

The Role of Field Independent and Field Dependent  
Cognitive Styles  
on  
Interest, Aptitude, and Success  
in  
Microcomputing Fundamentals

A Thesis  
Submitted to the Faculty of Graduate Studies  
at the University of Manitoba

In Partial Fulfillment  
of the Requirements for the Degree  
Master of Education



by  
Donald J. Metz  
March 1989



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THE ROLE OF FIELD INDEPENDENT AND FIELD DEPENDENT  
COGNITIVE STYLES ON INTEREST, APTITUDE, AND SUCCESS  
IN MICROCOMPUTING FUNDAMENTALS

BY

DONALD J. METZ

A thesis submitted to the Faculty of Graduate Studies of  
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**ABSTRACT**

This study is concerned with the effects of individual differences on the attitudes and success of students in microcomputing fundamentals. It was hypothesized that the characteristics associated with the cognitive style of field dependence/independence would be similar to the characteristics which would lead to more positive attitudes about and success with computers. Field dependent individuals are said to rely on external references for information processing, are more aware and influenced by their immediate environment, and prefer a more social orientation than field independent persons. Field dependence is associated with a need for external structuring and reinforcements, and field dependent individuals are more likely to go along with the salient properties of the prevailing field.

Field independent people use internal references as their predominant source of information, and therefore, are more likely to favour a more impersonal domain, perceive analytically, and demonstrate an ability to self structure situations, especially where no structure

exists. Individual differences of attitude, including the subscales of anxiety, confidence, likeability, and usefulness, and basic keyboarding ability are also examined to determine their relationship with field dependence-independence and their effects on the success and ability of students with respect to microcomputing fundamentals.

The data were obtained from a group of 67 high school students during a two year period. Students were tested for their field dependence-independence levels with a standardized embedded figures test developed by H. A. Witkin. A computer attitude survey developed by Loyd and Gressard was given to assess students' attitudes, including the subscales of anxiety, confidence, likeability, and usefulness. Students were examined for their speed and accuracy with a practical keyboarding test and their ability with computers was assessed over a six month period through classroom assignments and practical and written tests with Wordperfect and Lotus 1-2-3.

The data were analyzed using linear regression techniques to examine simple relationships and analysis of variance procedures were employed to establish

significance.

Since the effects of field dependence-independence may be more pronounced at the extreme levels, the top and bottom third of the field groups were compared using ANOVA procedures.

Students were divided into keyboarding (WPM > 20) and non-keyboarding (WPM < 20) groups to investigate effects on attitudes and grades for low and high field dependent-independent scores.

Attitude and grade means were examined to investigate sex differences and to explore possible cultural differences between regular and foreign students.

The results showed the field dependence-independence construct was not directly correlated to any of the other individual differences, however, significant differences were found between certain groups. It was found that the keyboarding group had scores which were significant in the field dependent direction. In comparisons of the field dependent-independent and keyboarding/non-keyboarding groups with respect to attitudes and grades it was found the field dependent/non-keyboarding group had significantly lower

grade scores than the field dependent/keyboarding group and the field independent/non-keyboarding group.

Sex and cultural differences showed females demonstrated more anxiety and less confidence than males and it was found visa students obtained higher grades than regular students.

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## I. INTRODUCTION

### CONTEXT OF THE PROBLEM

The field of computer science continues to expand as the technology steps out of adolescence and begins to pervade all streams of modern day activity. Although most of our attention is focused on the more complex and exciting applications of computers that stand out in our everyday lives, such as the guidance of a space shuttle, the balance of our bank accounts, the special effects in movies, and the intrigue of robotics, the appearance of the computer increasingly pervades all corners of modern society and demands an ever increasing level of ability in the modern day employer/employee.

Today, in the workforce, a computer console can be found at almost every check-out counter, warehouse depot, travel agency, library, classroom, and office desk as the retrieval, and storage of useful information within the modern data base structure takes the place of the historical pencil and paper clerical methods. It is becoming exceedingly important, as we

accelerate into the 21st century, for the educator, administrator, student, manager, and worker to recognize the usefulness of the computer and the development of skills to use the computer, reliably, confidently, and without anxiety, as prerequisite to many employment opportunities not seen years ago.

Recent developments in hardware technology have included microchips capable of 40 million operations per second highlighting the electronic evolution of the past twenty years which has dramatically increased the speed, efficiency, and memory capacity of computers while costs have plummeted. In the past number of years our schools have spent billions of dollars jumping on the computer bandwagon. Yet, because of inexperience, the rate of change and obsolescence found in the industry, and the lack of proper applications, most schools struggled with the notions of computer literacy and usefulness of computers in the educational system.

Initially, computer literacy in our schools meant programming a computer. If you wanted to use a computer you had to be able to design your own programs. Few practical programs existed, especially

in the educational field, and it was soon discovered not all people could be, or wanted to be, taught computer programming. As the computer software library expanded to include more practical applications, like word processing, database systems and spreadsheet analysis, more people were able to explore and amplify the realms of computer literacy. This development of the microcomputer as an information processing centre presents numerous implications to our everyday life and workforce.

The ability to interact with a computer in a variety of modes has become essential for an ever increasing slice of the workforce, even where no technical skill was ever anticipated. As computer literacy becomes an essential tool in preparation for all levels of the modern labour force, from the autoparts clerk to the steno pool, and from the purchasing department to the executive suite, it becomes paramount our society begin to adapt and prepare people to communicate and interface with these mysterious machines.

This need for adaptation impacts on many different elements of the community. The workplace must pursue

the necessary retooling of information and retrieval systems and clerical procedures, and designers need to develop reliable hardware and flexible software. Teachers, need to rethink their teaching strategies and administrators must confront the changing technologies within the spectre of balanced budgets. But what about the user? What are their interests and abilities, how do they learn about computers, and how may we teach them better? Do we generally assume they will relish the chance to tackle this new technology, or are there individual differences which may determine success or failure achieving some degree of computer literacy? To be successful educators, we must assess the needs of our students as they relate to our changing society and to plan programs to better prepare our students for a modern workplace.

This study attempted to identify some individual differences which may affect learning about computers and which may better aid the computer instructor in developing teaching strategies and remediation techniques.

**STATEMENT OF THE PROBLEM**

This study investigated the effect of individual differences on the attitudes and success of high school students in learning about and working with computers. Individual differences examined in this study include the cognitive styles of field dependence and field independence, basic keyboarding skills, and attitudes, including subscales of anxiety, confidence, likeability, and usefulness, to learning about and working with computers.

The author suggested students who exhibit field independence and possess previous experience in keyboarding will demonstrate the most positive attitudes and ability with computers. Further, students who exhibit the field dependent cognitive style and have little or no experience in keyboarding will show the most negative attitudes and the least amount of ability with computers.

