970's. The definitions of computer literacy were initially almost as varied as there were authors. The Conference Board of the Mathematical Sciences (1972) released a report recommending a junior high school course in which computer literacy was defined as an understanding of computer capabilities, applications, and algorithms. This definition of computer literacy largely ignored issues of social impact. But other educators, including Lykos (1974), Moursund (1976) and Rawitsch (1978), presumed that computer literacy should include emphasis upon social issues. Moursund (1976) viewed computer literacy as a knowledge of the low-technical aspects of the capabilities and limitations of computers, and of the social, vocational and educational implications of computers. However, Luehrmann (1980) and others tended to equate computer literacy with programming skills.

The arguments on computer literacy have not ended. Recently, numerous models or levels of computer literacy have been proposed for different types of people (Richman, 1983; Moore, 1986; Poirot, Taylor & Powell, 1983; Vockell & Rivers, 1983; Watt, 1981). It may be that the level of computer literacy should vary with the needs of individuals according to their roles in society.

Poirot, Taylor and Powell (1983) proposed five areas of study necessary in promoting computer literacy for all teachers. These included: (1) computer terminology, (2) computer applications in education, (3) human/machine relationships, (4) information on computers in education and (5) computer programming. Moore (1986) surveyed 270 members of the Northwest Council for Computer Education on their opinions regarding what constituted competence for regular classroom teachers as well as computer educators. Fourteen very specific competencies were proposed for all regular classroom teachers. These recommended competencies were concerned with a non-technical understanding of computers and the abilities to apply computers to teachers' teaching areas. These competencies provided a minimum in computer literacy for teachers; computer programming abilities were not among these recommended competencies. It should be noted, however, that a knowledge of computer programming is still essential for educational personnel who teach about computers and computing or who supervise computer education programs.

The cost and availability of computer hardware and software were identified in Chapter I as hindering the adoption of computers by teachers (Atkinson, 1984; Thomas, 1985a, 1985b). Both high cost and lack of availability for practical purposes have resulted in limited access to computer systems. The accessibility of computer hardware and software may be affected by two elements: availability and convenience. Computer hardware and software are only accessible to teachers if they are available when teachers wish to use them. As implied, however, the availability of hardware and software may be a relative rather than absolute measure since one teacher may be more tolerant of waiting to use a computer than another teacher.

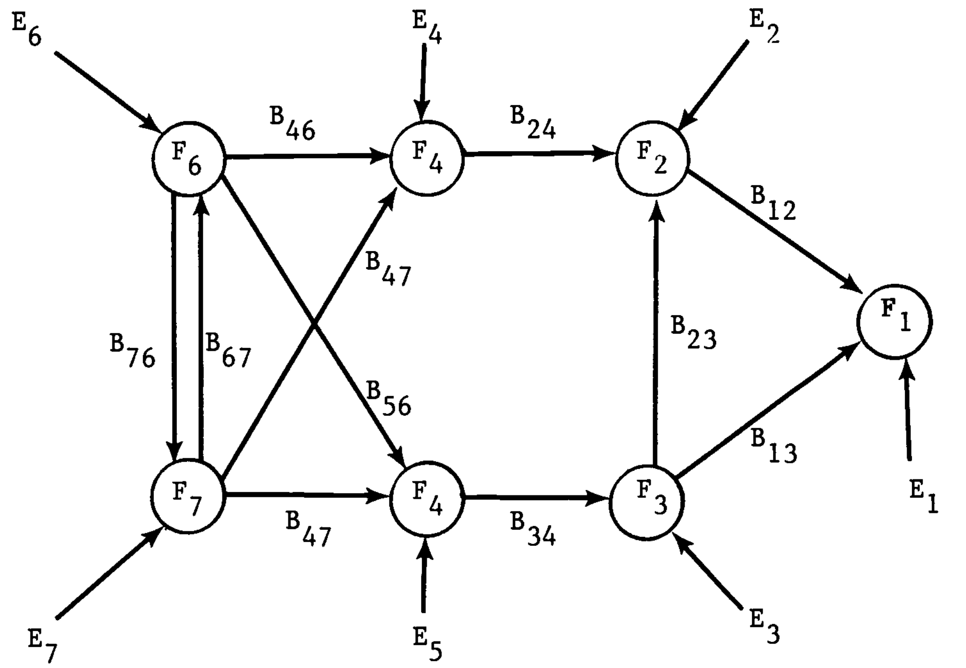
As for convenience, a teacher may have the use of a computer when desired, but it may be located in some other part of the school. Thus, it may or may not be considered to be conveniently located by the teacher. In the same manner as availability, convenience may also be relative. What may be perceived as convenient by one teacher in a particular situtation may not be convenient to another teacher.

When instructors know more about computers, they may be more likely to access computers in the school. On the other hand, instructors who have more opportunities to access computers should be more familiar with computers and software and may gain more knowledge about their applications and limitations. Thus, computer literacy and the accessibility of computers and software may influence each other.

According to Ajzen and Fishbein (1980), demographic variables, such as sex and age, may only influence the strengths of beliefs and normative beliefs. They should not affect the relationships among the factors in their model. From an educational perspective, these variables cannot be manipulated, and should be of no particular interest for this study.

A Proposed Causal Model

Six factors may influence the industrial education teachers' intentions and therefore influence their behavior to use computers in their jobs. These factors are as follows: attitude, subjective norm, belief, normative belief, computer literacy, and computer accessibility. The causal relationships (Asher, 1976; Blalock, 1971) among these factors are shown graphically in Figure 2. As discussed in this chapter, behavioral intention is caused by attitude and subjective norm. Attitude is caused by belief, and subjective norm by normative belief. Subjective norm may also contribute to the formation of attitude. The two external factors (computer literacy and computer accessibility) influence both belief and normative belief, and these two external factors may also influence each other. These relationships are shown by the linkages and directions of arrows in Figure 2. The causal equations that indicate direct relationships among factors are as follows:



Note: Arrows indicate the direction of influence.

Where: F_1 = Behavioral intention to use computers.
F_2 = Attitude toward using computers.
F_3 = Subjective norm toward using computers.
F_4 = Belief toward using computers.
F_5 = Normative belief toward using computers.
F_6 = Computer literacy.
F_7 = Accessibility to computers and software.
B_{xy} = Causal correlation coefficients.
E = Residuals.

Figure 2. The Proposed Causal Model of Factors That Influence Industrial Education Teachers' Intentions to use Computers.

$$F_1 = B_{12} F_2 + B_{13} F_3 + E_1$$

$$F_2 = B_{23} F_3 + B_{24} F_4 + E_2$$

$$F_3 = B_{35} F_5 + E_3$$

$$F_4 = B_{46} F_6 + B_{47} F_7 + E_4$$

$$F_5 = B_{56} F_6 + B_{57} F_7 + E_5$$

$$F_6 = B_{67} F_7 + E_6$$

$$F_7 = B_{76} F_6 + E_7$$

Where: F_1 = Behavioral intention to use computers.

F_2 = Attitude toward using computers.

F_3 = Subjective norm toward using computers.

F_4 = Belief toward using computers.

F_5 = Normative belief toward using computers.

F_6 = Computer literacy.

F_7 = Accessibility to comptuers.

B_{xy} = Causal correlation cofficients.

E = Residuals.

These causal correlation coefficients (B_{xy}) should not equal zero.

All other relationships among factors should be indirect. Their coefficients of correlation should be zero if the effects of the factors between them are controlled. The indirect relationships are as follows:

The Relationship Should Not Exist Between:	If the Effect of These Factors are Controlled:
F_1, F_4	F_2, F_3, F_5, F_6, F_7
F_1, F_5	F_2, F_3, F_4, F_6, F_7
F_1, F_6	F_2, F_3, F_4, F_5, F_7
F_1, F_7	F_2, F_3, F_4, F_5, F_6
F_2, F_5	F_3, F_4, F_6, F_7
F_2, F_6	F_3, F_4, F_5, F_7
F_2, F_7	F_3, F_4, F_5, F_6
F_3, F_4	F_5, F_6, F_7
F_3, F_6	F_5, F_7
F_3, F_7	F_5, F_6
F_4, F_5	F_6, F_7

III. METHODOLOGY

Population and Sample

The sample consisted of secondary teachers of industrial arts and/or trade and industrial education in Oregon during the 1985-86 school year. The subjects were randomly selected from the roster of secondary industrial education teachers presented in the 1985-86 directory compiled by the Oregon Department of Education and published jointly by the Oregon Vocational Trade and Technical Association (OVTTA) and the Oregon Industrial Arts Association (OIAA). The 813 teachers were listed by county and school. The teachers were assigned three-digit identification numbers based on the order in which their names appeared in the directory. A random number generator in the Cyber computer system in Oregon State University's Milne Computer Center was used to specify 210 identification numbers.

Questionnaires were mailed to the subjects (Table 1). The U.S. Postal Service returned one instrument as undeliverable, and three that were returned by subjects were unusable. Usable instruments were received from 165 subjects, a response rate of 80.1 percent. One third of the subjects were teaching in senior high schools, 22.4 percent in middle or junior high schools, and 9.7 percent in combined junior and senior high schools (Table 2). Among the subjects, 53.9 percent were industrial arts teachers, 22.5 percent were trade and industrial education teachers, and 23 percent were both industrial arts and trade and industrial education instructors (Table 3). The

Table 1. Number and Rate of Response.

Initial Number of Subjects	210
Number of Instruments Returned Unusable or Not Deliverable	4
Actual Number of Subjects	206
Number of Usable Returned Instruments	165
Response Rate	80.1 %

Table 2. Number and Percentage of Subjects by Teaching Level.

School Level	N	Percent
Middle or Junior High School	37	22.7 %
Senior High School	110	67.5
Combined Junior/Senior High Sch.	16	9.8
Total	163	100.0 %

Note: No Response = 2.

Table 3. Number and Percentage of Subjects by Specialization Areas.

Specialization	N	Percent
Industrial Arts	89	54.3 %
Trade & Industrial Education	37	22.6
Both IA and T & I	38	23.1
Total	164	100.0 %

Note: No Response = 1.

subjects' ages ranged from 24 to 62. The mean age of the subjects was 41.1 years with a standard deviation of 9.5 (Table 4). There were only two female subjects.

Instrument Development

A copy of the instrument that was used to collect data is provided in Appendix A. The instrument consists of seven sections. Section A contains five items related to computer literacy. Section B contains three items. The first item refers to behavioral intention, the second item to attitude, and the third item to subjective norm. There are eight items in Section C which are concerned with beliefs toward outcomes. Section D includes eight items which evaluate these belief outcomes and are parallel to those in Section C. The two sections represent the belief factor. The normative belief scales are in Sections E and F. Section E consists of seven items regarding people who instructors may believe may influence them in whether or not they should use computers in their jobs. Items in Section F refer to the instructors' willingness to comply with the opinions of these significant others. Two of the ten items (Items 2 and 3) in Section G collect data on the accessibility of computer hardware and software. Information on demographic variables, such as sex, age, school level and specialization area, was collected by Items 4 to 10 in Section G.

Initial Instrument. The construction of the instrument was based on guidelines given by Ajzen and Fishbein (1980). The initially developed instrument is shown in Appendix B. Behavioral

Table 4. Number and Percentage of Subjects by Age.

Age	N	Percent
Below 25	3	1.9 %
25 to 29	18	11.2
30 to 34	22	13.8
35 to 39	25	15.6
40 to 44	38	23.8
45 to 49	20	12.5
50 to 54	18	11.2
55 to 59	12	7.5
Above 60	4	2.5 %
Total	160	100.0 %

Note : No Response = 5; Median = 40.6; Mean = 41.1; S.D. = 9.5.

intention is measured by five items (Items 1 to 5 in Section A). The first four are for determining the intentions of using microcomputers in CAI, CMI, as a utility and as course content, and the fifth refers to overall measure of behavioral intention. The same method was applied to the attitude measures (Items 6 to 10 in Section A). The belief measures include two subcomponents: beliefs toward outcomes and self evaluation of these outcomes (Section C and Section B, respectively). The items in these two subcomponents are matched. Each subcomponent includes ten statements which were randomly selected from fifty-eight statements about beliefs that appeared in the related literature on computer literacy. Six refer to computer-assisted instruction (Items 1 to 4, 8, 9), one to utility (Item 7), one to course content (Item 5), and two to general beliefs toward using computers (Items 6 and 10).

The subjective norm is measured by the statement: "Most of the people who are important to me think I should use computers in my job." (Item 1 in Section D.) Ten different types of people who may influence an instructor to use computers determine the normative belief factor (Items 2 to 11 in Sections D and E). These ten types of people include students, students' parents, other teachers (Zahniser, Long & Nasman, 1983), administrators, school board, professional association, education experts (Cory, 1983), principal (Cory, 1983; Zartman, 1984), friends and family members. These types of people are the bases for the ten pairs of statements which attempt to determine their importance in relation to the respondent's willingness to comply with those persons' opinions (Item 2 to 11 in

Sections D and E, respectively).

On this version of the instrument, computer literacy is determined by titles and credit hours of computer courses and workshops which the subjects have taken (Item 7 in Section F), and a question on reading computer-related journals (Item 8 in Section F). Five items are concerned with the relative accessibility of a computer by respondents and their students (Items 2 to 6 in Section F). Demographic information on the subjects is also collected in Section F.

First Pilot Test and Revised Instrument. The initial instrument was subjected to a pilot test. Findings from the pilot test were used in the preparation of the revised instrument (Appendix C). The purposes of the pilot test were to reduce the number of items, improve the readability of the instrument, and verify the internal consistency of the factors. Thirty-two initial instruments were distributed to students who were enrolled in IED 576, Management of Industrial Education, at Oregon State University during Summer Term 1985. Most of the students who took this class were practicing teachers, pursuing fifth-year teacher certification and/or master's degrees. Only thirteen instruments were returned. Because of the low number of respondents, another data collection was conducted in the middle of October, 1985. At this time, eight instruments were distributed to students enrolled in an industrial education student teacher seminar. All eight instruments were returned after the class meeting which yielded a total of 21 subjects.

The Statistical Package for the Social Sciences (SPSS) in Oregon

State University's Milne computer center was used to compile data and to provide test statistics. Correlation coefficients among factors defined by the Fishbein model ranged from .49 to .68 (Table 1 in Appendix D). However, very low correlations were found between the computer literacy factor and all other factors. The Cronbach Alpha method was employed to compute reliability coefficients. The reliability for behavioral intention, attitude, belief, and normative belief factors ranged from .78 for belief to .93 for intention. Reliability coefficients are shown in the Table 2 in Appendix D.

For the intention factor, high correlation coefficients were found between the "overall" item and the four specific items--CAI, CMI, utility, and course content (Table 3 in Appendix D). The same results of high correlations have been found between attitudes toward using computers in general and the four specific applications (Table 4 in Appendix D). The *t*-tests showed that there were no significant differences between means of the four specific items and that of the overall item for both intention and attitude measures. These findings suggest that the overall items could substitute for the four specific ones in both intention and attitudes factors. Therefore, the four specific items on intention and on attitude were replaced by their overall counterparts (Items 1 and 2 in Section A).

Because computer-assisted instruction has been developing since the early 1960's, discussions about it dominate the literature on computer literacy. The initial item pool reflected this bias. Six of ten belief items in the initial instrument were concerned with computer-assisted instruction, and none were concerned with computer-managed instruction. This bias was not detected until an attempt was made to reduce the number of items in the belief factor. Only five belief items used in the initial instrument were retained in the revised instrument (Items 3, 4, 7, 11, 13 in Section A of the revised instrument). These items had the highest internal consistency coefficients in the initial instrument (Table 5 in Appendix D). Six new belief items were then selected from the item pool. These eleven items in the revised instrument address specific beliefs about the four applications areas (computer-assisted instruction, computer-managed instruction, utility, course content) and general beliefs toward computers (Items 3 to 13 in Section A, and Section B).

Instructors may gain computer literacy by various means--formal learning, informal learning, or a combination of these. The correlation coefficients between computer literacy and other factors, belief in particular, were low (Appendix D, Table 2). There also was an indication that "information" rather than the methods of acquiring information may influence belief. In the revised instrument, therefore, five computer literacy topics proposed by Poirot, Taylor and Powell (1983) served as the basis for items on the computer literacy (Items 1 to 5 in Section E).

Items on the subjective norm and normative belief factors in the revised instrument were not changed. The accessibility of computer hardware and software, and demographic variables were also not changed.

Second Pilot Test and Final Instrument Revision. The revised instrument was also pilot-tested. The purposes of the second pilot test were to reduce the number of items and to evaluate the computer literacy items. Twenty-seven students who were enrolled in IED 420, Organization and Management of Industrial Education, at Oregon State University during the Winter Term 1986 served as subjects. Most of the students were seniors, and all of them had participated in field experiences as sophomores and juniors. During a class meeting, subjects were given an oral explanation of the purposes of the study and were asked to respond to items as though they were teachers. The revised instruments were then passed out, and all were returned. The average time for answering the revised instrument was 15 minutes.

The Statistical Package for Social Sciences was again used to compute test statistics. A small group of the subjects (6 of 27 students) provided low computer literacy ratings but had high belief scores (Table 1 and Table 2 in Appendix E). There are two possible explanations for this. First, these students may not have understood terms used in the belief items and therefore responded randomly to them. This type of error may be reduced by having items in an understandable context. In the final instrument, items on the computer literacy are therefore situated as the first section of the instrument where they are defined before they are encountered in the belief items. Second, these subjects may represent people who would normally overestimate their abilities to use computers and the capabilities of computers. Data provided by this group was not included for further item analyses. Table 3 in Appendix E reports the correlation coefficients among factors after deleting the data of this small group. A similar group was not found during the actual field study.

The Cronbach Alpha reliability coefficient was .88 for attitude, .83 for belief, .96 for normative belief, and .95 for computer literacy after deleting data of that small group (Table 4 in Appendix E). Two principles were considered when deleting items from the instrument: (1) any item deleted should not affect the content validity, and (2) any item deleted should not substantially reduce reliability. Based on these two principles, three pairs of belief items (Items 5, 6, 9 in Section A and Items 3, 4, 7 in Section B) and three pairs of normative belief items (Items 2, 5, 10 in Section C and Items 1, 4, 9 in Section D) were deleted from the revised instrument. After these items were deleted, the reliability coefficient was .84 for the remaining eight belief items, and .95 for the seven normative belief items. Items on other factors were not changed. The Table 5 of Appendix E shows the correlation coefficients among factors after deleting these items and the data from the small group.

Reliability

After the data collection, Cronback's generalizability theory (Alpha) was used to estimate the internal consistency of factors. Very high internal consistency coefficients were found for the attitude, belief, normative belief and computer literacy factors. The results are reported in Table 5 as well as Appendix F. The Alpha

Table 5. Summary of Alpha Reliability Coefficients (Internal Consistency).

Factor	No. of Subjects	No. of Items	Alpha
Intention	165	1	NA
Attitude	158	5	.92
Subjective Norm	162	1	NA
Belief	156	8	.82
Normative Belief	157	7	.91
Computer Literacy	164	5	.87
Accessibility	164	2	NA

Note: 1. Item scores of belief and normative belief are combined scores.
2. Internal Consistency for each item is reported in Appendix F.
3. Summary of the factor scores and item scores are reported in Appendix H.

coefficients for the attitude and normative belief factors were .92 and .91, respectively. Alpha coefficienents were .87 for computer literacy and .82 for belief. The measures on the intention, subjective norm and accessibility factors included only one or two items; their internal consistencies therefore could not be estimated.

Survey Procedures

The procedures proposed by Dillman (1978) were those primarily followed to conduct the survey. A copy of the final instrument, a cover letter (Letter 1 in Appendix G), a stamped, pre-addressed return envelope, and an incentive was mailed to each subject in March 1986. The incentive consisted of a pencil with "Oregon State University" and a logogram of the beaver mascot printed on it. One week later, a postcard (Letter 2 in Appendix G) was mailed to each subject. The purpose of the postcard was to urge the subjects to complete and return the instrument. Three weeks later, a follow-up packet was sent to those who still had not responded. The packet included a second transmittal letter (Letter 3 in Appendix G), an instrument, and another stamped return envelope.

Statistical Analyses

As suggested by Ajzen and Fishbein (1980), a modification of Osgood's semantic differential scale was employed for all items except for the demographic variables. According to Ajzen and Fishbein (1980), the "motivation to comply" items were coded from 1 to 7; all other scales were coded from -3 to +3. The two factors defined by the present study, the computer literacy and the accessibility of computer hardware and software, were coded from 1 to 7. Factors scores for each subject were the mean of responses to related items.

Data were entered into an Apple II Plus microcomputer with a customer-designed Pascal program. These data were then transmitted to the Cyber computer at Oregon State University's Computer Center via telephone line. The path analysis method was employed for testing the causal model and computing causal coefficients among factors (Asher, 1976; Blalock, 1971). The estimates of causal coefficients were obtained from multiple regressions in which the causal factors proposed to have direct causal effects on a given dependent factor were included as independent variables (Goldberger, 1970). The unpredicted linkages were tested by partial correlations; controlled variables were all factors prior to or intervening between the two factors in question (Blalock, 1968; Simon, 1957). The Multiple Regression Analysis and Partial Correlation subprograms in the Statistical Package for the Social Sciences (Nie, Hull, Jenkins, Steinbrenner & Bent, 1975) were applied for these purposes.

IV. RESULTS

This study proposed a causal model which attempted to identify the relationships among factors that may influence the use of computers by industrial education teachers. The purpose of this chapter is to test this causal model and discuss the findings.

Findings

The median, mean, standard deviation, and 95 percent confidence interval of each factor investigated by this study are reported in Appendix H. The zero-order correlation coefficients for the factors are presented in Table 6. There were substantial correlations among factors proposed by Fishbein. Both attitudes and subjective norms correlated with intentions highly ($r = .80$, $N = 165$, $p = .00$, and $r = .71$, $N = 162$, $p = .00$, respectively). There was a high correlation between normative beliefs and subjective norms ($r = .63$, $N = 161$, $p = .00$). The relationship between beliefs and attitudes was significant, too ($r = .53$, $N = 165$, $p = .00$). As expected, subjective norms correlated highly with attitudes ($r = .79$, $N = 164$, $p = .00$). This implies that the subjective norm factor highly influences the formation of attitude although Fishbein did not discuss this relationship.

According to the causal model, the computer literacy and accessibility factors should be more highly correlated with belief and normative belief factors than with the attitude and subjective norm factors. Their relationships with the intention factor should

Table 6. Intercorrelation (Zero-Order) Coefficients Among Factors.

Factor	Factor 1.	2.	3.	4.	5.	6.
1. Intention						
2. Attitude	.80 (165)					
3. Subjective Norm	.71 (162)	.79 (164)				
4. Belief	.51 (165)	.53 (165)	.54 (162)			
5. Normative Belief	.56 (164)	.57 (164)	.63 (161)	.64 (164)		
6. Computer Literacy	.57 (165)	.48 (165)	.53 (162)	.45 (165)	.39 (164)	
7. Accessi-bility	.42 (164)	.43 (164)	.38 (161)	.20 (164)	.26 (164)	.20 (164)

Note: All correlations are greater than zero ($p < .02$).
Numbers of subjects are reported within parentheses.

be even weaker. However, zero-order correlations indicated that these two factors correlated highest with the intention factor, less high with attitude and subjective norm, and least with belief and normative belief. Furthermore, the correlation between the computer literacy and accessibility factors was very weak ($r = .20$, $N = 164$, $p = .10$). The correlation coefficient was considerably higher in the second pilot test although the number of subjects were less than one-seventh of the field sample.

The model proposed in Chapter II was described by seven causal equations. The equations indicated the direct linkages among the factors and the relative importances between causal coefficients. These equations served as the bases for conducting regression analyses. The result of statistical test of each equation is shown in Table 7 as well as Appendix I. A *t*-test was employed to examine each causal coefficient statistically (H_o: Beta = 0). The summaries of these tests are also presented in Table 7. The accounted for variance (R^2), error (E^2), and residual (E) for each factor predicted by its causal equation are shown in Table 7, too. A schematic representation of these direct linkages and their representative standardized, nonstandardized causal coefficients and residuals is shown in Figure 3.

The results indicated that both the attitude factor and subjective norm factor could directly influence the industrial education instructors' intentions to use computers. The causal coefficient between the attitude and intention factors was .61 ($t = 8.2$, ndf = 159, $p = .00$), and between the subjective norm and

Table 7. Statistical Tests of Causal Coefficients and Causal Equations.

(1) $F_1 = B_{12} F_2 + B_{13} F_3 + E_1$

$B_{12} = .61$, $t = 8.2$, $p = .00$

$B_{13} = .23$, $t = 3.1$, $p = .00$

$R^2 = .65$, $E^2 = .35$, $R = .81$, $E = .59$

$F = 149.1$, $ndf = (2, 159)$, $p = .00$

(2) $F_2 = B_{23} F_3 + B_{24} F_4 + E_2$

$B_{23} = .69$, $t = 11.9$, $p = .00$

$B_{24} = .16$, $t = 2.8$, $p = .01$

$R^2 = .63$, $E^2 = .37$, $R = .79$, $E = .61$

$F = 131.2$, $ndf = (2, 159)$, $p = .00$

(3) $F_3 = B_{35} F_5 + E_3$

$B_{35} = .63$, $t = 10.3$, $P = .00$

$R^2 = .40$, $E^2 = .60$, $R = .63$, $E = .77$

$F = 105.7$, $ndf = (1, 159)$, $p = .00$

(4) $F_4 = B_{46} F_6 + B_{47} F_7 + E_4$

$B_{46} = .43$, $t = 6.0$, $p = .00$

$B_{47} = .12$, $t = 1.7$, $p = .10$ **

$R^2 = .21$, $E^2 = .79$, $R = .46$, $E = .89$

$F = 19.9$, $ndf = (2, 161)$, $p = .00$

(5) $F_5 = B_{56} F_6 + B_{57} F_7 + E_5$

$B_{56} = .35$, $t = 4.8$, $p = .00$

$B_{57} = .19$, $t = 2.7$, $p = .01$

$R^2 = .19$, $E^2 = .81$, $R = .43$, $E = .90$

$F = 18.2$, $ndf = (2, 161)$, $p = .00$

(continued)

Table 7. (Continued)

(6) $F_6 = B_{67} F_7 + E_6$

$B_{67} = .20$, $t = 2.4$, $P = .02$

$R^2 = .04$, $E^2 = .96$, $R = .20$, $E = .98$

$F = 7.0$, ndf = (1, 162), $p = .01$

(7) $F_7 = B_{76} F_6 + E_7$

$B_{76} = .20$, $t = 2.4$, $p = .02$

$R^2 = .04$, $E^2 = .96$, $R = .20$, $E = .98$

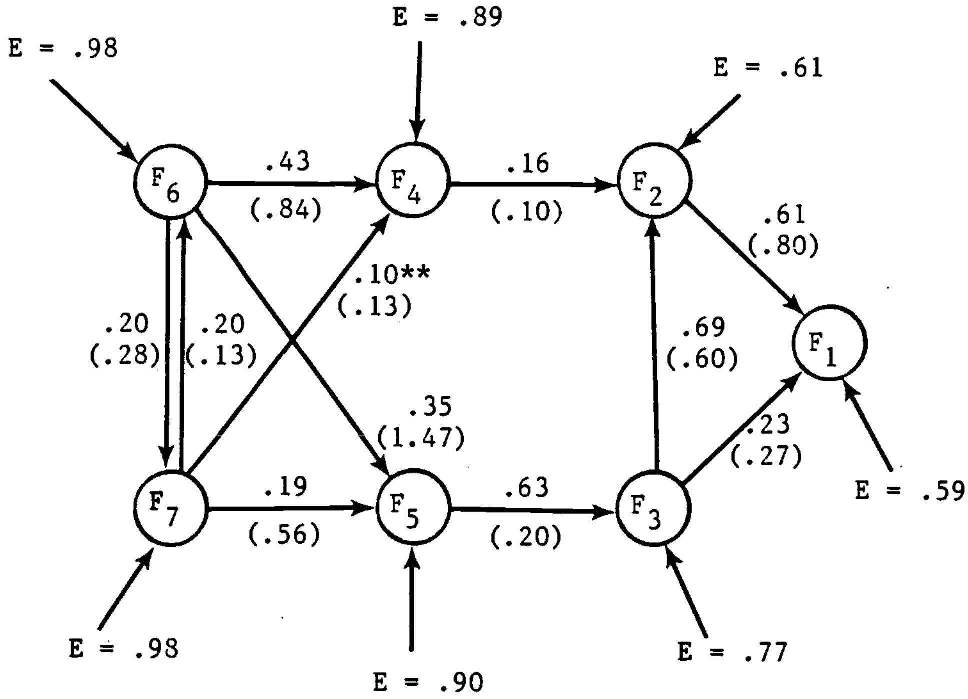
$F = 7.0$, ndf = (1, 162), $p = .01$

Key: F_1 = Intention; F_2 = Attitude; F_3 = Subjective Norm;

F_4 = Belief; F_5 = Normative Belief;

F_6 = Computer Literacy; F_7 = Accessibility;

** = not significant at .05 level.



Where: F_1 = Intention.

F_2 = Attitude.

F_3 = Subjective Norm.

F_4 = Belief.

F_5 = Normative Belief.

F_6 = Computer Literacy.

F_7 = Accessibility.

E = Residual for each factor.

** = not significant at .05 level.

Note: The standardized causal coefficients and unstandardized causal coefficients (within parentheses) are reported with their respective linkages.

Figure 3. Schematic Representation of Factors, Paths and Causal Coefficients of the Proposed Model.

intention was .23 (t = 3.1, ndf = 159, p = .00). However, when the effect of the attitude was held constant, adding subjective norm to the prediction of intention would increase the accounted for variance by only one percent.