Sex differences and cultural differences were also explored to see if they have any impact on the attitudes about and ability with computers.

## STATEMENT OF THE HYPOTHESES

The hypotheses are stated as follows:

1. There will be no correlation between the field dependence-independence scores and attitudes about and learning of computers.
  - 1.1 There will be no difference between the attitudes of the extreme groups of field dependent and field independent students.
2. There will be no correlation between the field dependence-independence scores and keyboarding ability.
  - 2.1 There will be no difference between the field dependence-independence scores for the keyboarding and non-keyboarding groups.
3. There will be no correlation between the field dependence-independence scores and grades.

- 3.1 There will be no difference between the grades of the extreme groups of field dependent and field independent students.
  
- 4. There will be no correlation between keyboarding skills and attitudes about and learning of computers.
  
- 4.1 There will be no difference in attitudes about and learning of computers for the keyboarding and non-keyboarding groups.
  
- 5. There will be no correlation between keyboarding ability and grades.
  
- 5.1 There will be no difference between the grades of the keyboarding and non-keyboarding groups.
  
- 6. There will be no correlation between attitudes about and learning of computers and grades.
  
- 7. There will be no difference in attitudes about and learning of computers for the field independent/

keyboarding and field dependent/keyboarding groups.

8. There will be no difference in grades between the field independent/keyboarding and field dependent/keyboarding groups.
9. There will be no difference in attitudes between the male and female groups.
10. There will be no difference in grades between the male and female groups.
11. There will be no difference in attitudes between the foreign and regular student groups.
12. There will be no difference in grades between the foreign and regular student groups.

Rationale for the Hypotheses

Field dependence-independence theory (Witkin,

Moore, Goodenough, and Cox, 1977a) states that students who demonstrate a high level of field independence perceive analytically, can self structure situations, have self defined goals and reinforcement, and prefer the impersonal domain. On the other hand, field dependent learners prefer a more social orientation, are more sensitive to criticism, perceive in a more global fashion and are greatly influenced by their immediate environment. The operation of a computer involves the completion of many tasks by communicating with the computer through a keyboard. It is hypothesized the keyboard provides a distraction to the processes at hand. Field dependent users, easily influenced by their environment may find difficulty just getting "past the keyboard". In many software applications processes are embedded in a multi-structured environment which could be confusing to students who are field dependent. As well, the theory suggests that students who are field dependent prefer interpersonal activities and may view the computer as being mechanistic and impersonal.

Research (Hadfield & Maddux, 1988) has shown that students who experience anxiety and lack of confidence

in mathematics have poor attitudes and experience difficulties with the subject. Since mathematics shares common characteristics with the study of computers, such as an analytical nature, abstract ideas, and symbolic communication, it follows that students who have more positive attitudes, exhibit less anxiety and more confidence with computers are likely to do better than students who have negative attitudes about computers and experience anxiety and a lack of confidence.

Basic keyboarding skills are required to communicate effectively with a computer. If a student has difficulty interfacing with the computer, the student is more likely to experience frustration and difficulty learning about computers.

As well, it is suggested that students who are field dependent and lack keyboarding skills will be distracted and frustrated by the keyboard and, consequently, reflect more negative attitudes and lower grades.

The examination of sex differences is generally exploratory; however, research (Fenema and Carpenter, 1981) has shown that, for various reasons, perhaps

attitudes or expectations, sex differences persist in areas like mathematics. It is hypothesized these sex differences may manifest themselves in the computer domain because of the common characteristics between the subject areas.

The investigation of cross cultural differences are purely exploratory in nature and no differences are anticipated other than the possibility foreign students will be high achievers and could skew the sample in that direction.

**DEFINITION OF TERMS****Computer Attitude Survey (Loyd and Gressard 1984)**

The survey is a Likert-type instrument which measures attitudes about and learning of computers. The survey consists of four sub-groups; Anxiety, Confidence, Liking, and Usefulness.

**Anxiety**

Computer anxiety means anxiety toward or fear of computers or learning to use computers.

**Confidence**

Computer confidence means the confidence in the ability to learn about or use computers.

**Liking**

Computer liking means the enjoyment or liking of computers and using computers.

**Useful**

Computer usefulness refers to the perception of the student to the value and usefulness of computers.

**Basic Keyboarding Skill (BKS)**

The ability to type accurately and the familiarity with the standard computer keys. Students who achieve twenty (20) words per minute in speed and accuracy tests are presumed to have attained basic keyboarding skills.

**Field dependence-independence (FDI)**

A cognitive style which indicates a process of perceiving. A field dependent style is greatly influenced by the surrounding environment while the field independent style relies on internal references in perception.

**Group Embedded Figures Test (GEFT)**

The group embedded figures test (Witkin et al 1971) measures the degree of field dependence-independence in a test which requires locating geometric figures within a complex framework.

**ANOVA**

Analysis of variance statistical technique to

determine if the means between two or more groups are significant.

### Computer Literacy

The term computer literacy implies some degree of knowledge and ability with computers.

### Microcomputing Fundamentals

The ability to perform basic operating skills with the computer including DOS familiarity, word processing, spreadsheet analysis, data manipulation, and input/output such as printing and saving files.

### Grades

The measure of grades consists of classroom assignments, written content and procedure tests, and timed practical tests of computer skills with MS-DOS, Lotus 1-2-3, and Wordperfect 4.1. Grades were accumulated marks for three six week terms.

### Foreign Students

Students who have been accepted to the program with student visa permits from foreign countries.

### Limitations of the Study

There are some limitations to the study which should be considered when making generalizations. The lack of randomness in the sample implies generalizations beyond the specific population would only amount to speculation.

Another limitation which could have affected the attitude results is the timing of the test on attitudes. It was originally intended to test attitudes before the course began and at a later date. Initial testing was not carried out because of logistical difficulties. Loyd and Gressard (1984) report experience with computers results in more positive attitudes. If this is the case, which seems likely, further research would be recommended with respect to field dependence-independence and change in attitude with computer experience.

## II. REVIEW OF THE LITERATURE

### INTRODUCTION

The relationship between education and psychology continues to evolve as educators pursue the design and development of effective learning strategies and delivery systems. Although early applications of learning theory dealt with the behaviorists stimulus-response theories (learning which depended on some external actions), a swing towards the ideas of cognition and the perception and processes of the learner, began in the Post-War period of the late 1940's and early 1950. Witkin and Goodenough (1981) reported the 1949 symposium on "Personal and Social Factors in Perception," originated the "New Look" in perception. They point out this New Look in perception stemmed from discontent with the popular approaches to perception which neglected the person who does the perceiving and they refer to Klein and Schlesinger's paper, "Where is the Perceiver in Perceptual Theory?" to sum up the feelings of the day. The act of perceiving needed to be examined in relation to

personality structure, needs, interests, and values of the learner. This led to a wide ranging study of personality-perception relationships reported in numerous journal articles and texts.