The subjective norm factor appears to influence the attitude factor directly (Beta = .69, t = 11.9, ndf = 159, p = .00). Although the literature generally suggested that beliefs should be the primary influence on attitudes, the results indicated that the influence of subjective norms was more important than that of beliefs on the teachers' attitudes toward the use of computers (Beta = .16, t = 2.8, ndf = 159, p = .01). Both the belief and the subjective norm factors accounted for 63 percent of the variance for the attitude.

The linkage between normative belief and subjective norm was significant (Beta = .63, t = 10.3, ndf = 159, P = .00). The computer literacy and the accessibility factors interacted with each other, but weakly (Beta = .20, t = 2.4, ndf = 159, p = .02).

Although both computer literacy and accessibility directly influenced normative beliefs, they could only explain 19 percent of the total variance. This very low level of accounted for variance suggests that methodological problems or theoretical inadequencies may exist within one or more of these three factors.

The proposed linkage between accessibility and beliefs did not seem to exist statistically (Beta = .12, t = 1.7, ndf = 159, p = .10). The direct linkage between computer literacy and beliefs, however, was significant (Beta = .43, t = 6.0, ndf = 159, p = .00). Both computer literacy and accessibility accounted for 21 percent of the total variance.

The proposed causal model held that relationships should not exist between 11 pairs of factors. Partial correlations were used to test whether or not there were in fact no relationships between these 11 pairs. The results are shown in Table 8. Correlations did not seem to exist for six of the eleven pairs. As the model proposed, relationships did not exist between: beliefs and intentions (partial r = .02, N = 154, p = .38), normative beliefs and intentions (partial r = .10, N = 154, p = .12), normative beliefs and attitudes (partial r = .07, N = 155, p = .18), computer literacy and attitudes (partial r = .07, N = 155, p = .18), beliefs and subjective norms (partial r = .11, N = 156, p = .09), and accessibility and subjective norms (partial r = .10, N = 155, p = .12).

Five unpredicted relationships existed statistically. The highest partial correlation was found between beliefs and normative beliefs (partial r = .57, N = 160, p = .00). Partial correlation coefficients also suggested direct linkages between computer literacy and intentions (partial r = .29, N = 154, p = .00), computer literacy and subjective norms (partial r = .30, N = 157, p = .00), accessibility and intentions (partial r = .15, N = 154, p = .03), and accessibility and attitudes (partial r = .23, N = 155, p = .00).

In summary, the analyses of causal coefficients and partial correlations indicated that 16 of the 22 possible relationships among the seven factors were verified as predicted by the causal model. The six deviations from the proposed model were as follows:

Table 8. Partial Correlation Coefficients Between Factors That Should Not Have Direct Linkages in the Proposed Causal Model.

Factors	Controlled Factors	Partial r	N	p
$F_1 - F_4$	F_2, F_3, F_5, F_6, F_7	.02	154	.38
$F_1 - F_5$	F_2, F_3, F_4, F_6, F_7	.10	154	.11
$F_1 - F_6$	F_2, F_3, F_4, F_5, F_7	.29	154	.00
$F_1 - F_7$	F_2, F_3, F_4, F_5, F_6	.15	154	.03
$F_2 - F_5$	F_3, F_4, F_6, F_7	.07	155	.18
$F_2 - F_6$	F_3, F_4, F_5, F_7	.07	155	.18
$F_2 - F_7$	F_3, F_4, F_5, F_6	.23	155	.00
$F_3 - F_4$	F_5, F_6, F_7	.11	156	.09
$F_3 - F_6$	F_5, F_7	.30	157	.00
$F_3 - F_7$	F_5, F_6	.10	155	.12
$F_4 - F_5$	F_6, F_7	.57	160	.00

Key: F_1 = Intention.
F_2 = Attitude.
F_3 = Subjective Norm.
F_4 = Belief.
F_5 = Normative Belief.
F_6 = Computer Literacy.
F_7 = Accessibility.

1. An unpredicted linkage was found between the belief and normative belief factors.
2. An unpredicted linkage was found between the computer literacy and subjective norm factors.
3. An unpredicted linkage was found between the computer literacy and intention factors.
4. An unpredicted linkage was found between the accessibility and attitude factors.
5. An unpredicted linkage was found between the accessibility and intention factors.
6. The predicted linkage between the accessibility and belief factors did not exist statistically.

Discussion

Both industrial education teachers' attitudes and their subjective norms toward using computers related highly to their intentions to use them. That is, teachers' attitudes and their perceptions of the opinions of others were relatively good predictors of their intentions to use computers (65 percent of the total variance). This finding supported the assertion by Fishbein that attitude and subjective norm can be used to predict intention when appropriately measured.

Industrial education teachers' attitudes toward using computers were the most important factor in predicting their intentions to use computers. The relative importance of attitudes and subjective norms in predicting intentions was about three to one (Beta = .61 and .23, respectively). However, this counts for only direct influences from the subjective norm to the intention factor. When the indirect influences were included (.69 X .61 = .42), the total causal influence from the subjective norm to intention (Beta = .65) becomes as important as that from the attitude to intention (Beta = .61). This finding indicated that the opinions of others (subjective norm) were also very important to the industrial education teachers' decisions to use computers. Although industrial education teachers' attitudes were most important to their decisions to use them, these attitudes were strongly influenced by the opinions of significant others. This coincides with the suggestions by Woelfel and Haller (1971) that significant others affect the formation of attitude.

In addition to subjective norms, the teachers' beliefs toward using computers also influenced the formation of their attitudes toward using computers. However, the relative strength of this linkage was weak (Beta = .16) when compared to the influence of subjective norms on attitudes. This finding should be viewed in light of possible deficiencies in the wording of items in the belief factor. According to Fishbein and Ajzen (1975; Ajzen & Fishbein, 1980), behavioral criteria may include up to four elements: action, target, context, and time. The same elements must be consistently employed in all measures of the five factors in his model. In this study, the items in the intention, attitude, and subjective norm factors included a time element, "by this time next year." However, this time element was not included in the items on the belief and normative belief factors (Section C and E in Appendix B). The time element was considered when designing the initial instrument. It was assumed that if the time element was included in the items on belief and normative belief factors, it would also have to be employed in the items on computer literacy and accessibility factors. It was felt at that time that including the time element would cause more serious measurement difficulties than if excluded. To ask the subjects to predict what their computer competency and accessibility would be "by this time next year" did not seem to be reasonable. A possible solution for the time element problem is to use a shorter time period, e.g., three months, as the time element. This shorter time element seems reasonable for all seven factors in the proposed causal model. The correlations between beliefs and attitudes and between normative beilefs and subjective norms should increase if the time element is included in the belief and normative belief items. The extent to which the relative influences of beliefs and subjective norms on attitudes would change is, however, uncertain.

The first of the six deficiencies noted above was concerned with the linkage between the normative belief and belief factors (partial r = .53). Fishbein did not discuss the relationship between these two factors; however, such a strong partial correlation raises two questions. First, does this linkage actually exist? Second, if the linkage exists, what is the direction of the influence? The influences of this linkage on the belief and normative belief factors are shown in Table 9. If the direction of the influence was from the belief factor to normative belief factor, it would explain 26 percent of the total variance for normative beliefs. On the other hand, if

Table 9. The Influence of the Unpredicted Linkages.

1. From belief factor to normative belief factor.

   (1) $r_{45.67} = .57$ (2) $R^2_{4.67} = .21$

   (3) $E^2_{4.67} = .79$ (4) $r^2_{4(5.67)} = .257$

2. From normative belief factor to belief factor.

   (1) $r_{54.67} = .57$ (2) $R^2_{5.67} = .19$

   (3) $E^2_{5.67} = .81$ (4) $r^2_{5(4.67)} = .263$

3. From computer literacy factor to subjective norm factor.

   (1) $r_{36.57} = .30$ (2) $R^2_{3.57} = .40$

   (3) $E^2_{3.57} = 60$ (4) $r^2_{3(6.57)} = .054$

4. From computer literacy factor to intention factor.

   (1) $r_{16.23457} = .29$ (2) $R^2_{1.23457} = .68$

   (3) $E^2_{1.23457} = .32$ (4) $r^2_{1(6.23457)} = .027$

5. From accessibility factor to attitude factor.

   (1) $r_{27.3456} = .23$ (2) $R^2_{2.3456} = .65$

   (3) $E^2_{2.3456} = .35$ (4) $r^2_{2(7.3456)} = .019$

6. From accessibility factor to intention factor.

   (1) $r_{17.23456} = .17$ (2) $R^2_{1.23456} = .68$

   (3) $E^2_{1.23456} = .32$ (4) $r^2_{1(7.23456)} = .009$

Note: (1) = partial correlation.
(2) = accounted for variance when controlling for factors in the model.
(3) = error when controlling for factors in the model.
(4) = part correlation square, the influence of the linkage.
$(4) = (1)^2 \times (3)$.

the influence was from normative beliefs to beliefs, the addition of the accounted for variance in the belief factor would also be about the same. Regardless, there does not appear to be any theoretical or logical foundation for both confirming the existence of the linkage and the direction of the influence.

The findings in this study suggested that computer literacy may influence industrial education instructors' beliefs and normative beliefs toward using computers. Industrial education instructors who felt that they knew more about computers possessed stronger beliefs toward using them. They also perceived that significant others felt they should use computers in their instruction. Therefore, encouraging industrial education instructors to learn about computers is an important step toward their actually use.

Low correlations were found between the accessibility and other factors most closely associated with it. However, these may be due to deficiencies in the items on accessibility. As discussed in Chapter II, the concept of accessibility should include both the use of hardware and software. The items on accessibility directly followed the questions on locations (Item 1 in Section G). This order could have predisposed the subjects to answer the accessibility items in term of hardware only. Correlations between the accessibility and its directly related factors were considerably higher during the second pilot test. During the second pilot test, the items on accessibility followed the items on computer literacy as well as the questions on location. The items on computer literacy may have therefore reminded the subjects to include software with hardware when they considering accessibility. If the reference to software was included in the items on accessibility, both correlations of the accessibility with computer literacy factor and the accessibility with belief factor may have been higher.

Partial correlation coefficients indicated that four of the five unpredicted correlations were concerned with computer literacy and accessibility. These correlations were between: (1) the computer literacy and subjective norm factors, (2) the computer literacy and intention factors, (3) the accessibility and attitude factors, (4) the accessibility and intention factors. The possible influence of each of these unpredicted correlations is shown in Table 9. Only small portions (one to five percent) of the unexplained variance (error) were attributable to these unpredicted linkages. It would therefore be reasonable to expect that such small amounts of variance would be controlled by stronger linkages between both beliefs and subjective norms with computer literacy and accessibility. The only one predicted linkage that did not exist statistically was the relationship between the accessibility and belief factors. The correlation between accessibility and beliefs might also be enhanced if the accessibility items were improved.

All relationships among the factors in the Fishbein model were statistically significant in this study. The primary purpose of the Fishbein model is to predict the intentions of behaviors by using a very simplified scheme. Studies of the Fishbein model have not examined whether or not causal linkages existed between the factors in the model. When path analysis was employed to test the causal model proposed by this study, the results indicated some linkages which were not included in research or speculation on the Fishbein model. An important finding of this study was the verification of the proposed linkage between subjective norms and attitudes. Fishbein stated that "beliefs" is the only factor which influences the formation of attitudes. On the other hand, Woelfel and Haller's theory proposed that significant others may influence the formation of attitudes. The findings of this study suggest that both beliefs and subjective norms (significant others) influence the formation of attitudes. Although it may be possible to improve the relationship between beliefs and attitudes, the result would only affect the relative influence of beliefs and subjective norms on attitudes and not the importance of subjective norms to the formation of attitudes.

The findings of persons who may have influenced Oregon industrial education teachers to use computers are shown in Table 10. Educational experts were rated significantly higher by the industrial education teachers than any other type of persons. The next most important type of significant others included administrators, school boards, and other instructors in the school. The least important significant others were family members, friends outside the schools, and the students' parents. This seems to suggest that persons who are authorities on computers are more likely to influence Oregon industrial education teachers' attitudes toward using computers than those who are perceived to be less knowledgeable. The literature generally suggested that other instructors in the school and students' parents were the most influential persons to encourage

Table 10. People Who May Influence Oregon Industrial Education Teachers' Normative Beliefs Toward Using Computers.

Type of People	N	Median	Mean	S.D.	.95 C.I.
Educational Experts	161	10.5	9.5	6.4	8.4 to 10.5
Administrators	163	5.0	4.6	7.9	3.3 to 5.8
School Board	161	3.8	4.0	7.1	2.8 to 5.1
Other Instructors	163	4.2	3.4	6.4	2.5 to 4.4
Family Members	163	0.3	2.9	7.0	1.8 to 3.9
Friends Outside School	162	0.4	2.6	6.4	1.7 to 3.6
Students' Parents	162	0.2	2.0	6.6	0.9 to 3.0

Note: 1. Scale range : -21 (extremely negative) to +21 (extremely positive).
2. Items are shown in Section E and F.
3. Score of a normative belief is the product of a item score in Section E multiples its relative item score in Section F.

instructors to use computers during the early stage of adopting computers in schools. Industrial educators and computer educators have been working on the adoption of computer technology in Oregon public schools for quite some time. Computer technology has probably transitioned from an innovative concept to a state of being considered as accepted equipment and method in Oregon schools. Significant others may have also made a transition from the less expert to more.

Although the computer literacy factor was internally consistent (Alpha = .87), two items seemed to have correlated more highly with other factors than the other three items (Table 11). The two items were concerned with computer terminology and computer applications. The other three items addressed computer programming, human-machine relationships, and the popular, professional and technical literature on computers in education. The favoring of computer applications could have at least in part been due to the focus on CAI, CMI, utility programs, and computers as subject matter in the items on intentions and beliefs. The possibility of this bias is somewhat lessened because the intention and belief items were located after the computer literacy items. As indicated in the first and second chapters, the research on the relationship between computer literacy and behavior to use computers has been relatively unsophisticated, and the bulk of the literature is based on speculation. The components of computer literacy and the relative importance among them are still unknown.

The subjects' accessibility scores were related to the locations

Table 11. Zero-Order Correlation Coefficients Between the Items on Computer Literacy and Factors in the Proposed Causal Model.

Factors	Items on Computer Literacy* Programming (A)	Terminology (B)	Applications (C)	Relationship (D)	Information (E)
Intention	.40 (165) p=.00	.55 (165) p=.00	.57 (165) p=.00	.33 (164) p=.00	.43 (165) p=.00
Attitude	.28 (165) p=.00	.44 (165) p=.00	.48 (165) p=.00	.35 (164) p=.00	.39 (165) p=.00
Subjective Norm	.40 (162) p=.00	.46 (162) p=.00	.51 (162) p=.00	.32 (161) p=.00	.43 (162) p=.00
Belief	.31 (165) p=.00	.43 (165) p=.00	.45 (165) p=.00	.25 (164) p=.00	.38 (165) p=.00
Normative Belief	.23 (164) p=.00	.32 (164) p=.00	.40 (164) p=.00	.28 (163) p=.00	.32 (164) p=.00
Computer Literacy	.78 (165) p=.00	.86 (165) p=.00	.86 (165) p=.00	.70 (164) p=.00	.83 (165) p=.00
Accessibility	.15 (164) p=.03	.19 (164) p=.01	.20 (164) p=.01	.14 (163) p=.03	.15 (164) p=.03

Note: 1. * Items from Section A in the final instrument.
(A) Programming.
(B) Computer terminology.
(C) Computer applications in education.
(D) Human and machine relationships.
(E) Information on computers in education.
2. Numbers of subjects are reported within parentheses.

of computers in their schools (Appendix H). The subjects felt that computers were accessible when they were located in their offices and/or in classrooms/laboratories (Table 12). This could indicate that instructors will be more willing to incorporate computers into their normal functioning if the computers are located in their immediate work area.

In summary, six deficiencies in the total 22 possible predicted and unpredicted linkages among the seven proposed factors were found; however, these do not necessarily invalidate the proposed causal model. According to Asher (1976), any linkage proposed in a causal model must have a theoretical foundation. Statistical tests may only confirm whether or not proposed linkages exist. The addition or deletion of any linkage in a proposed causal model must also coincide with known constructs. It is noteworthy that only one of the 11 predicted direct linkages in the model proposed by this study failed to be supported statistically. However, this one discrepancy may be due to possible deficiencies in items. Four of the five unpredicted correlations had very limited impact on the model, and would probably cease to exist if the validity of two factors were improved. Unexplained is the apparent but unpredicted linkage between the belief and normative belief factors. Although its existence was strongly supported statistically, the linkage lacks a theoretical rationale.

Table 12. *t*-test of Accessibility Scores Between the Subjects Who Had Computers in Office or Laboratory (Classroom) and Who Did Not.

Computer Available	N	Mean	S.D.	t	df	p
Yes	54	6.3	1.1	7.76	162	.00
No	110	4.1	1.9			

V. SUMMARY, CONCLUSIONS AND IMPLICATIONS

Summary

Prior research has indicated that although many teachers favored the use of computers, few of them actually used them. If the factors that could encourage or enable teachers to use computers were known, perhaps remedial steps could be taken. The purposes of this study were: (1) to identify the factors that would influence industrial education teachers to use computers in their instructions and (2) to explain how these factors were related to each other. For the purpose of this study, the uses of computers were identified as follows: computer-assisted instruction, computer-managed instruction, a utility and course content.

Based on the Theory of Reasoned Action that was proposed by Fishbein and Ajzen (1976; Ajzen & Fishbein, 1980), it was assumed that extent to which industrial education teachers actually use computers could be predicted by their intentions to use computers. It was then proposed that industrial education teachers' intentions could be directly influenced by their subjective norms and attitudes toward using computers in their instruction. The teachers' beliefs and normative beliefs toward using computers in their instruction then directly influenced their attitudes and subjective norms, respectively. Two additional factors were proposed to influence the industrial education teachers' beliefs and normative beliefs toward using computers in their instruction. These two factors were "computer literacy" and "accessibility" to computer systems in schools.

An instrument was developed based on the findings of two pilot tests. Copies of the instrument were mailed to 210 Oregon secondary industrial education teachers who were randomly selected from the 1985-86 directory of industrial education teachers in Oregon. The survey procedures were based on the method proposed by Dillman (1978). The response rate for the survey was 80.1 percent. The coefficients of internal consistency (Cronbach's Alpha) ranged from .82 to .92 for the factors which consisted of more than two items.

The direct relationships among the seven factors proposed by this study were expressed by seven causal (multiple regression) equations. These seven causal equations were used to test the 11 predicted direct relationships among factors in the proposed causal model. Ten of the 11 predicted relationships among the seven factors were verified. The only relationship that was not statistically significant was between the accessibility and belief factors. An examination of the instrument indicated that the relationship between these two factors could be enhanced by improving the related items.

Partial correlations were used to determine whether or not relationships existed among the factors where they should not have. Six of the eleven pairs of factors were not related statistically. The results also indicated that four of the five unpredicted relationships which statistically existed only minimally improved the predictions among factors in the proposed causal model. It is very likely that they would not have exist at all if the previously mentioned improvments had been made to the related items. The only unpredicted relationship that could not be explained was between beliefs and normative beliefs; however, a linkage between the two factors cannot be justified theoretically.

In summary, the findings of this study suggested that the opinions of other people, knowledge of computers, and accessibility to computer systems were three basic factors that could be manipulated to influence industrial education teachers to use computers in their instruction.

Limitations

The findings about the relationships among factors in the proposed causal model should be generalizable to all secondary industrial education teachers in the United States. The causal model proposed by this study described the factors which influence industrial education teachers to use computers in their instruction. These factors and the relationships among them described the formation of beliefs, normative beliefs, attitudes, subjective norms and intentions toward using computers by industrial education teachers. According to Fishbein and Ajzen (1976; Ajzen & Fishbein, 1980), external factors, such as geography and intelligence, should not affect the relationships among all the factors in the model. Where teachers live should not have any effect on how their attitudes toward the applications of computers in industrial education develop. However, external factors may affect the substance and magnitude of beliefs and normative beliefs, and may similarly affect attitude and subjective norms. For this study, therefore, the status of each factor, for example, the mean score and particular characteristics, would be generalizable to only secondary industrial education teachers in Oregon.

In this study, the computer literacy and accessibility factors were based on the subjects' perceptions of their abilities and knowledge on computers and their accessibility to computer systems in their schools, respectively. The effects of these factors may have be different if the subjects' actual abilities and knowledge on computers and their accessibility to computer hardware and software were measured.

Conclusions

Industrial education teachers' intentions to use computers in their instruction are influenced by their subjective norms and attitudes toward using computers in their instruction. Their attitudes toward using computers in their instruction are determined by their subjective norms and beliefs toward using computers in their instruction. Their subjective norms are influenced in terms of their normative beliefs. Industrial education teachers' beliefs and their normative beliefs toward using computers in their instruction are influenced by their computer literacy and their perception of the accessibility of computer systems in their schools to them. Their computer literacy and their perception of the accessibility of computer systems enhance each other.

Changing computer literacy, accessibility to computer software and hardware, and the opinions of significant others are three fundamental means of influencing industrial education teachers to use computers in their instruction. In Oregon, the most influential significant others are educational experts. Computer hardware is perceived accessible only if located in the office, laboratory or classroom, since other locations in the school are perceived as inaccessible.

Implications

Three conditions are important to encourage industrial education teachers to use computers in their work. First, the teachers must be computer literate. However, the extent to which they must become literate is unknown. Studies on computer literacy often use consensual and survey methods to establish the desired content. These studies have not attempted to link content to behavior either directly or indirectly. The research that has attempted to link computer literacy with attitudes, and therefore to behavior, did not appear to have been concerned with the content of computer literacy. Further research is needed to explain the influence of computer literacy and its components on behavior.

Second, industrial education teachers must feel that they have access to computer hardware and appropriate software. The location and possibly the control over computer systems influence their willingness to use computers in their work. However, both the physical and psychological meaning of "accessibility" deserves further study. As an example, the extent to which distance and control of the computer system influence a teacher's willingness to use computers should be studied. The relative importance of psychological and physical considerations in instructors' ideas of accessibility should also be studied.

Third, significant others are influential on the instructors' use of computers. Educational experts were identified as important significant others for industrial education teachers in Oregon. A more specific identification of these experts could not be determined for this study. Furthermore, knowing exectly how these experts may influence teachers would be very helpful in encouraging teachers to use computers and doing so efficiently. Whether experts are similarly influential in states other than Oregon also needs to be studied.

It appears evident from the results of this study that the relationship between the belief and normative belief factors need to be explored further. Given the strengths of the relationships between the externals, accessibility and computer literacy, with beliefs and normative beliefs, there may also be one or more additional external factors. The identification of these factors as well as the linkage between beliefs and normative beliefs could explain the formation of beliefs and normative beliefs.

Further research is also needed on the structure and content of computer literacy. This may include research on the relationships between perceived and actual abilities and knowledge. Definitive findings will permit more effective diagnosis of instructor capabilities. These in turn should lead to more effective methods for helping them to become computer literate and thereby increase their intention to adopt computer technology.

The causal model proposed by this study could be employed to investigate the use of computers in other fields of education. The items in each factor may need to be recompiled based on the computer applications in those particular educational fields. Regardless, the proposed model provides a theoretical framework for these later studies.

REFERENCES

Ajzen, I. & Fishbein, M. (1970). The prediction of behavior from attitudinal and normative variable. Journal of Experimental Social Psychology, 6, 466-487.

Ajzen, I. & Fishbein, M. (1977). Attitude-behavior relations: A theoretical analysis and review of empirical research. Psychological Bulletin, 84, 888-918.

Ajzen, I. & Fishbein, M. (1980). Understanding Attitudes and Predicting Social Behavior. Englewood Cliffs, NJ: Prentice-Hall.

Allport, G. W. (1935). Attitudes. In C. Murchison (Ed.), A Handbook of Social Psychology (pp. 798-844). Worcester, Mass: Clark University Press.

American Industrial Arts Association (1980). Industrial Arts: A Means of Preparing Youth to Understand and Contribute to Our Industrial Technological Society (p. 3). Washington, DC: American Industrial Arts Association.

Anderson, R. E. (1984). Before the subcommittee on investigations and oversight of the House Science and Technology Committee. SIGCUE Bulletin: Computer Uses in Education, 18, (1), 4-10.

Anderson, R. E., Welch, W. W., & Harris, L. J. (1984). Inequities in opportunities for computer literacy. The Computing Teacher, 4, 10-16.

Asher, H. B. (1976). Causal Modeling. Sage University Paper on Quantitative Applications in the Social Science. Beverly Hills, CA: Sage Publications.

Atkinson, M. L. (1984). Computer-assisted instruction: Current state of the art. Computers in the School, 1, 91-99.

Baker, B. O. (1985). A survey of microcomputer use in small rural high schools. Computers in the Schools, 1, 47-51.

Beach, R. H., & Vacca, A. M. (1985). Administrative variables and microcomputer implementation: A survey of high school principals'. Computers in the Schools, 2, (1), 31-46.

Blalock, H. M. Jr. (1968). Theory building and causal inferences. In H. M. Blalock & A. B. Blalock (Eds.), Methodology in Social Research (pp. 155-198). New York: McGraw-Hill.

Blalock, H. M. Jr. (Ed.). (1971). Causal Models in the Social Sciences. Chicago: Aldine-Atherton.

Bowen, B. E. (1984). Effects of microcomputers as classroom evaluation tools. Journal of Vocational Education Research, 9, (3), 51-64.

Bowman, C., & Fishbein, M. (1978). Understanding public reaction to energy proposals: An application of the Fishbein model. Journal of Applied Social Psychology, 8, (4), 319-340.

Bradford, C. R. (1985). An analysis of the relationships between computer literacy, attitude and the utilization of microcomputers in public school settings (Doctoral dissertation, University of Iowa, 1984). Dissertation Abstracts International, 45, 2070A.

Buxton, M., & Taitt, H. (1982). Microcomputer: A creative approach for young mind. Computer: Extension of the Human Minds (pp. 157-165). Eugene, OR: School of Education, University of Oregon.

Campbell, D. T. (1963). Social attitudes and other acquired behavioral dispositions. In S. Koch (Ed.), Psychology: A Study of a Science (pp. 94-172). New York: McGraw-Hill.

Carey, M. L. (1981). Occupational employment growth through 1990. Monthly Labor Review, 104, 42-55.

Chambers, J., & Sprecher, J. (1983). CAI current trends and critical issues. In Dennis Harper & James H. Stewart (Eds.), Run Computer Education (pp. 107-117). Monterey, CA: Brooks/Cole Publishing.

Chen, D., & Rafi, N. (1984). The design and implementation of an introductory computer literacy course for teachers and educational decision-makers. T.H.E. Journal, 11, (14), 113.

Cole, D., & Hannafin, J. (1983). An analysis of why students select introductory high school computer coursework. Educational Technology, (April), 26-29.

Conference Board of the Mathematical Sciences (1972). Recommendations regarding computers in high school education. Washington, DC: U.S. Office of Education.

Condon, M. (1983). Straight talk about robots. Training and Development Journal, 1983, (November), 15-24.

Cory, S. (1983). A 4-stage model of development for full implementation of computers for instruction in a school system. The Computing Teacher, 11, 11-16.

Davidson, A. (1974). The prediction of family planning intentions. (Doctoral dissertation, University of Illinois at Urbana-Champaign, 1974). Dissertation Abstracts International, 36, 3199A.

Davidson, A., & Jaccard, J. J. (1975). Population psychology: A new look at an old problem. Journal of Personality and Social Psychology, 31, (6), 1073-1082.

Dillehay, R. C. (1973). On the irrelevance of the classical negative evidence concerning the effect of attitudes on behavior. American Psychologist, 237-256.

Dillman, D. A. (1978). Mail and Telephone Surveys. New York: John Wiley & Sons, Inc.

Emmett, A. (1983). American education: The dead end of the 80's. Personal Computing, 7, (8), 96-105.

Festinger, L. (1957). A Theory of Cognitive Dissonance. Paloalto, CA: Stanford University Press.

Fishbein, M. (1967a). Attitude and the prediction of behavior. In M. Fishbein (Ed.), Readings in Attitude Theory and Measurement (pp. 477-492). New York: John Wiley.

Fishbein, M. (1967b). A behavior theory approach to the relation between beliefs about an object and the attitude toward the object. In M. Fishbein (Ed.), Readings in Attitude Theory and Measurement (pp. 389-400). New York: John Wiley.

Fishbein, M., & Ajzen, I. (1972). Attitudes and opinions. Annual Review of Psychology, 23, 487-544.

Fishbein, M., & Ajzen, I. (1974). Attitudes toward objects as predictors of single and multiple behavioral criteria. Psychological Review, 81, (1), 59-74.

Fishbein, M., & Ajzen, I. (1975). Beliefs, Attitude, Intention, and Behavior: An Introduction to Theory and Research. Reading, Mass: Addison-Wesley Publishing.

Fishbein, M., & Ajzen, I. (1976a). Misconceptions about the Fishbein model: Reflections on a study by Songer-Nocks. Journal of Experimental Social Psychology, 12, 579-584.

Fishbein, M., & Ajzen, I. (1976b). Misconceptions revisited: A final comment. Journal of Experimental Social Psychology, 12, 591-593.

Fishbein, M., Ajzen, I., & McArdle, J. (1980). Changing the behavior of alcoholics: Effects of persuasive communication. In I. Ajzen & M. Fishbein (Eds.), Understanding Attitudes and Predicting Social Behavior (pp. 217-242). Englewood Cliffs, NJ: Prentice-Hall.