It was out of these investigations of perception, personality, and individual differences that the concept of cognitive style emerged as an area of critical analysis. Witkin, et al (1977a) outline:

"cognitive styles are concerned with form rather than the content of cognitive activity. They refer to individual differences in how we perceive, think, solve problems, learn, relate to others, etc. The definition of cognitive styles is thus cast in process terms."

Among the wide range of cognitive styles identified in the early years was constricted-flexible control, leveling-sharpening, equivalence range, tolerance for unrealistic experiences, reflection-impulsivity, conceptualizing, strong vs weak automatization, and

field dependence-independence. Of the cognitive styles identified, it is the dimension of field dependence-independence which has received the most attention in the literature, in an effort to better identify how people learn and, how better delivery systems can be designed to provide maximal opportunity for learning.

#### **FIELD DEPENDENCE-INDEPENDENCE**

The cognitive style of field dependence-independence had a simple beginning in the psychological laboratory of Herman A. Witkin who was studying the perception of the upright. In his early experiments Witkin tried to determine how people locate the upright as quickly and accurately as they normally do (Witkin 1948, Witkin and Asch 1954). He found individual differences among subjects in their preferred way of evaluating the information available to locate the upright. Witkin and Goodenough (1981) identified the two different modes of information processing used to determine the upright.

The direction of the perceived upright is

ordinarily determined by two sets of experiences working in tandem. First, the field around us, apprehended through vision, usually has the character of a framework, the main axes of which correspond to the true vertical and horizontal directions of space. This framework provides one ready basis for establishing the upright. Second, the direction of gravity, apprehended through the vestibular, tactile, and kinesthetic senses, provides another definition of the vertical direction of space.

The two experiences used to identify the upright involved the processing of information perceived from the immediate environment and/or the sensations perceived internally. Since the upright of the external field and the internal perception of the pull of gravity normally coincide in direction, either or both can be used to determine the upright. Therefore, in most circumstances, all of us determine the upright equally. To find which reference, the internal field or the external field, predominates, Witkin and his

associates separated the two fields in the laboratory.

In his investigations, Witkin used three tests, the body-adjustment test (BAT), the rod and frame test (RFT), and the rotating room test (RRT).

In the BAT, the body adjustment test, the subject was seated in a small tilted room on an adjustable chair. When the room was tilted the subject was required to adjust the chair to the vertical. The subjects could align the chair according to the internal field, their sensation of the gravitational pull, or the external field, the vertical axis of the tilted room. It was found that in the extremes, some subjects aligned the chair with the true vertical according to their internal referents and others aligned the chair with the tilted room ignoring the sensations from the body.

In RFT, the rod and frame test, the subject was seated in a darkened room and shown a tilted square frame, within which is a rod which could be tilted separately from the frame. The subject was required to adjust the rod to the vertical position while the frame remained in its tilted position. As in the BAT, some subjects using the external referent of the

frame, aligned the rod with the frame; others, using internal referents of the body, aligned the rod to the true vertical. Results of the tests were consistent and Witkin concluded that the individual differences observed were the result of using the external field of vision or the internal referents of the body in the perception of the vertical. Scores represented a continuous distribution, with the extremes being labelled field dependent for persons using the external field as the primary reference of verticality and field independent for persons relying on the body for information of the upright.

In both the BAT and RFT the true vertical was obtained from internal references. To obtain the opposite situation Witkin developed another test, the rotating room test (RRT), where a small upright room was rotated around a circular track with the subject seated in a tilted chair. The direction of the effective force on the body was the result of the inertia of the body and the downward pull of gravity on the body. The subject was required to bring his chair to an upright position. Witkin, as a result of the confusing nature of the forces, found that reliance on

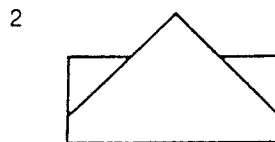
bodily cues lead to inaccurate adjustments of the chair to the vertical. In other words, this time persons who were field independent made the incorrect adjustment. Therefore, neither field dependence nor field independence in itself was inherently good or bad in determining the upright. There is not necessarily a preferred style, each method of locating the vertical would be advantageous under certain conditions. Studies have also shown field dependent and field independent people are not psychologically well adjusted or poorly adjusted, and the two groups do not demonstrate differences in general IQ ability.

In further studies, Witkin and Goodenough (1981) initiated the idea that tasks in the BAT and RFT involved the separation of an item (the body or the rod) from an organized field (the room or the frame). They developed an embedded figures test in which a simple geometric figure (figure A) is hidden within a complex geometric design (figure B).

**FIGURE A**



**FIGURE B**



Find Simple Form "G"

It was found that subjects who had difficulty isolating the simple figure within the complex framework were the ones who adjusted the rod or chair with the external field. In other words they were field dependent, they tended to rely upon external sources of information for their perception of the upright and were confused by the surrounding field in the embedded figures test. People who were field independent were found to be able to easily separate the simple figure from the organized complex design. They were not distracted by the confounding framework in the BAT and RFT tests, nor by the complex figures in the embedded figures test.

Witkin and Goodenough conceived field dependence-independence as a perceptual-analytical ability and began to study levels of field dependence-independence and tasks involving various social and intellectual domains. Initially, studies focused on the issue of the relationship between disembedding ability in perception and personality characteristics, social behavior, and interpersonal competencies.

**FIELD DEPENDENCE-INDEPENDENCE AND SOCIAL FUNCTIONING**

Witkin, Goodenough, and Karp (1967) examined various psycho-social domains for individual differences congruent with those identified in perception. They reported

In a field dependent mode of perceiving, perception is dominated by the overall organization of the field; there is relative inability to perceive parts of a field as discrete. This global quality is indicative of limited differentiation.

They suggest the less articulated drawings of human figures by field dependent persons indicates limited differentiation in their experience of the world about them and ...

Further, just as they rely on the surrounding visual field in their perception of a stimulus object within it, so do they tend to use the social context in which they find

themselves for definitions of attributes of the self.

They also report the likelihood of more global defense mechanisms such as repression and denial are exhibited by field dependent persons. Field dependent persons are identified as being more aware of their immediate environment and tend to go along with the dominant properties of that field. They receive social cues more readily (Ruble & Nakamura, 1972) are more perceptive to "body language" and prefer to be physically closer in a social situations (Justice, 1970; Holley, 1972).

Field dependent persons prefer situations where they can be personally involved. In a study with student nurses who trained in surgical procedures and psychiatric care, Quinlan and Blatt (1972) reported that field dependence correlated with the grades of students enroled in the psychiatric care segment of nursing instruction. They suggest

field dependence may be related to capacity for empathy, in that greater social

sensitivity of moderately global subjects facilitates functioning with severely disturbed patients.

Weissenberg (1966) reported that field dependent supervisors are more considerate to their employees.

This social sensitivity of persons who perceive in a field dependent manner manifests itself through various personal activities. In a study by Konstadt and Forman (1965) students writing a simple letter cancellation test were given approving or disapproving remarks on their abilities, neatness, and cooperation. They found students identified as field dependent scored significantly lower under the disapproval condition, and were observed looking away from their papers more often. It was concluded that field dependent individuals have a greater attentiveness to their environment and seek external definition for a particular situation. In a similar study of negative reinforcement, Ferrell (1971) also found field dependent individuals were more quickly influenced by verbal warnings and, Randolph (1971) showed field dependent types to be more influenced by extrinsic

rewards and performed better when praised.

On the other hand, field independent persons who function more autonomously from the field are able to sample more fully the less obvious features of the field which may be relevant. Goodenough (1976) reports field independent individuals take more active approaches to learning, such as hypothesis testing and verbal mediation. As well, defense mechanisms are more likely to be intellectualization and isolation. They prefer more solitary, impersonal situations (Witkin et al, 1977a), are more concerned with abstract ideas, and favour domains like science which require cognitive restructuring skills (Burkhalter & Schaer, 1985; Ronning et al, 1984; Arbuttnot, 1969). In a number of studies, field independent students were found to possess better problem solving abilities (Ronning et al, 1984; Smilansky & Halberstadt, 1986), and Farr (1968) found field dependence-independence related to non-verbal problem solving ability for students of equal math aptitude. Ronning et al (1984) observed high field independent students solving problems, and reported they had more direct and certain solutions, had fewer pauses, and keyed on relevant information without

cueing. Relationships between field independence and mathematical ability have also been reported in numerous studies (Witkin et al 1977a, Bieri 1958, Greenfield 1970).

The opposing styles of perceiving are neither good nor bad. It is generally assumed that to have more of an ability is better, but as Witkin et al suggest ...

With cognitive styles ... each pole has adaptive value under specified circumstances and so may be judged positively in relation to those circumstances.

The field independent and dependent styles identified manifest themselves throughout many different domains and in a wide range of situations affecting the collective personality. Witkin et al (1977a) broaden the field dependent-independent cognitive style to an articulated-global continuum. A person who perceives items as distinct from their background when the background is organized, or imposes structure in a field which has little structure, is said to perceive in an articulated fashion (field independent). People

who are field dependent will tend to receive most of their informational cues from the surrounding environment and are said to perceive in a more global manner.

Therefore, if the information from the surrounding environment is confusing or "hidden", as in the rod and frame test or the embedded figures test, the field dependent person will experience difficulties perceiving the information, and the field independent person will likely impose an organization on the field. These individual differences, identified by the field dependent-independent continuum, have many educational implications, and subsequent research focused on the role of field dependence-independence and intellectual functioning.

#### **FIELD DEPENDENCE-INDEPENDENCE AND INTELLECTUAL FUNCTIONING**

Research has shown overall academic ability is not related to field dependence independence (FDI) (Witkin et al, 1977a). However, because of the inherent differences manifested by the global-

articulated domain, certain tasks and abilities may become easier or more favoured by the contrasting methods of processing information.

There is a growing amount of research to support the individual differences predicted by the articulated-global construct. Collins-Eiland (1986) found field independent students performed better than field dependent students when subjected to noise conditions. The field dependent students, more aware of the immediate environment, seemed to be distracted easier by external conditions. In a parallel situation, where external conditions influenced students functioning, Garner and Cole (1986), studying the success and failure of students in low socio-economic status settings, found a relationship between field dependence and locus of control (tendency to blame success/failure on outside forces). Students with an external locus of control, who were field dependent, had the lowest scores on math and reading tests. They identified the strongest predictors for failure would be attribution of failure to external forces, non-analyticalness, and sensitivity to social cues.

Thompson and Knox (1987) found the characteristics associated with field independence are similar to those which are assumed to be important for correspondence study. They found students enrolled in a distance education program showed significantly higher field independence scores than normal groups. Students who are better suited for independent study indicate a need for autonomy in their programs and are able to impose their own structure with limited feedback and guidance between student and teacher.

In a study by McCleod et al (1978), where the instructional treatments varied with the amount of guidance, it was found field independent students did better with minimum guidance, and field dependent students performed better with more guidance, indicating field independent students prefer to work independently, get bored with too much help, and do not like high levels of guidance. In a similar study, Mcleod and Adams (1979), using manipulative materials, reported that field independent students achieve more in a discovery treatment, and field dependent students learn better in expository instruction.

Abraham (1985) also found field dependent students

did better with expository instruction. She studied the relationship of field dependence-independence in teaching of grammar to ESL pupils. She found field dependent students had difficulty with the rules and did better with examples while field independent students performed better with deductive lessons.

This propensity toward expository and discovery learning has important implications for instructional strategies. Post (1987) found a relationship between field independence and students' achievement on CAI lessons, and found field dependence-independence was a more effective predictor of achievement than IQ. He suggested consideration be given, when using CAI, to selecting appropriate programs for field dependent students.

Ronning et al (1984) suggested field dependent students will benefit from carefully structured instruction with clearly defined objectives. They studied individual differences among problem solvers and found field independent students significantly outperformed field dependent students on the problems. Field independent students possessed the analytical skills and the restructuring ability necessary to view

problems, not immediately solvable, from a new perspective.

It follows that differences exhibited through social and intellectual functioning would lead field dependent-independent persons to be more interested in, and demonstrate preferences for, certain subject areas which matched their cognitive styles. These preferences extend logically to a variety of educational-vocational fields and occupations.

#### FIELD DEPENDENCE-INDEPENDENCE AND EDUCATIONAL AND VOCATIONAL IMPLICATIONS

In a longitudinal study Witkin et al (1977b) examined the role of field dependence-independence, academic selection, and subsequent major for over 1400 college students. They hypothesized that field dependent students would be interested in and would select domains which were primarily social in context and require interpersonal relations. Field independent students would favour domains which were analytical, abstract, requiring cognitive restructuring abilities, and were non-social in context. The students were

divided into three groups upon entrance to college. The Science group included mathematical and medical selections, the Education group included speech therapy and nursing, and disciplines which were more diverse in nature, such as psychology, were placed in a third grouping called Others. Field independence was highest for the Science group and lowest for the Education group as the theory predicted. Students who stayed in Science had higher field independence than those who dropped out or switched from a science program. Field independent students who initially chose Science were more likely to stay in Science, and field dependent students who initially chose Education were more likely to stay in Education. Most field independent students who changed their major switched to art, music, or science while field dependents who switched, opted for education or the humanities.