Fishbein, M., Bowman, C. H., Thomas, K., Jaccard, J. J., & Ajzen, I. (1980). Predicting and understanding voting in British elections and American referenda: Illustrations of the theory's generality. In I. Ajzen & M. Fishbein (Eds.), Understanding Attitudes and Predicting Social Behavior (pp. 196-216). Englewood Cliffs, NJ: Prentice-Hall.

Fishbein, M., & Coombs, F. S. (1974). Basis for decision: An attitudinal analysis of voting behavior. Journal of Applied Social Psychology, 4, (2), 95-124.

Fishbein, M., & Jaccard, J. J., Davidson, A. B., Ajzen, I. & Loken, B. (1980). Predicting and understanding family planning behaviors: Beliefs, attitudes, and intentions. In I. Ajzen & M. Fishbein (Eds.), Understanding Attitudes and Predicting Social Behavior (pp. 130-147). Englewood Cliffs, NJ: Prentice-Hall.

Garton, R., Reed, M., Reed, G., & Steven, E. (1984). Developing a CBI course. Proceedings of the 25th Conference of ADCIS, 25, 142-158.

Goldberger, A. S. (1970). On Boundon's method of linear causal analysis. American Sociological Review, 35, 97-101.

Golladay, M. A. (1977). The Condition of Education. U.S. National Center for Educational Statistics. Washington, DC: U.S. Government Printing Office.

Greene, M. M. (1982). The use of microcomputers in education evaluation. The Computer: Extension of the Human Minds (pp. 115-120). Eugene, OR: School of Education, University of Oregon.

Hamilton, C. R. (1986). Factors influencing administrative and instructional use of computers in independent schools (Doctoral dissertation, University of Minnesota, 1985). Dissertation Abstracts International, 46, 1910A.

Hazen, M. D. (1973). The role of Attitudes in prediction of behavior: A new perspective. (ERIC Document Reproduction Service No. ED 077 037)

Heider, F. (1946). Attitudes and cognitive organization. Journal of Psychology, 21, 107-112.

Ingersoll, G., & Smith, C. (1984). Reported availability of microcomputers in American schools: Year 2. [Summary] Proceedings of 25th ADCIS Conference, 25, 230.

Jaccard, J., Davidson, A. R. (1972). Toward an understanding of family planning behaviors: An initial investigation. Journal of Applied Social Psychology, 2, (3), 228-235.

Krech, D., Crutchfield, R., & Ballachey, E. (1962). Individual in Society. New York: McGraw-Hill.

LaPiere, R. T. (1934). Attitude vs. actions. Social Forces, 13, 230-237.

Lautenberg, F. R. (1984). Equity in computer education. The Computing Teacher, (April), 13-14.

Lazean, T. J. (1984). CAD training in industry and education. T.H.E. Journal, 11, (3), 78-79.

Levy, J. (1983). A Short Course to Computer Literacy. New York: John Wiley & Sons, Inc.

Lichtman, D. (1979). Survey of educator's attitudes toward computers. Creative Computing, 5, 48-50.

Liedtke, J. A. (1983). Predicting metrication intention of industrial arts teachers using a theory of reasoned action (Doctoral dissertation, Purdue University, 1983). Dissertation Abstracts International, 44, 2695A.

Lindauer, B. D., & Bruemmer, L. F. (1984). Robotics: Training challenge of the 1980's. Proceedings of the 25th ADCIS Conference, 25, 28-33.

Luehrmann, A. (1980). Computer literacy: A national crisis and a solution for it. Byte, 5, (7), 98-102.

Lumsden, D. B., & Norris, C. A. (1985). A survey of teacher attitudes and beliefs related to educational computing. Computers in the Schools, 2, (1), 53-59.

Lykos, P. G. (1974). The computer literacy problem: A practical solution. American Mathematics Monthly, 81, (4), 393-398.

MacPhail-Wilcox, B. (1983). Fast forward with a plan for cost-efficient statewide computing. Educational Technology, (March), 20-21.

Martin, E. P. (1985). Teacher attitudes toward the use of computers in the educational process (Doctoral dissertation, Texas A & I University, 1984). Dissertation Abstracts International, 45, 3616A.

Mazis, M. B., Ahtola, O. T., & Klippel, R. E. (1975). A comparison of four multiattribute models in the prediction of consumer attitudes. Journal of Consumer Research, 2, 38-52.

McGuire, W. J. (1969). The nature of attitudes and attitude change. In G. Lindzey & E. Aronson (Eds.). The Handbook of Social Psychology, (2nd ed.), 3, pp. 136-314. Reading, Mass: Addison-Wesley.

Melmed, A. S. (1984). Educational productivity: The teacher and technology. T.H.E. Journal, 11, 78-82.

Molnar, A. R. (1983). The next crisis in American education. In Dennis Harper, & James Stewart (Eds.). Run: Computer Education (pp. 24-29). Monterey, CA: Brooks/Cole Publishing.

Moore, M. L. (1986). Preparing teachers to teach about computers and computing. In Dennis Harper & James Stewart (Eds.). Run: Computer Education (2nd ed.), (pp.97-102). Monterey, CA: Brooks/Cole Publishing.

Moursund, D. (1976). What is computer literacy? Creative Computing, 2, (6), 55.

Nasman, L. (1982). Computers mean new decisions. Voc Ed Journal, 57, (3), 36.

National Center for Education Statistics (1982). Instructional Use of Computers in Public Schools Spring 1982. (FRSS Report No. 44). Washington, DC: U.S. Department of Education. (ERIC Document Reproduction Service No. Ed 112514)

Nie, N. H., Hull, C. H., Jenkins, J. G., Steinibrenner, K., & Bent, D. H. (1975). Statistical Package for the Social Sciences (2nd ed.). New York: McGraw-Hill.

Oregon Department of Education (1985a). Subject Matter Update 1986-87, Forestry/Forest Products (p. 10). Salem, OR: Division of Vocational Education, Oregon Department of Education.

Oregon Department of Education (1985b). Subject Matter Update 1986-87, Industrial Mechanics (p. 4). Salem, OR: Division of Vocational Education, Oregon Department of Education.

Oregon Department of Education (1985c). Subject Matter Update 1986-87, Metals (p. 9). Salem, OR: Division of Vocational Education, Oregon Department of Education.

Osgood, C. E., & Tannenbaum, P. H. (1955). The principle of congruity in the prediction of attitude change. Psychological Review, 62, 42-55.

Oskamp, S. (1977). Attitudes and Opinions. Englewood Cliffs, NJ: Prentice-Hall.

Parker, J., & Widmer, C. (1983). Computer: Less apprehension, more enthusiasm. Procerdings of National Educational Computing Conference, pp. 377-380.

Poirot, J., Taylor, R., & Powell, J. (1983). Teacher education. In D. Harper & J. Stewart (Eds.), Run: Computer Education (pp. 60-67). Monterey, CA: Brooks/Cole Publishing.

Post, E. P. (1985). The effect of students' field independence/field dependence on computer assisted instruction achievement (Doctoral dissertation, Purdue University, 1984). Dissertation Abstracts International, 45, 2013A.

Pressman, I., & Rosenbloom, B. (1984). CAI system costs: Present and future. T.H.E. Journal, 11, (6), 94.

Rawitsch, D. G. (1978). The concept of computer literacy. The MAEDS Journal of Educational Computing, 2, (2), 1-19.

Richman, E. (1983). The Random House Book of Computer Literacy. New York: Random House, Inc.

Robardey, C. P. Sr. (1972). A study of selected Michigan elementary and secondary teachers' and principals' attitudes toward computer-assisted instruction (Doctoral dissertation, Michigan State University, 1971). Dissertation Abstracts International, 32, 4929A.

Robbat, R. J. (1985). The utilization of computers in high school history education (Doctoral dissertation, University of Oregon, 1984). Dissertation Abstracts International, 45, 3537A.

Rosenberg, M. J. (1956). Cognitive structure and attitude affect. Journal of Abnormal and Social Psychology, 53, 367-372.

Rosenberg, M. J., Hovland, C. I., & McGuire, W. J., Abelson, R. P., & Brehm, J. W. (1960). Attitude organization and change: An analysis of consistency among attitude components. New Haven, CT: Yale University Press.

Rueckert, V. L. (1985). A comparison study of teachers' perceptions of computer education as related to grade level, teacher training and computer accessibility (Doctoral dissertation, University of South Dakota, 1984). Dissertation Abstracts International, 45, 1980A.

Sanders, J. S. (1984). The computer: Male, female or androgynous? The Computing Teacher, 4, 31-34.

Scheaffer, R. L., Mendenhall, W., & Ott, L. (1979). Elementary Survey Sampling, (2nd ed.). North Scituate, Mass: Duxbury Press.

Schmidt, J. (1984). Procedures for evaluating microcomputer software used in vocational education. Journal of Vocational Education Research, 9, (1), 10-23.

Schwerkolt, E. (1985, Fall). Journal of Epsilon Pi Tau production changes. "Quote...Unquote". The newsletter of Epsilon Pi Tau, 8, (1).

Seidel, R., Anderson, R., & Hunter, B. (Eds.). (1982). Computer Literacy Issues and Directions for 1985. New York: Academic Press.

Sejwacz, D., Ajzen, I., & Fishbein, M. (1980). Predicting and understanding weight loss: Intentions, behaviors, and outcomes. In I. Ajzen & M. Fishbein (Eds.), Understanding Attitudes and Predicting Social Behavior (pp. 101-112). Englewood Cliffs, NJ: Prentice-Hall.

Sherman, S. W. (Ed.). (1984). Education for Tomorrow's Job. Washington, DC: National Academic Press.

Simon, H. (1957). Spurious correlation: A causal interpretation. New York: Wiley.

Snelbecker, G. E., & Stepansky, D. (1985). Gigo--how does it apply to computer-based instruction. Proceedings of 26th International Conference of ADCIS, 26, 29-33.

Songer-Nocks, E. (1976a). Situational factors affecting the weighting of predictor components in the Fishbein model. Journal of Experimental Social Psychology, 12, 56-69.

Songer-Nocks, E. (1976b). Reply to Fishbein and Ajzen. Journal of Experimental Social Psychology, 12, 585-590.

Sperber, B. M., Fishbein, M., & Ajzen, I. (1980). Predicting and understanding women's occupational orientations: Factors underlying choice intentions. In Ajzen & Fishbein. Understanding Attitudes and Predicting Social Behavior (pp. 113-129). Englewood Cliffs, NJ: Prentice-Hall.

Stephens, S. (1979). Assessment of a model to predict attitudes and behavior of vocational teacher trainees toward handicapped individuals. (Doctoral dissertation, Oregon State University, 1979). Dissertation Abstracts International, 40, 823A.

Stern, S. & Liedtke, J. A. (1984). A Methodology for Computer Skills Improvement in Vocational Secondary Program. Corvallis, OR: Department of Vocational-Technical Education, Oregon State University.

Stevens, D. J. (1980). How educators perceive computers in the classroom. Association for Educational Data Systems Journal, 13, 221-232.

Thomas, B. (1985a). A survey study of computers in nursing education. Proceedings of the 26th International ADCIS Conference, 26, 79-84.

Thomas, B. (1985b). Promoting computing in nursing education: A delphi study. Proceedings of the 26th International ADCIS Conference, 26, 85-93.

Thomas, W. I., & Zmaniecki, F. (1918). The Polish Peasant in Europe and America (Vol. 1). Boston: Badger.

Tolman, M. N., & Allred, R. A. (1984). The Computer and Education: What Research Says to the Teacher. Washington, DC: National Education Association.

Triandis, H. C. (1971). Attitudes and Attitude Change. New York: Wiley.

U.S. Department of Education (1986, January). Teacher preparation in the use of computers. Bulletin: OERI. Washington, DC: Office of Educational Research and Improvement, U.S. Department of Education.

U.S. Office of Education (1966). Administration of Vocational Education: Rules and Regulations (Vocational Education Bulletin, No. 1, p. 46). Washington, DC: U.S. Government Printing Office.

Vinokur-Kaplan, K. (1978). To have or not to have another child: Family planning attitudes, intentions, and behavior. Journal of Applied Social Psychology, 8, (1), 29-46.

Vockell, E. L., & Rivers, R. (1983). Computer literacy for educators: An applied programming approach. The Computing Teacher, 4, 61-63.

Watt, D. H. (1981). Education for citizenship in a computer-based society. In R. Seidel, R. Anderson & B. Hunter (Eds.), Computer Literacy: Issues and Directions for 1985 (pp. 53-67). New York: Academic Press.

Weber, S. J., & Cook, T. D. (1972). Subject effects in laboratory research: An examination of subject roles, demand characteristics, and valid inference. Psychological Bulletin, 77, 273-295.

Wicker, A. W. (1969). Attitude versus actions: The relationship of verbal and overt behavioral responses to attitude objects. Journal of Social Issues, 24, 41-77.

Woelfel, J., & Haller, A. O. (1971). Significant others, the self-reflexive act and the attitude formation process. American Sociological Review, 36, 74-87.

Yuen, C. (1985). Attitudes of trade and industrial teachers toward the use of microcomputers. The Journal of Vocational Education Research, 10, (2), 51-64.

Zahniser, F., Long, J. P., & Nasman, L. O. (1983). Microcomputers in Voc Ed: A Decision Guide. The National Center for Research in Vocational Education (Research & Development Series No. 239A). Columbus, OH: Ohio State University.

Zartman, C. G. Jr. (1984). A study of the importance of microcomputer usage skills as compared to other factors in decisions related to principles' hiring practices in secondary school (Doctoral dissertation, University of Colorado at Boulder, 1984). Dissertation Abstracts International, 44, 2844A.

APPENDICES

APPENDIX A

THE FINAL INSTRUMENT

COMPUTER USE IN INDUSTRIAL EDUCATION

Instruction

The questions will be concerned with factors which may influence your use of computers. The term "computer" will signify microcomputer, minicomputer, mainframe computer, or microcprocesser.

For most of the questions, you will be asked to express your opinion on a measure such as this:

:______:______:______:______:______:______:______:

Words with opposite meanings appear at the two ends of the measure, and increments will be printed below each space. You should place your mark in the space that best describes your opinion. For example, you will be asked to rate how "good" or "bad" increasing usage of computers in industrial education is. If you think that increasing usage of computers in industrial education is "quite good," you should place your mark as follows:

good:								:bad
		X						
	extremely	quite	slightly	neither	slightly	quite	extremely	

If you think that increasing usage of computers in industrial education is "neither good nor bad," then you should place your mark as follows:

good:								:bad
				X				
	extremely	quite	slightly	neither	slightly	quite	extremely	

Other descriptors, such as, likely-unlikely, important-unimportant, encouraged-discouraged, etc., should be rated in the same way. In marking your rates, please remember the following points:

(1) Place your marks in the middle of space, not on the boundaries (colons).
(2) Place one and only one check mark on a single measure.
(3) Again, we encourage you to answer all items; missing information makes interpreting your answers difficult.
(4) If you feel any word or term used in this questionnaire is ambiguous, please circle that word or term.

Section A:

1. "Programming" includes development of a problem-solving strategy and its implementation in a programming language (e.g., BASIC, PASCAL, FORTRAN) and debugging.