Witkin et al (1977b) cite a considerable amount of research on the role of cognitive style and career differentiation. Table A summarizes the vocational choices they identified in various studies.

**TABLE A**

Interest/Choices of Relatively Field-Dependent and Field-Independent Individuals within Educational-Vocational Domains.

FIELD DEPENDENT	FIELD INDEPENDENT
Clinical Psychology	Experimental psychology
Pyschiatric nursing	Surgical nursing
Interpersonal therapist	Impersonal therapist
Business personell director	
Business education teacher	Business production mgr.
Social studies teacher	Natural sciences teacher
Elementary teacher	Industrial arts teacher
Informal art students	Formal art students

Frank (1986) found that even with a homogeneous grouping of teacher education majors that cognitive style was related to the chosen area of specialization. Teachers who specialized in natural sciences, math, and business were more field independent than majors in the

humanities, family and child development, home economics, special ed, and speech pathology.

In a another recent study, Koroluk (1987) examined high school students selection of courses, present occupations, and level of field dependence-independence. He reported that students tended to select concentrations, generally favoured, and perceived as useful, subjects which matched their cognitive style. He also found a significant relationship between field independence and academic success not generally supported in other studies (Witkin et al, 1977a).

The inclination to favour a particular intellectual domain or vocational stream because of the influence of field dependence-independence extends naturally to attitudes and success with computers. The field independent individual tends towards impersonal activities and would have few problems with the mechanistic nature of computing. Working with computers is an independent and impersonal activity often relying on discovery and problem solving abilities to determine even the most fundamental tasks like what key to push or what sequence of commands is

necessary to perform a given task.

The less differentiated person would rely on the context of the information the computer displays, information which is often ambiguous and embedded. Assumptions such as pressing the return key, default settings, abbreviated commands, and multi-level command sequences present a complex organization in which the field dependent student would be expected to experience difficulty. Negative reinforcement (even user-friendly software presents disapproval conditions) and external distractions like the video display and keyboard counter the characteristics of field dependence.

The characteristics identified by the field independent cognitive style suggest a greater compatibility between field independent persons and working with computers. Griswold (1983) in a study of education majors and their computer awareness suggests understanding of computers requires appreciation that the user, not the computer, controls the information process. Smith (1976) suggests individual cognitive learning style traits could be associated with achievement. He reports those who achieved using games demonstrated a higher degree of individuality.

Field dependence-independence theory would suggest that students who exhibit the cognitive style of field independence would be more likely to choose a course in computer science, would display more positive attitudes towards computers, and would be more likely to experience success than the field dependent student.

#### ATTITUDES TOWARDS COMPUTERS

Most educators generally agree that positive attitudes lead to more participation in a particular activity, and should result in higher achievement. Therefore, important questions concerning attitudes arise. What are the components of attitude, what shapes attitude, and how much influence do attitudes have on achievement?

An attitude is a state of mind which reflects one's ideas about, behavior with, and conduct towards, some particular condition. It reflects interest, anxiety, confidence, opinions, and perceptions pertaining to the situation. Attitudes are shaped by our abilities, experience, feelings, families, and friends. They can turn us on to, or off of an

experience, affect our motivation, and influence our achievement.

For a number of students the computer experience is not necessarily a successful one. Although little research exists showing the effects of attitudes and success with computers, a few studies have recently begun to suggest the relationship of attitudes and achievement in computers may be the same as the relationships found in similar areas requiring cognitive restructuring skills and analytical ability.

Loyd and Gressard (1984), studying the effects of age, sex, and experience on computer attitudes suggest computer anxiety may inhibit the successful mastery of computer skills in much the same way that math anxiety inhibits achievement in mathematics. They found computer experience was related to more positive attitudes on scales which measured anxiety, confidence, and liking.

Cambre and Cook (1987) described computer anxiety as the fear of using computers, involving an array of emotional reactions, which may lead to a distrust of the technology, and reported computer anxiety can be reduced by exposure to microcomputers.

To what extent attitudes affect achievement in computer studies is still unknown, however it is assumed the most desired state in the educational system would be positive attitudes.

### KEYBOARDING

Communication with a computer, in most cases, involves the interaction between a keyboard and the user. In the traditional sense, keyboarding is associated with the clerical skill of typing. Today the typing equivalent would be word processing but the use of the keyboard extends beyond the office desk, and requires different and varying degrees of skill. Basic keyboarding skills are now required in the workplace, for automated banking, locating a book in the library, for electronic mail and infoservices, and doing an experiment in the science laboratory.

Initially keyboarding was the domain of the secretary. Sox (1988) stated keyboarding today is no longer considered inappropriate for others. Managers, executives, and professionals are accepting the need for basic keyboarding skills in order to increase their

productivity and make maximum use of available time. In her 1984 survey, Sox reports 59% of managers used a keyboard. In a subsequent survey (1986) she reports the number has increased to 76% and suggested management students should be viewed as needing skills which are not necessarily the same as those traditionally taught to secretarial students. Sox identified the most important aspects of keyboarding as error correction, numeric input, and retrieval capabilities requiring keyboard codes, and proposed the content of traditional typewriting/keyboarding courses may need be challenged.

Other educators are calling for an examination of the curriculum and an early introduction of keyboarding skills. Williams (1988) outlined the preparation of elementary teachers for the early introduction of keyboarding and Balajthy (1988) supported the teaching of keyboarding at the elementary level. He suggested delaying keyboarding may have negative consequences for students who will use computers.

There is little research which examines the process of computer keyboarding. Gades (1980) reported that although a number of articles indicate concerns

about keyboarding and computers, there is no research data to substantiate these claims. He studied the effects of previous computer experience, and found no significant results between working on a computer and acquisition of keyboarding skills.

If the ability to communicate with a computer depends upon one's keyboarding skills, to what extent does the keyboard "get in the way", and how does it affect attitudes and achievement in working with computers?

Balajthy (1988) described keyboarding as an exploratory activity which requires visual cues, and reported the tendency of students to look at the monitor.

This suggests students who are field dependent, influenced easily by their environment, are likely to prefer an expository approach to learning and may have problems with keyboarding as a distraction in learning about computers and may possibly demonstrate more anxiety and dislike for working with computers.

**SEX AND CULTURAL DIFFERENCES**

Research indicates that females experience more anxiety, participate less, and drop out of mathematics more often than males (Fennema and Carpenter, 1981). Abelew (1974) reported boys have higher math skills than girls. Collis and Williams (1987) reported persistent sex differences have been found in attitudes towards mathematics and science, with males consistently more positive than females in their attitudes, self-confidence levels, and participation rates.

Hadfield and Maddux (1988) suggested one possible cause of mathematics anxiety is cognitive learning style. In their study of 481 secondary school students they found field dependent learners experienced more mathematics anxiety than did field independent learners. Bieri (1958) found males superior in spatial relations and males had higher field independence and Math SAT scores. Many conjectures have been made for the discrepancy between male and female math ability, including, cultural expectations and sex inequity and accessibility. In spite of the concern, some of the same characteristics are beginning to appear in studies

of females and males in their attitudes with computers.

In the research with respect to female attitudes and computers, mixed results are reported. Collis (1985) reported results which support low self-confidence among girls with regard to computers, and, Collis and Williams (1987), in a very broad cross-cultural study of Canadian and Chinese students found boys were significantly more positive with respect to attitudes toward mathematics, computers, the impact of computers on society, as well as in self-confidence. Griswold (1983) found greater computer awareness was related to the male gender, and, Demetrulias (1985) cited a national study which indicates, among teachers who do not use computers, 73 % are female.

On the other hand, Loyd and Gressard (1984) and Stephens, Wileman, and Konvalina (1981) reported no significant differences with respect to sex were found in attitudes toward computers and computer science aptitude.

Although there may be some disagreement with respect to sex differences, computer attitudes, and abilities, most researchers identify a need to increase the use of computers among girls. Sanders (1984)

pointedly stated

The computer-use sex discrepancy matters because it turns into an occupational and economic sex discrepancy when today's children grow up into tomorrow's adults.

This study examined, in an exploratory manner, sex differences as they related to attitudes about and learning of computers, and ability with computers. There is very little reliable evidence of cultural differences in computer attitudes or cognitive styles. However, in one broad, and rather unique study, Collis and Williams (1987) analyzed the attitudes of 2105 students in British Columbia and Shanghai, China, toward computers and selected school subjects. They found the Chinese students were significantly more positive in their attitudes toward computers, science, and writing. This study investigated, in an exploratory manner, the attitudes about and learning of computers, and ability with computers, of the foreign students (mostly Chinese) and regular students.

**SUMMARY**

The construct of field dependence-independence is a cognitive style which outlines two modes of processing information. Field dependent individuals tend to use external references as the major influence in processing information. Persons who are field dependent have a more social orientation, prefer to be involved with their activities, are more sensitive to social cues and criticism, and have difficulty processing information which is hidden or embedded, or has little structure.

Field independent persons prefer a more impersonal domain. They demonstrate analytical and problem solving abilities, tend to more solitary activities, and impose their own structure when no structure is apparent.

The characteristics of field dependence-independence, keyboarding, and attitudes, are assumed to be characteristics which may affect the acquisition of microcomputer fundamentals.

### III. METHOD

#### SUBJECTS

The subjects were 67 students attending the University of Winnipeg Collegiate, Winnipeg, Manitoba, enrolled in the MICROCOMPUTER APPLICATIONS 305 course. The subject group was a cultural mix of mainly teenagers, from diverse backgrounds, tending towards the upper middle class. About one quarter of the students were from other countries.

#### INSTRUMENTS

The instrument selected to measure the field independence/dependence of the student was the Group Embedded Figures Test ( GEFT ) by Philip K. Oltman, Evelyn Raskin, and Herman A. Witkin. The test has proven to be a measure of field dependence-independence highly correlated with the rod and frame test. A reliability estimate of 0.82 for the GEFT has been reported by Witkin et al. (1971). The GEFT consists of a number of complex geometric designs from which

students must find and trace a given figure (see appendix)

Students who are able to locate the most hidden figures in the given amount of time would tend towards the field independent style, and students who have difficulty locating the figures would tend toward the field dependent end of the scale. The test consists of eighteen (18) items and is scored one point per correct answer.

The test for attitudes will be the Survey of Attitudes Towards Learning About and Working with Computers by Brenda H. Loyd and Clarice P. Gressard. (1984). This test contains sub scales of computer Anxiety, Liking, Confidence and Usefulness. Loyd and Gressard report the total score based on the subscales could reasonably be interpreted to represent a general attitude toward working with computers. There are ten questions on each subscale and student response varies from strongly agree to strongly disagree in a Likert-type scale. Each item is graded 1-4 and the maximum score of 160 indicates the most positive attitude.

The measurement of keyboarding abilities consists of a speed and accuracy test as described by Stevenson,

Ranger, and St. John (1985). Students who were able to achieve 20 words per minute in the speed and accuracy tests were presumed to have basic keyboarding abilities (Sormunen, 1986).

The measure of grades consists of classroom assignments, written content and procedure tests, and timed practical tests of computer skills with MS-DOS, Lotus 1-2-3, and Wordperfect 4.1. Tests and assignments were designed by the classroom instructor, Dr. Wilf Schlosser, a highly knowledgeable and experienced computer science teacher. Grades were accumulated over three terms to give a general indication of the students ability with computers. A grade of 50 would be a perfect score.

#### PROCEDURE

Students enrolled in the Microcomputer Applications 305 course in the Collegiate Division of the University of Winnipeg in 1987, and again in 1988, were tested for attitudes and basic keyboarding abilities approximately halfway through the school year and for field independence/dependence as logistics

permitted at various times. Witkin et al. (1977) reported that field independent/dependent cognitive styles are process rather than content variables and are stable over time.

Marks were recorded for the students' knowledge and ability, as well as for, sex, age, and student status.

The attitude and field testing was administered by the author. The keyboarding and grading was done by the classroom instructor. However, the author initially taught and designed the curriculum for the course which consists of word processing using Wordperfect, spreadsheet analysis with Lotus 1-2-3 and a brief introduction to DBASE. Computer literacy is discussed, with the major emphasis on practical skills and the integration of computing skills across the curriculum.

Students were informed of the intent of the study and permission notes were received from students. Parental permission was required for students under the age of 18. A number of students elected not to take the tests, usually because they failed to return the permission form. The number of students who

participated in the study was sixty-seven (67). However, not all students were in attendance for the all tests, reducing the numbers in various comparisons. The numbers of students participating in a specific study are indicated in the results.

All data was recorded in Lotus 1-2-3 and statistical calculation was performed by Lotus programs written by the author. Software validation was performed for all programs written by the author (see appendix).