   How do you rate your programming abilities?

   good:______:______:______:______:______:______:______:poor
   extremely quite slightly neither slightly quite extremely

2. "Computer terminology" includes computer terms about software (e.g., operation systems, time-sharing system, etc.), hardware (e.g., CRT, tape, disk, computer, etc.), and miscellaneous items (e.g., documentation, simulation, CAI, CMI, etc.).

   How do you rate your knowledge of computer terminology?

   good:______:______:______:______:______:______:______:poor
   extremely quite slightly neither slightly quite extremely

3. "Computer applications in education" includes experience in using educational application software (e.g., grade book, word processing, spread sheet, data base management, etc.), and understanding how to implement computer use into your instruction or your job in the school.

   How do you rate your knowledge about computer applications in education?

   good:______:______:______:______:______:______:______:poor
   extremely quite slightly neither slightly quite extremely

4. "Human and machine relationships" means an understanding of the relationships between human and artifical intelligence, robotics, computer assistance in decision making (e.g., medical, legal, business, etc.), and a ability to discuss moral, psychological, and sociological issues of computing in society and in education.

How do you rate your knowledge about human and machine relationships?

good:________:________:________:________:________:________:________:poor
extremely quite slightly neither slightly quite extremely

5. "Information on computers in education" includes computer periodicals, books, computer professional societies , computer users network, hardware and software vendor groups, and other sources of information on computers in your specific teaching area.

How do you rate your knowledge about information on computers in education?

good:________:________:________:________:________:________:________:poor
extremely quite slightly neither slightly quite extremely

Section B:

1. "Use computers in some aspect of my job" means to employ computers regularly in any or some of the following areas: (1) computer-assisted instruction, e.g., tutorial, drill & practice, simulations, instructional games, (2) computer-managed instruction, e.g., grade book, (3) as a utility, e.g., word processing, data base management, spread sheet, (4) as course content, e.g., computer-aided design, computer-aided manufacture, robotics.

I intend to use computers in some aspect of my job by this time next year.

probable:________:________:________:________:________:________:________:improbable
extremely quite slightly neither slightly quite extremely

2. Generally speaking, using computers in some aspect of my job by this time next year will be: (Please place a check mark for each of the five items below.)

easy:________:________:________:________:________:________:________:difficult

possible:________:________:________:________:________:________:________:impossible

encouraged:________:________:________:________:________:________:________:discouraged

important:________:________:________:________:________:________:________:unimportant

good:________:________:________:________:________:________:________:bad
extremely quite slightly neither slightly quite extremely

3. Generally speaking, most of the people who are important to me think I should use computers in some aspect of my job by this time next year.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

Section C:

1. My using computers in the school would improve the quality of my instruction.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

2. My using computers in the classroom would facilitate individualized instruction.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

3. My using computers in the instruction would keep course content up to date.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

4. My using computers for instruction would help my students learn necessary skills for social survival in the future.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

5. My using computers in the school would facilitate my keeping of student records.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

6. My using computers in the school would make my job easier.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

7. My using computers in the school would allow me to use word processing programs.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

8. My using computers in the school would make a good impression on administrators.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

Section D:

1. Improving the quality of instruction is:

good:________:________:________:________:________:________:________:bad
extremely quite slightly neither slightly quite extremely

2. Having individualized instruction is:

good:________:________:________:________:________:________:________:bad
extremely quite slightly neither slightly quite extremely

3. Keeping course content up to date is:

good:________:________:________:________:________:________:________:bad
extremely quite slightly neither slightly quite extremely

4. Having students learn necessary skills for social survival is:

good:________:________:________:________:________:________:________:bad
extremely quite slightly neither slightly quite extremely

5. Keeping students' records is:

good:________:________:________:________:________:________:________:bad
extremely quite slightly neither slightly quite extremely

6. Making instructors jobs easier is:

good:________:________:________:________:________:________:________:bad
extremely quite slightly neither slightly quite extremely

7. Having materials, tests, letters, etc. typed or being able to type them myself is:

good:________:________:________:________:________:________:________:bad
extremely quite slightly neither slightly quite extremely

8. Making a good impression on administrators is:

good:________:________:________:________:________:________:________:bad
extremely quite slightly neither slightly quite extremely

Section E:

1. My students' parents think I should use computers in my instruction.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

2. The administrators in my school think I should use computers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

3. The school board thinks I should use computers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

4. Instructors in my school think I should use computers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

5. My family members think I should use computers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

6. My friends outside of school think I should use computers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

7. Education experts think I should use computers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

Section F:

1. Generally speaking, I want to do what students' parents think I should do.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

2. Generally speaking, I want to do what the administrators think I should do.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

3. Generally speaking, I want to do what the school board thinks I should do.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

4. Generally speaking, I want to do what other teachers think I should do.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

5. Generally speaking, I want to do what my family members think I should do.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

6. Generally speaking, I want to do what my friends outside of school think I should do.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

7. Generally speaking, I want to do what education experts think I should do.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

Section G:

1. Where are the computer(s) which you can use located in your school? (check all that applied)

_____ My office.
_____ My classroom or lab.
_____ Classroom or lab next to mine.
_____ Computer center.
_____ Other classrooms or labs.
_____ Other. (please specify) ____________________

2. In general, you can use computer(s) whenever you need to.

agree:________:________:________:________:________:________:________:disagree
extremely quite slightly neither slightly quite extremely

3. In general, the locations of computer(s) which you can use are:

convenient:________:________:________:________:________:________:________:inconvenient
extremely quite slightly neither slightly quite extremely

4. What is the school level in which you are teaching?

_____ Junior high or middle school.
_____ Combined junior and senior high school.
_____ High school.
_____ Other. (please specify) ____________________

5. What is your specialization?

_____ Industrial arts.
_____ Trade and industrial education.
_____ Both.

6. What is your gender?

_____ Female.
_____ Male.

7. What is your age? _______________ years old.

8. Do you have a computer in your home?

_____ Yes.
_____ No.

9. How many credits of computer courses, workshops or seminars have you taken?

____________________ (credits).

10. How many clock hours of computer conferences, non-credit inservice, or workshops have you participated in?

____________________ (hours)

Your comments and insights are welcomed! Please provide them on the next page.

Thank you for your help!

APPENDIX B

THE INITIAL INSTRUMENT

Section A:

1. I intend to use computers for computer-assisted instruction (CAI) during the next school year.

probable:____:____:____:____:____:____:____:improbable
extremely quite slightly neither slightly quite extremely

2. I intend to use computers as a tool to manage my instruction during the next school year, such as, grade book, inventory, budgets.

probable:____:____:____:____:____:____:____:improbable
extremely quite slightly neither slightly quite extremely

3. I intend to use computers as a tool to prepare my instruction during the next school year, such as, develop lab manuals, instructional plans.

probable:____:____:____:____:____:____:____:improbable
extremely quite slightly neither slightly quite extremely

4. I intend to use computers as part of the subject content in my instruction during the next school year, such as, word processor, teaching data-base management on accounting, CAD, CAM.

probable:____:____:____:____:____:____:____:improbable
extremely quite slightly neither slightly quite extremely

5. Overall, I intend to use computers to help me in my job during the next school year.

probable:____:____:____:____:____:____:____:improbable
extremely quite slightly neither slightly quite extremely

6. Using computers for computer-assisted instruction during the next school year will be: (please place a check mark for each measure.)

easy:____:____:____:____:____:____:____:difficult
possible:____:____:____:____:____:____:____:impossible
encouraged:____:____:____:____:____:____:____:discouraged
important:____:____:____:____:____:____:____:unimportant
good:____:____:____:____:____:____:____:bad
extremely quite slightly neither slightly quite extremely

7. Using computers as a tool to manage my instruction during the next school year will be:

easy:____:____:____:____:____:____:____:difficult
possible:____:____:____:____:____:____:____:impossible
encouraged:____:____:____:____:____:____:____:discouraged
important:____:____:____:____:____:____:____:unimportant
good:____:____:____:____:____:____:____:bad
extremely quite slightly neither slightly quite extremely

8. Using computers as a tool to prepare my instruction during the next school year will be:

easy:____:____:____:____:____:____:____:difficult
possible:____:____:____:____:____:____:____:impossible
encouraged:____:____:____:____:____:____:____:discouraged
important:____:____:____:____:____:____:____:unimportant
good:____:____:____:____:____:____:____:bad
extremely quite slightly neither slightly quite extremely

9. Using computers as part of the subject content in my instruction during the next school year will be:

easy:____:____:____:____:____:____:____:difficult

possible:____:____:____:____:____:____:____:impossible

encouraged:____:____:____:____:____:____:____:discouraged

important:____:____:____:____:____:____:____:unimportant

good:____:____:____:____:____:____:____:bad
extremely quite slightly neither slightly quite extremely

10. Overall, using computers to help me in my job during the next school year will be:

easy:____:____:____:____:____:____:____:difficult

possible:____:____:____:____:____:____:____:impossible

encouraged:____:____:____:____:____:____:____:discouraged

important:____:____:____:____:____:____:____:unimportant

good:____:____:____:____:____:____:____:bad
extremely quite slightly neither slightly quite extremely

Section B:

1. Improving the quality of instruction is:

good:____:____:____:____:____:____:____:bad
extremely quite slightly neither slightly quite extremely

2. Ensuring students have motivation to learn is:

good:____:____:____:____:____:____:____:bad
extremely quite slightly neither slightly quite extremely

3. Having students learn appropriate work attitudes is:

good:____:____:____:____:____:____:____:bad
extremely quite slightly neither slightly quite extremely

4. Making instruction interesting for students is:

good:____:____:____:____:____:____:____:bad
extremely quite slightly neither slightly quite extremely

5. Keeping course content up to date is:

good:____:____:____:____:____:____:____:bad
extremely quite slightly neither slightly quite extremely

6. Making a good impression on administrators is:

good:____:____:____:____:____:____:____:bad
extremely quite slightly neither slightly quite extremely

7. Making an instructor's job easier is:

good:____:____:____:____:____:____:____:bad
extremely quite slightly neither slightly quite extremely

8. Dehumanized education is:

good:____:____:____:____:____:____:____:bad
extremely quite slightly neither slightly quite extremely

9. Having individualized instruction is:

good:________:________:________:________:________:________:________:bad
extremely quite slightly neither slightly quite extremely

10. Having a computer always accessible for an instructor is:

good:________:________:________:________:________:________:________:bad
extremely quite slightly neither slightly quite extremely

Section C:

1. My using computers would improve the quality of my instruction.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

2. My using computers in the classroom would ensure the students' motivation to learn.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

3. My using computers in the classroom would help my students to learn appropriate work attitudes.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

4. My using computers in the classroom would ensure my students' interests.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

5. My using computers in the instruction would keep course content up to date.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

6. My using computers in the classroom would make a good impression on administrators.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

7. My using computers in the school would make my job easier.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

8. My using computers in the school would dehumanize my instruction.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

9. My using computers in the classroom would permit individualized instruction

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

10. My using computers in the school would be convenient because computers are accessible for me.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

Section D:

1. Most of the people who are important to me think I should use computers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

2. My students think I should use computers in my instruction.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

3. My students' parents think I should use computers in my instruction.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

4. The administrators in my school think I should use computers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

5. The principal of my school thinks I should use computers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

6. The school board thinks I should use computers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

7. Some instructors think I should use computers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

8. My family members think I should use computers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

9. My friends out of the school think I should use computers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

10. The association to which I belong thinks I should use computers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

11. The education experts think I should use computers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

Section E:

1. Generally speaking, I want to do what my students think I should do.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

2. Generally speaking, I want to do what students' parents think what I should do.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

3. Generally speaking, I want to do what the administrators think I should do.

likely:_____:_____:_____:_____:_____:_____:_____:unlikely
extremely quite slightly neither slightly quite extremely

4. Generally speaking, I want to do what the principal thinks I should do.

likely:_____:_____:_____:_____:_____:_____:_____:unlikely
extremely quite slightly neither slightly quite extremely

5. Generally speaking, I want to do what the school board thinks I should do.

likely:_____:_____:_____:_____:_____:_____:_____:unlikely
extremely quite slightly neither slightly quite extremely

6. Generally speaking, I want to do what other teachers think I should do.

likely:_____:_____:_____:_____:_____:_____:_____:unlikely
extremely quite slightly neither slightly quite extremely

7. Generally speaking, I want to do what my family members think I should do.

likely:_____:_____:_____:_____:_____:_____:_____:unlikely
extremely quite slightly neither slightly quite extremely

8. Generally speaking, I want to do what my association thinks I should do.

likely:_____:_____:_____:_____:_____:_____:_____:unlikely
extremely quite slightly neither slightly quite extremely

9. Generally speaking, I want to do what my friends think I should do.

likely:_____:_____:_____:_____:_____:_____:_____:unlikely
extremely quite slightly neither slightly quite extremely

10. Generally speaking, I want to do what education experts think I should do.

likey:_____:_____:_____:_____:_____:_____:_____:unlikely
extremely quite slightly neither slightly quite extremely

<u>Section F:</u>

School name (optional): __________ County: __________

Sex: _____ Age: _____ Certificate: __________

Subject(s) you will be teaching during the next school year:

(1) ____________ (2) ____________

(3) ____________ (4) ____________

What is the highest degree that you have earned (check one only)?

_____ Associates degree
_____ Bachelors degree
_____ Masters degree
_____ Doctors degree

How many credits have you earned since receiving the degree? _____credits

1. Where are the computer(s) which you can use located in your school?

_____ My office.
_____ My classroom or lab.
_____ Classroom or lab next to mine.
_____ Computer center.
_____ Other classrooms or labs.
_____ Other. ____________________ (please specify)

2. In general, the locations of computer(s) which you can use are:

far:________:________:________:________:________:________:________:near
extremely quite slightly neither slightly quite extremely

3. In general, you can use the computer(s) whenever you need it.

agree:________:________:________:________:________:________:________:disagree
extremely quite slightly neither slightly quite extremely

4. In general, the locations of computers which your students can use are:

far:________:________:________:________:________:________:________:near
extremely quite slightly neither slightly quite extremely

5. In general, your students can use the computers whenever they need them.

agree:________:________:________:________:________:________:________:disagree
extremely quite slightly neither slightly quite extremely

6. There are enough computers available to your students whenever they need them.

agree:________:________:________:________:________:________:________:disagree
extremely quite slightly neither slightly quite extremely

7. Please list all computer courses, conferences, workshops, inservices which you have had. Please include how many credits or how long the courses(workshops) were.

(1) ____

(2) ____

(3) ____

(4) ____

8. Do you read any journal or magazine on computer applications?

____ no. ____ yes, occasionly. ____ yes, often. ____ yes, regularly.

If your answer is yes, please list the name(s) of those journals.

(1) ____

(2) ____

(3) ____

9. Which type of person(s) (e.g., another vocational instructor) or organization(s) you think may have influenced your attitudes on computer applications in vocational education?