#### DATA ANALYSIS

The correlation between the effects of field dependence-independence and attitudes, grades and keyboarding was examined using linear regression techniques.

Since the effects of field independence-dependence are more apparent for extreme groups (Witkin, Oldtman, Raskin, and Karp, 1971), analysis of variance was performed on the top and bottom third (plus tied scores) of the sample for a comparison of the means of field dependent (bottom third of GEFT) and field

independent (top third of GEFT) students with respect to attitudes (including subscales), Keyboarding skills, and Grades. Since separate scores were available for the subscales of Anxiety, Confidence, Likeability, and Usefulness, these measures were treated independently in their comparisons. The N's for the top and bottom thirds were different because of tied scores and the ANOVA for unequal means (Pazur and Swanson, 1972) was employed.

A similar technique was employed to determine the ANOVA of attitude and abilities with respect to keyboarding skills and the ANOVA of Grades with respect to attitudes.

The test of significance for the field dependent/keyboarding and field independent/keyboarding groups with respect to Grades required a 2 X 2 factorial design to test for main effects and interaction.

Simple one way ANOVA was used to determine if any sex or cultural differences exist with respect to knowledge and ability.

#### IV. RESULTS

The results are contained in the following tables, which are presented in the order of the hypotheses. Relationships which require more than one comparison (ex. attitude subscales) are summarized and conclusions are presented for each hypothesis.

##### ATTITUDES vs FIELD DEPENDENCE-INDEPENDENCE

The relationship between field dependence-independence ( FDI ) and attitudes was examined to see if attitudes depended upon the field dependent-independent scores. The data is shown in Table 1 which also gives a correlation coefficient for FDI and ATTITUDE of  $r = 0.06$  and a coefficient of determination of zero. This means the variation in attitude due to the effect of field dependence-independence is zero.  $F(1, 53) = 0.16$  indicating the relationship is not significant.

**TABLE 1**  
**REGRESSION STATISTICS**  
**ATTITUDE vs FIELD DEPENDENCE-INDEPENDENCE**

	ATTITUDE	FDI		
MEANS	122.9	9.2		
SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	73.19	73.19	0.16
RESIDUALS	53	23803.65	449.13	
TOTALS	54	23876.84		
COEFFICIENT OF CORRELATION	r = 0.06			
COEFFICIENT OF DETERMINATION	r <sup>2</sup> = 0.00			

The test for attitude consists of the four subscale of anxiety, confidence, likeability, and usefulness. Table 2 shows the linear regression statistics with respect to field dependence-independence and anxiety. The coefficient of correlation for FDI and ANXIETY is  $r = 0.09$  and the coefficient of determination  $r^2 = 0.01$  indicates 1 % of

the variation in anxiety was due to field dependence-independence. The F ( 1, 53 ) ratio of 0.39 means the relationship is not significant.

**TABLE 2**  
**REGRESSION STATISTICS**  
**ANXIETY vs FIELD DEPENDENCE-INDEPENDENCE**

	ANXIETY	FDI		
MEANS	30.7	9.2		
SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	13.74	13.74	0.39
RESIDUALS	53	1879.61	35.46	
TOTALS	54	1893.35		
COEFFICIENT OF CORRELATION	r = 0.09			
COEFFICIENT OF DETERMINATION	r <sup>2</sup> = 0.01			

Table 3 shows the linear regression statistics with respect to field dependence-independence ( FDI )

and confidence. The coefficient of correlation for FDI and CONFIDENCE is  $r = 0.09$  and the coefficient of determination  $r^2 = 0.01$  indicates 1 % of the variation in confidence was due to field dependence-independence. The  $F ( 1, 53 )$  ratio of 0.44 indicates the relationship is not significant.

TABLE 3  
REGRESSION STATISTICS  
CONFIDENCE vs FIELD DEPENDENCE-INDEPENDENCE

	CONFIDENCE	FDI
MEANS	29.7	9.2

SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	17.64	17.64	0.44
RESIDUALS	53	2100.80	39.64	
TOTALS	54	2118.44		

COEFFICIENT OF CORRELATION	$r = 0.09$
COEFFICIENT OF DETERMINATION	$r^2 = 0.01$

Table 4 shows the linear regression statistics

with respect to field dependence-independence ( FDI ) and likeability.

**TABLE 4**  
**REGRESSION STATISTICS**  
**LIKEABILITY vs FIELD DEPENDENCE-INDEPENDENCE**

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	CONFIDENCE	FDI
MEANS	29.7	9.2

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SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	15.73	15.73	0.35
RESIDUALS	53	2352.20	44.38	
TOTALS	54	2367.93		

---

COEFFICIENT OF CORRELATION       $r = 0.08$

COEFFICIENT OF DETERMINATION       $r^2 = 0.01$

---

The coefficient of correlation for FDI and LIKEABILITY is  $r = 0.08$  and the coefficient of determination  $r^2 = 0.01$  indicates 1 % of the variation

in likeability was due to field dependence-independence. The  $F ( 1,53 )$  ratio of 0.35 indicates the relationship is not significant.

TABLE 5  
REGRESSION STATISTICS  
FIELD DEPENDENCE-INDEPENDENCE vs USEFULNESS

	FDI	USEFULNESS		
MEANS	9.2	33.0		
SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	11.00	11.00	0.52
RESIDUALS	53	1118.53	21.10	
TOTALS	54	1129.53		

COEFFICIENT OF CORRELATION  $r = - 0.10$

COEFFICIENT OF DETERMINATION  $r^2 = 0.01$

Table 5 shows the linear regression statistics with respect to field dependence-independence ( FDI )

and usefulness. The coefficient of correlation between FDI and USEFULNESS is  $r = - 0.10$  and the coefficient of determination  $r^2 = 0.01$  indicates 1 % of the variation in usefulness was due to field dependence-independence. The F ( 1,53 ) ratio of 0.52 indicates the relationship is not significant.

Table 6 summarizes the coefficients of correlation and determination and the F ratios for the relationships between field dependence-independence and attitudes including the subscales.

TABLE 6

**SUMMARY**

**FIELD DEPENDENCE-INDEPENDENCE and ATTITUDES**

<u>TEST</u>	<u>r</u>	<u>r<sup>2</sup></u>	<u>F</u>
ATTITUDE	0.06	0.00	0.16
ANXIETY	0.09	0.01	0.39
CONFIDENCE	0.09	0.01	0.44
LIKEABILITY	0.08	0.01	0.35
USEFULNESS	-0.10	0.01	0.52

Table 6 indicates no statistically significant

relationships were found between field dependence-independence and attitudes including the subscales of anxiety, confidence, likeability, and usefulness. Therefore hypothesis #1 must be accepted. There was no correlation between the field dependence-independence scores and attitudes about and learning of computers.