(1) ____

(2) ____

(3) ____

10. How do you rate your computer knowledge?

____ very good ____ good ____ average ____ below average ____ poor

11. How do you rate your computer programming ability (any computer language)?

_____ expert _____ good _____ average _____ beginner _____ none

12. How do you rate your math ability?

____ very good ____ good ____ average ____ below average ____ poor

13. How do you rate your reading ability?

____ very good ____ good ____ average ____ below average ____ poor

14. If you are currently a computer user, what do you mainly use the computer for?

(1) ____________________

(2) ____________________

(3) ____________________

15. Please list some advantages of using computers on your job.

(1) ____________________

(2) ____________________

(3) ____________________

(4) ____________________

16. Please give some reasons that may prohibit your using computers on your job.

(1) ____________________

(2) ____________________

(3) ____________________

(4) ____________________

17. Understanding terms used in this questionnaire was:

easy:________:________:________:________:________:________:________:difficult

extremely quite slightly neither slightly quite extremely

18. The number of items in this questionnaire was:

many:________:________:________:________:________:________:________:few

extremely quite slightly neither slightly quite extremely

19. How much time did it take you to complete this questionnaire? ______(minutes)

Other comments about this questionnaire are welcomed.

____

____

____

____

____

____

Thank you for your help!

APPENDIX C

THE REVISED INSTRUMENT

Instruction

For most of the questions, you will be asked to express your opinion on a measure such as this:

:________:________:________:________:________:________:________:

Words with opposite meanings appear at the two ends of the measure, and increments will be printed below each space. You should place your mark in the space that best describes your opinion. For example, you will be asked to rate how "good" or "bad" increasing usage of computers in industrial education is. If you think that increasing usage of computers in industrial education is "quite good," you should place your mark as follows:

good:		X						:bad
	extremely	quite	slightly	neither	slightly	quite	extremely	

If you think that increasing usage of computers in industrial education is "neither good nor bad," then you should place your mark as follows:

good:				X				:bad
	extremely	quite	slightly	neither	slightly	quite	extremely	

Other descriptors, such as, likely-unlikely, important-unimportant, encouraged-discouraged, etc., should be rated in the same way. In marking your rates, please remember the following points:

(1) Place your marks in the middle of space, not on the boundaries (colons).
(2) Place one and only one check mark on a single measure.
(3) Again, we encourage you to answer all items; missing information makes interpreting your answers difficult.
(4) If you feel any word or term used in this questionnaire is ambiguous, please circle that word or term.

Section A:

1. "Use microcomputers in some aspects of my job" means to employ microcomputers regularly in any or some of the following areas: (1) computer-assisted instruction, (2) computer-managed instruction, (3) as an utility, e.g., word processing, data base managment, spread sheet, (4) as course content, e.g., Computer-aided design, computer-aided manufacture, robotics.

   I intend to use microcomputers in some aspects of my job during the next school year.

probable:								:improbable
	extremely	quite	slightly	neither	slightly	quite	extremely	

2. Generally speaking, using microcomputers in some aspects of my job during the next school year will be: (Please place a check mark for each of the five items below.)

easy:								:difficult
possible:								:impossible
encouraged:								:discouraged
important:								:unimportant
good:								:bad
	extremely	quite	slightly	neither	slightly	quite	extremely	

3. Improving the quality of instruction is:

good:								:bad
	extremely	quite	slightly	neither	slightly	quite	extremely	

4. Having individualized instruction is:

good:								:bad
	extremely	quite	slightly	neither	slightly	quite	extremely	

5. Adopting computer-assisted instruction in my instruction is:

good:________:________:________:________:________:________:________:bad
extremely quite slightly neither slightly quite extremely

6. Grading students' tests quickly and accurately is:

good:________:________:________:________:________:________:________:bad
extremely quite slightly neither slightly quite extremely

7. Keeping course content up to date is:

good:________:________:________:________:________:________:________:bad
extremely quite slightly neither slightly quite extremely

8. Having students learn necessary skills for social survial is:

good:________:________:________:________:________:________:________:bad
extremely quite slightly neither slightly quite extremely

9. Having students understand microcomputers is:

good:________:________:________:________:________:________:________:bad
extremely quite slightly neither slightly quite extremely

10. keeping students' records in computers is:

good:________:________:________:________:________:________:________:bad
extremely quite slightly neither slightly quite extremely

11. Making instructors jobs easier is:

good:________:________:________:________:________:________:________:bad
extremely quite slightly neither slightly quite extremely

12. Using word processing programs in my job is:

good:________:________:________:________:________:________:________:bad
extremely quite slightly neither slightly quite extremely

13. Making a good impression on administrators is:

good:________:________:________:________:________:________:________:bad
extremely quite slightly neither slightly quite extremely

<u>Section B:</u>

1. My using microcomputers in the school would improve the quality of my instruction.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

2. My using microcomputers in the classroom would permit individualized instruction.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

3. My using microcomputers in the school would permit me to adopt CAI in my classroom

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

4. My using microcomputers in the school would make me grade students' test quickly and accurately.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

5. My using microcomputers in the instruction would keep course content up to date.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

6. My using microcomputers in the instruction would make my students learn necessary skills for social survial in the future.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

7. My using microcomputers in the classroom would make my students understand microcomputers.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

8. My using microcomputers in the school would allow me to keep my studnets' records in computers.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

9. My using microcomputer in the school would make my job easier.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

10. My using microcomputer in the school would allow me to using word processing programs.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

11. My using microcomputer in the school would make a good impression on administrators.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

<u>Section C:</u>

1. Generally speaking, most of the people who are important to me think I should use microcomputers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

2. My students think I should use microcomputers in my instruction.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

3. My students' parents think I should use microcomputers in my instruction.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

4. The administrators in my school think I should use microcomputers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

5. The principal of my school thinks I should use microcomputers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

6. The school board thinks I should use microcomputers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

7. Instructors in my school think I should use microcomputers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

8. My family members think I should use microcomputers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

9. My friends out of the school think I should use microcomputers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

10. The association to which I belong thinks I should use microcomputers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

11. The education experts in universities think I should use microcomputers in my job.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

Section D:

1. Generally speaking, I want to do what my students think I should do.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

2. Generally speaking, I want to do what students' parents think what I should do.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

3. Generally speaking, I want to do what the administrators think I should do.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

4. Generally speaking, I want to do what the principal thinks I should do.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

5. Generally speaking, I want to do what the school board thinks I should do.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

6. Generally speaking, I want to do what other teachers think I should do.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

7. Generally speaking, I want to do what my family members think I should do.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

8. Generally speaking, I want to do what my association thinks I should do.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

9. Generally speaking, I want to do what my friends think I should do.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

10. Generally speaking, I want to do what education experts in universities think I should do.

likely:________:________:________:________:________:________:________:unlikely
extremely quite slightly neither slightly quite extremely

Section E:

1. "Programming" may include development of a problem solving strategy and it implementation in a computer language, debugging, and task-specific programming for your needs.

How do you rate your programming abilities?

good:________:________:________:________:________:________:________:poor
extremely quite slightly neither slightly quite extremely

2. "Computer terminology" includes computer terms about software (e.g., operation systems, time-sharing system, etc.), hardware (e.g., CRT, tape, disk, microcomputer, etc.), and miscellaneous items (e.g., documentation, simulation, CAI, CMI, etc.).

How do you rate your knowledge of computer terminology?

good:________:________:________:________:________:________:________:poor
extremely quite slightly neither slightly quite extremely

3. "Computer applications in education" includes experience with using educational application software (e.g., grade book, word processing, spread sheet, data base management, etc.), and understanding how to implement computer use into your instruction or your job in the school.

How do you rate your knowledge about computer applications in education?

good:________:________:________:________:________:________:________:poor
extremely quite slightly neither slightly quite extremely

4. "Human and machine relationships" means an understanding of the relationships between human and artifical intelligence, robotics, computer assistance in decision making (e.g., medical, legal, business, etc.), and to be able to discuss moral, psychological, and sociological issues of computing in society and in education.

How do you rate your knowledge about human and machine relationships?

good:________:________:________:________:________:________:________:poor
extremely quite slightly neither slightly quite extremely

5. "Information on computers in education" includes computer periodicals, books, computer professional societies , computer users network, hardware and software vendor groups, and other sources of information on computers in your specific teaching area.

How do you rate your knowledge about information on computer in education?

good:________:________:________:________:________:________:________:poor
extremely quite slightly neither slightly quite extremely

6. Where are the microcomputer(s) which you can use located in your school? (check all applied)

_____ My office.
_____ My classroom or lab.
_____ Classroom or lab next to mine.
_____ Computer center.
_____ Other classrooms or labs.
_____ Other. (please specify) ______________________________

7. In general, you can use microcomputer(s) whenever you need it.

agree:________:________:________:________:________:________:________:disagree
extremely quite slightly neither slightly quite extremely

8. In general, the locations of microcomputer(s) which you can use are:

convenient:________:________:________:________:________:________:________:inconvenient
extremely quite slightly neither slightly quite extremely

9. What is the school level in which your are teaching?

_____ Junior or middle school.
_____ High school.
_____ Other. (please specify) ____________________

10. What is your specialization?

_____ Industrial arts.
_____ Trade and industrial education.
_____ Both.

11. What is your gender?

_____ Female.
_____ Male.

12. What is your age?

____

13. Do you have a computer in your home?

_____ Yes.
_____ No.

14. How many credits of computer courses, workshops or seminars have you taken?

____________________ (credits).

15. How many clock hours of computer conferences, non-credit inservice, or workshops have you participated in?

____________________ (hours)

16. Understanding terms used in this questionnaire was:

easy:________:________:________:________:________:________:________:difficult
extremely quite slightly neither slightly quite extremely

17. How much time did it take you to complete this questionnaire?

________________ (minutes)

Any comment about this questionnaire is welcomed.

____

____

____

____

____

Thank you for your help!

APPENDIX D

STATISTICAL RESULTS OF FIRST PILOT TEST

Table 1. Intercorrelation (Zero-Order) Coefficients Among Factors in the First Pilot Test.

Factor	Factor 1.	2.	3.	4.	5.	6.
1. Intention						
2. Attitude	.63 (19) p=.00					
3. Subjective Norm	.49 (21) p=.01	.57 (19) p=.01				
4. Belief	.57 (19) p=.01	.65 (19) p=.00	.65 (21) p=.00			
5. Normative Belief	.63 (21) p=.00	.60 (19) p=.00	.68 (21) p=.00	.69 (21) p=.00		
6. Computer Literacy	.13 (21) p=.27	.12 (21) p=.28	.12 (21) p=.28	.15 (21) p=.28	.17 (21) p=.24	
7. Accessi-bility	.17 (21) p=.27	.25 (21) p=.10	.21 (21) p=.17	.30 (21) p=.07	. 37 (21) p=.07	.31 (21) p=.06

Note: Numbers of subjects are reported within parentheses.

Table 2. Means, Standard Deviations and Alpha Reliability Coefficients in the First Pilot Test.

Factor	N	Mean	S.D.	Alpha	Scale Range
Intention	21	1.5	1.5	.93	-3 to +3
Attitude	19	1.1	1.5	.89	-3 to +3
Belief	21	2.8	1.4	.79	-9 to +9
Subjective Norm	21	2.1	1.8	--	-3 to +3
Normative Belief	20	6.1	4.8	.91	-21 to +21
Computer Literacy	20	5.3	3.2	--	--
Accessibility	20	4.6	2.3	.75	1 to +7

Table 3. Mean, Standard Deviation of Items on the Intention Factor in the First Pilot Test.

Item	Item No.	Mean	S.D.	N
CAI	1	1.9	1.3	22
CMI	2	1.4	1.3	22
Utility	3	1.5	1.4	22
Course Content	4	1.5	1.6	21
Overall	5	1.6	1.5	22

Note: 1. Item No. = Item number in Scetion A.
2. Scale range = -3 to 3.

Table 4. Mean, Standard Deviation of Items on the Attitude Factor in the First Pilot Test.

Item	Item No.	Mean	S.D.	N
CAI	6	1.3	1.3	18
CMI	7	1.1	1.4	19
Utility	8	1.2	1.4	18
Course Content	9	1.2	1.2	18
Overall	10	1.1	1.5	18

Note: 1. Item No. = Item number in Section A.
2. Scale range = -3 to 3.

Table 5. *t*-test Between Specific Intention and Overall Intention in the First Pilot Test.

Item	Mean	S.D.	df	Correlation	t-value	p
Specific Intention	1.6	1.3	21	.90	1.1	.30
Overall Intention	1.5	1.5				

Note: Specific Intention = Items 1 to 4 in Section A.
Overall Intention = Item 5 in Section A.

Table 6. *t*-test Between Specific Attitude and Overall Attitude in the First Pilot Test.

Item	Mean	S.D.	df	Correlation	t-value	p
Specific Attitude	1.2	1.6	18	.73	.2	.85
Overall Attitude	1.1	1.5				

Note: Specific Attitude = Items 6 to 9 in Section A.
Overall Attitude = Item 10 in Section A.

APPENDIX E

STATISTICAL RESULTS OF SECOND PILOT TEST

Table 1. Mean and Standard Deviation of Factors in the Second Pilot Test.

	All Subjects		Group 1		Group 2	
Factor	Mean	S.D.	Mean	S.D.	Mean	S.D.
Intention	1.9	1.2	1.6	2.1	2.0	1.0
Attitude	1.9	.9	1.7	.9	1.9	.9
Belief	5.0	1.7	6.1	1.2	4.7	6.2
Subjective Norm	1.5	1.1	1.7	1.1	1.4	1.2
Normative Belief	7.4	5.6	7.5	6.5	7.4	5.4
Computer Literacy	4.1	1.6	1.8	.5	4.6	1.2
Accessibility	4.8	1.4	3.1	1.3	5.3	1.0

Note: 1. Subjects in Group 1 had low scores on computer literacy, but porvided high scores on beliefs. All other subjects were in Group 2.

2. Scale range:

Intention	=	-3 to 3.
Attitude	=	-3 to 3.
Belief	=	-9 to 9.
Subjective Norm	=	-3 to 3.
Normative Belief	=	-21 to 21.
Computer literacy	=	1 to 7.
Accessibility	=	1 to 7.

Table 2. Intercorrelation (Zero-Order) Coefficients Among Factors Included All Subjects in the Second Pilot Test.

Factor	Factor 1.	2.	3.	4.	5.	6.
1. Intention						
2. Attitude	.62 (27) p=.00					
3. Subjective Norm	.29 (27) p=.03	.48 (27) p=.00				
4. Belief	.36 (27) p=.03	.60 (27) p=.00	.60 (27) p=.00			
5. Normative Belief	.51 (27) p=.00	.62 (27) p=.00	.56 (27) p=.00	.67 (27) p=.00		
6. Computer Literacy	.40 (27) p=.02	.39 (27) p=.02	-.01 (27) p=.42	.04 (27) p=.47	.18 (27) p=.18	
7. Accessi-bility	.20 (26) p=.17	.32 (26) p=.06	.13 (26) p=.26	.04 (26) p=.43	.29 (26) p=.07	.72 (26) p=.00

Note: Numbers of subjects are reported within parentheses.

Table 3. Intercorrelation (Zero-Order) Coefficients Among Factors After Deleting the Data of the Samll Group in the Second Pilot Test.

Factor	Factor 1.	2.	3.	4.	5.	6.
1. Intention						
2. Attitude	.73 (21) p=.00					
3. Subjective Norm	.41 (21) p=.03	.58 (21) p=.00				
4. Belief	.42 (21) p=.00	.65 (21) p=.00	.63 (21) p=.00			
5. Normative Belief	.46 (21) p=.02	.56 (21) p=.00	.68 (21) p=.00	.64 (21) p=.00		
6. Computer Literacy	.37 (21) p=.05	.55 (21) p=.01	.15 (21) p=.25	.44 (21) p=.02	.39 (21) p=.04	
7. Accessi-bility	.15 (20) p=.26	.39 (20) p=.04	.38 (20) p=.05	.49 (20) p=.01	.64 (20) p=.00	.58 (20) p=.00

Note: Numbers of subjects are reported within parentheses.

Table 4. Alpha Relaibility Coefficients for Items in the Revised Instrument.

Factor	Before Deleting Items		After Deleting Items	
	Alpha	No. Of Item	Alpha	No. Of Item
Intention	--	1	--	1
Attitude	.88	5	.88	5
Belief	.83	11	.84	8
Subjective Norm	--	1	--	1
Normative Belief	.96	10	.95	7
Computer Literacy	.95	5	.95	5
Accessi-bility	--	2	--	2

Note: No. of subjects = 21.

Table 5. Intercorrelation (Zero-Order) Coefficients Among Factors After Deleting the Data of the Small Group and Items in the Second Pilot Test.

Factor	Factor 1.	2.	3.	4.	5.	6.
1. Intention						
2. Attitude	.73 (21) p=.00					
3. Subjective Norm	.41 (21) p=.03	.58 (21) p=.00				
4. Belief	.37 (21) p=.05	.67 (21) p=.00	.64 (21) p=.00			
5. Normative Belief	.43 (21) p=.03	.53 (21) p=.01	.66 (21) p=.00	.56 (21) p=.00		
6. Computer Literacy	.37 (21) p=.05	.55 (21) p=.01	.15 (21) p=.25	.41 (21) p=.03	.45 (21) p=.02	
7. Accessi-bility	.15 (20) p=.26	.39 (20) p=.04	.38 (20) p=.05	.46 (20) p=.02	.66 (20) p=.00	.58 (20) p=.00

Note: Numbers of subjects are reported within parentheses.

APPENDIX F

SUMMARIES OF INTERNAL CONSISTENCY

Table 1. Internal Consistency for Items in the Attitude Factor.

Item	Item Variance	Corrected Item-total r	Alpha if Item Deleted
Easy - Difficult	4.2	.79	.90
Possible - Impossible	3.1	.83	.87
Encouraged - Discouraged	3.0	.81	.89
Important - Unimportant	2.7	.74	.91
Good - Bad	2.1	.79	.90

Note: Number of subjects = 158; total-items variance = 56.7; Alpha for factor = .92.

Source of Variance	Sum of Squares	df	Mean Squares	F	p
Between People	1781.0	157	11.3		
Within People	684.8	632	1.0		
Between Measures	88.3	4	22.1	22.1	.00
Residuals	596.5	628	1.0		
Total	2465.6	789	3.1		

Table 2. Internal Consistency for Items in the Belief Factor.

Item	Item Variance	Corrected Item-total r	Alpha if Item Deleted
Improving Quality of Instruction	15.7	.70	.78
Individualized Instruction	17.6	.55	.80
Keeping Course Content Update	16.1	.59	.79
Learning Skills for Social Survival	14.6	.54	.80
Keeping Students' Recodrs	17.3	.50	.81
Making Job Easier	13.5	.58	.80
Using Word Processing Programs	17.4	.46	.81
Good Impression on Administrators	12.2	.43	.81

Note: Number of subjects = 156; total-items variance = 445.3; Alpha for factor = .82.

(Continued)

Table 2. (Continued)

Source of Variance	Sum of Squares	df	Mean Squares	F	p
Between People	8626.9	155	55.7		
Within People	11119.6	1092	10.2		
Between Measures	329.4	7	47.1	4.8	.03
Residuals	10790.2	1085	9.9		
Total	19746.1	1247	15.8		

Table 3. Internal Consistency for Items in the Normative Belief Factor.

Item	Item Variance	Corrected Item-total r	Alpha if Item Deleted
Students' Parents	41.9	.74	.90
Administrators	61.8	.75	.90
School Board	50.0	.79	.89
Other Instructors	40.7	.73	.90
Family Members	48.3	.69	.90
Friends Outside School	40.0	.80	.89
Educational Experts	40.0	.64	.91

Note: Number of subjects = 157; total-items variance = 1470.3; Alpha for factor = .91.

Source of Variance	Sum of Squares	df	Mean Squares	F	p
Between People	32766.8	156	210.0		
Within People	23112.6	942	24.5		
Between Measures	5662.0	6	943.7	23.5	.00
Residuals	17450.6	936	40.1		
Total	55879.4	1098	50.9		

Table 4. Internal Consistency for Items in the Computer Literacy Factor.

Item	Item Variance	Corrected Item-total r	Alpha if Item Deleted
Programming	3.4	.63	.85
Computer Terminology	3.2	.75	.82
Computer Applications	2.8	.76	.82
Human/Machine Relationship	2.3	.56	.87
Information on Computers	2.4	.74	.83

Note: Number of subjects = 164; total-items variance = 46.0; Alpha for factor = .87.

Source of Variance	Sum of Squares	df	Mean Squares	F	p
Between People	1500.6	163	9.2		
Within People	1046.0	656	1.6		
Between Measures	235.1	4	58.8	11.8	.02
Residuals	810.9	652	5.0		
Total	2546.6	819	3.1		

APPENDIX G

TRANSMITTING LETTERS

School of Education
OSU WOSC

February 24, 1986

Dear Industrial Educator:

Microcomputer technology is impacting significantly on our society and industry. Industrial education must therefore keep pace with this technology. The question has been raised regarding how industrial education teachers may be helped to adopt microcomputer technology in their jobs.

You are one of a small group of industrial education instructors who are being asked to give an opinion on this issue. You were randomly selected from among all industrial education teachers in Oregon. In order that the results truly represent the thinking of all industrial education instructors in Oregon, it is important that you complete and return the questionnaire. Although you need not answer any or all of the questions, every bit of information that you provide will contribute to the certainty of the answers to the question.

You may be assured of complete confidentiality. The questionnaire has an identification number for mailing purposes only so we may check your address off the mailing list when your questionnaire is returned. Your name will never be placed on the questionnaire.

We will be happy to answer any question. Please feel free to call or write us. We would appreciate your returning of the questionnaire within a week.

Thank you for your assistance.

Sincerely,

Warren Suzuki
Associate Professor

David Lin
Research Assistant

Department of Vocational and Technical Education
OSU Campus: Batcheller Hall, Room 100 · Corvallis, Oregon 97331 · (503) 754-2961

Department of Vocational and Technical Education
Oregon State University

Dear Industrial Educator:

Last week a questionnaire was mailed to you seeking information about your perceptions on the use of microcomputers in industrial education.

If you have already returned the completed questionnaire, please accept our sincere thanks. If you haven't, please do so today, because it has been sent to only a small but representative sample of industrial education teachers in Oregon. Thank you.

Warren Suzuki
Associate Professor

David Lin
Research Assistant

March 7, 1986

School of Education
OSU WOSC

March 19, 1986

Dear Industrial Educator:

About three weeks ago, we sent you a survey form seeking your opinion on the use of computers in industrial education. We have not received your completed survey form.

We need your help! We have undertaken this study because of the belief that computer technology should be an integral part of industrial education. Whether or not you are currently a computer user, your experience will help us to identify ways to promote this integration.

In case your questionnaire has been misplaced, another is enclosed. May we please have your questionnaire before April 4, 1986? Your cooperation is greatly appreciated.

Sincerely,

Warren Suzuki
Associate Professor

David Lin
Research Assistant

Department of Vocational and Technical Education
OSU Campus: Batcheller Hall, Room 100 · Corvallis, Oregon 97331 · (503) 754-2961

APPENDIX H

DESCRIPTIVE STATISTICS FOR FINAL INSTRUMENT

Table 1. Summary of the Factors Scores in the Proposed Causal Model.

Factor	Range of Sacle	No. of Sujeects	Mean	S.D.	.95 C.I.
Intention	-3 to +3	165	0.9	2.1	0.6 to 1.2
Attitude	-3 to +3	165	1.2	1.6	0.9 to 1.4
Subjective Norm	-3 to +3	162	0.5	1.8	0.2 to 0.8
Belief	-9 to +9	165	2.7	2.6	2.3 to 3.1
Normative Belief	-21 to +21	164	4.2	5.7	3.3 to 5.1
Computer Literacy	1 to 7	165	4.0	1.4	3.8 to 4.2
Accessi- bility	1 to 7	164	4.8	1.9	4.5 to 5.1

Table 2. Oregon Industrial Education Instructors' Attitudes Toward Using Computers in Their Instruction.

Type of Attitude	N	Median	Mean	S.D.	.95 C.I.
Easy - Difficult	165	.9	.5	2.1	0.2 to 0.9
Possible - Impossible	165	1.7	1.3	1.8	1.0 to 1.5
Encouraged - Discouraged	160	1.6	1.3	1.7	1.0 to 1.5
Important - Unimportant	162	1.8	1.3	1.7	1.1 to 1.6
Good - Bad	161	1.9	1.5	1.5	1.3 to 1.8

Note: 1. Scale range from -3 (extremely negative) to +3 (extremely positive).
2. Type of attitudes are sub-items in Item 2 in Section A.

Table 3. Oregon Industrial Education Instructors Beliefs Toward Using Computers.

Belief	N	Median	Mean	S.D.	.95 C.I.
Improving Quality of Instruction	164	3.1	2.9	4.0	2.3 to 3.5
Individualized Instruction	165	3.5	3.0	4.2	2.3 to 3.6
Keeping Course Content Update	165	3.0	3.0	4.1	2.4 to 3.6
Learning Skills for Social Survival	163	2.1	1.9	3.9	1.3 to 2.5
Keeping Studnet Records	162	3.5	3.1	4.1	2.5 to 3.8
Making Job Easier	164	1.8	1.8	3.6	1.2 to 2.4
Using Word Processing Programs	162	3.6	3.2	4.1	2.6 to 3.9
Good Impression on Administrators.	159	1.9	2.8	3.4	2.3 to 3.4

Note:
1. Scale range from -9 (extremely negative) to +9 (extremely positive).
2. Items are shown in Section C and Section D.
3. Score is the product of a item score in Scetion C multiples its relative item score in Section D.

Table 4. Oregon Industrial Education Instructors' Self Perceptions of Their Capabilities on Computer Literacy.

Competency	N	Median	Mean	S.D.	.95 C.I.
Programming	165	2.5	3.0	1.8	2.7 to 3.3
Computer Terminology	165	4.7	4.1	1.8	3.8 to 4.3
Computer Applications	165	4.8	4.4	1.7	4.1 to 4.6
Human/Machine Relationship	165	4.9	4.6	1.5	4.4 to 4.8
Information on Computers	165	4.4	4.0	1.5	3.8 to 4.3

Note: 1. Scale Value:
1 = Extremely Poor.
2 = Quit Poor.
3 = Slightly Poor.
4 = Neither Good nor Poor.
5 = Slightly Good.
6 = Quit Good.
7 = Extremely Good.

2. Items are shown in Section A.

Table 5. Oregon Industrial Education Instructors' Self Perceptions of How Available and Convenient Computers Are to Them in Their Schools.

Dimension	N	Median	Mean	S.D.	.95 C.I.
Availability	164	5.7	5.1	2.0	4.8 to 5.4
Convenience	163	5.2	4.6	2.1	4.2 to 4.9

Note: 1. Scale ranged from 1 (extremely negative) to 7 (extremely positive).
2. Items are shown in Item 2 and 3 in Section G.

Table 6. *t*-test of Accessibility Score by Locations of Computers in Schools.

Location	Computer Available	N	Mean	S.D.	t	df	p
Office	Yes	20	6.5	.6	4.4*	162	.00
	No	144	4.6	1.9			
Lab/Classroom	Yes	46	6.3	1.1	6.7*	162	.00
	No	118	4.3	1.9			
Computer Center	Yes	28	5.0	1.8	.4	41.1	.65
	No	136	4.8	2.0			
Next Labs	Yes	107	4.8	1.8	-.3	100.3	.77
	No	57	4.9	2.1			
Other Labs	Yes	70	4.8	1.9	-.3	153.2	.73
	No	94	4.9	2.0			
Other Locations	Yes	35	5.0	1.9	.6	53.8	.55
	No	129	4.8	1.9			

Note: * = Pooled-variance *t*-test; all others are separate group *t*-test.

APPENDIX I

ANOVA SUMMARIES FOR CAUSAL EQUATIONS

Table 1. Analysis of Variance of the Intention Factor Predicted by the Attitude and Subjective Norm Factors.

Source of Variance	Sum of Squares	df	Mean Squares	F	p
Regression	451.6	2	225.8	149.1	.00
Residual	240.8	159	1.5		
Total	692.4	161			

Table 2. Analysis of Variance of the Attitude Factor Predicted by the Subjective Norm and Belief Factors.

Source of Variance	Sum of Squares	df	Mean Squares	F	p
Regression	251.0	2	125.5	131.2	.00
Residual	152.1	159	1.0		
Total	403.1	161			

Table 3. Analysis of Variance of the Subjective Norm Factor Predicted by the Normative Belief Factor.

Source of Variance	Sum of Squares	df	Mean Squares	F	p
Regression	207.8	1	207.8	105.7	.00
Residual	312.4	159	2.0		
Total	520.2	160			

Table 4. Analysis of Variance of the Belief Factor Predicted by the Computer Literacy and Accessibility Factors.

Source of Variance	Sum of Squares	df	Mean Squares	F	p
Regression	212.4	2	106.2	19.9	.00
Residual	860.6	161	5.3		
Total	1073.0	163			

Table 5. Analysis of Variance of the Normative Belief Factor Predicted by the Computer Literacy and Accessibility Factors.

Source of Variance	Sum of Squares	df	Mean Squares	F	p
Regression	973.0	2	486.5	18.2	.00
Residual	4301.0	161	26.7		
Total	5274.0	163			

Table 6. Analysis of Variance of the Computer Literacy Factor Predicted by the Accessibility Factor.

Source of Variance	Sum of Squares	df	Mean Squares	F	p
Regression	25.1	1	25.1	7.0	.01
Residual	582.8	162	3.6		
Total	607.9	163			

Table 7. Analysis of Variance of the Accessibility Factor Predicted by the Computer Literacy Factor.

Source of Variance	Sum of Squares	df	Mean Squares	F	p
Regression	12.2	1	12.2	7.0	.01
Residual	281.9	162	1.7		
Total	403.1	163	.		