**TABLE 7**

**EXTREME GROUP ANOVA**

**ATTITUDE vs FIELD DEPENDENCE-INDEPENDENCE**

	FDI < 7	FDI > 12		
MEANS	123.1	126.4		
N	18	19		

SOURCE OF VARIATION	DF	SS	MS	F
ROWS	1	101.3	101.3	0.22
RESIDUALS	35	15956.4	455.9	
TOTALS	36	16057.7		

Since the effects of field dependence-independence are most apparent for the extreme scores an ANOVA was performed to compare the means of the top and bottom

thirds of the FDI scores

Since  $N = 55$  for the FDI and attitude scores the bottom third resulted in a  $N = 18$  and the top third resulted in  $N = 19$  because of tied scores.

Table 7 shows the mean scores and ANOVA statistics with respect to field dependence-independence and attitudes for the field dependent (  $FDI < 7$  ) and field independent (  $FDI > 12$  ) groups. The means of the attitude scores for the field dependent group were lower than the means of the field independent group as predicted. However the  $F ( 1, 35 )$  ratio of 0.22 indicates the variation is not significant.

The test for attitudes contains four subscales of anxiety, confidence, likeability, and usefulness. Table 8 shows the mean scores and ANOVA statistics with respect to field dependence-independence and anxiety for the field dependent (  $FDI < 7$  ) and field independent (  $FDI > 12$  ) groups.

The means of the anxiety scores for the field dependent group were lower than the means of the field independent group as predicted. However the  $F ( 1, 35 )$  ratio of 0.41 indicates the variation is not significant.

**TABLE 8**  
**EXTREME GROUP ANOVA**  
**ANXIETY vs FIELD DEPENDENCE-INDEPENDENCE**

	FDI < 7	FDI > 12			
ANXIETY MEANS	30.3	31.6			
N	18	19			
SOURCE OF VARIATION	DF	SS	MS	F	
ROWS	1	15.6	15.6	0.56	
RESIDUALS	35	1326.4	37.9		
TOTALS	36	1342.0			

Table 9 shows the mean scores and ANOVA statistics with respect to field dependence-independence and confidence for the field dependent ( FDI < 7 ) and field independent ( FDI > 12 ) groups. The means of the confidence scores for the field dependent group were lower than the means of the field independent group as predicted. However the F ( 1,35 ) ratio of 0.56 indicates the variation is not significant.

**TABLE 9**  
**EXTREME GROUP ANOVA**  
**CONFIDENCE vs FIELD DEPENDENCE-INDEPENDENCE**

	FDI < 7	FDI > 12			
CONFIDENCE MEANS	29.8	31.3			
N	18	19			
SOURCE OF VARIATION	DF	SS	MS	F	
ROWS	1	21.9	21.9	0.56	
RESIDUALS	35	1369.2	39.1		
TOTALS	36	1391.1			

Table 10 shows the mean scores and ANOVA statistics with respect to field dependence-independence and likeability for the field dependent ( FDI < 7 ) and field independent ( FDI > 12 ) groups. The means of the likeability scores for the field dependent group were lower than the means of the field independent group as predicted. However the F ( 1,35 ) ratio of 0.36 indicates the variation is not

significant.

TABLE 10  
EXTREME GROUP ANOVA  
LIKEABILITY vs FIELD DEPENDENCE-INDEPENDENCE

	FDI < 7	FDI > 12			
MEANS	29.1	30.4			
N	18	19			
<hr/>					
SOURCE OF VARIATION	DF	SS	MS	F	
ROWS	1	14.6	14.6	0.36	
RESIDUALS	35	1430.2	40.9		
TOTALS	36	1444.8			

Table 11 shows the mean scores and ANOVA statistics with respect to field dependence-independence and usefulness for the field dependent ( FDI < 7 ) and field independent ( FDI > 12 ) groups. The means of the usefulness scores for the field dependent group were higher than the means of the field independent group. However the F ( 1,35 ) ratio of

0.27 indicates the variation is not significant.

**TABLE 11**  
**EXTREME GROUP ANOVA**  
**USEFULNESS vs FIELD DEPENDENCE-INDEPENDENCE**

	FDI < 7	FDI > 12			
USEFULNESS MEANS	33.9	33.1			
N	18	19			
<hr/>					
SOURCE OF VARIATION	DF	SS	MS	F	
ROWS	1	5.7	5.7	0.27	
RESIDUALS	35	749.6	21.4		
TOTALS	36	755.3			

Table 12 summarizes the F ratios for the variation between means for the field dependent ( FDI < 7 ) and field independent ( FDI > 12 ) cognitive styles and attitudes including the subscales of anxiety, confidence, likeability, and usefulness. Table 12 indicates variations in means found between field

dependence-independence and attitudes including the subscales of anxiety, confidence, likeability, and usefulness were not significant.

**TABLE 12**

**SUMMARY**

**EXTREME GROUPS**

**ATTITUDES and FIELD DEPENDENCE-INDEPENDENCE**

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	FDI < 7	FDI > 12	
<u>TEST</u>	<u>MEAN</u>	<u>MEAN</u>	<u>F</u>
ATTITUDE	123.1	126.4	0.22
ANXIETY	30.3	31.6	0.41
CONFIDENCE	29.8	31.3	0.56
LIKEABILITY	29.1	30.4	0.36
USEFULNESS	33.9	33.1	0.27

---

Since no significant relationships between field dependence-independence and attitudes were found hypothesis #1.1 is accepted. There was no difference between the attitudes of the extreme groups of field dependent and field independent students.

**KEYBOARDING AND FIELD DEPENDENCE-INDEPENDENCE**

The relationship between field dependence-independence (FDI) and keyboarding was examined to see if keyboarding depended upon the FDI scores.

TABLE 13

REGRESSION STATISTICS

KEYBOARD vs FIELD DEPENDENCE-INDEPENDENCE

	FDI	KEYBOARD		
MEANS	9.5	17.8		
SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	0.24	0.24	2.90
RESIDUALS	51	4.22	0.08	
TOTALS	52	4.46		
COEFFICIENT OF CORRELATION	$r = - 0.23$			
COEFFICIENT OF DETERMINATION	$r^2 = 0.05$			

Table 13 gives a correlation coefficient between FDI and KEYBOARD skills of  $r = - 0.23$  and a coefficient of determination of  $r^2 = 0.05$ . This means the

variation in keyboarding due to the effect of field dependence-independence is 5 %. Since  $F ( 1,51 ) = 2.90$  the relationship is not significant. The negative correlation indicates that keyboarding skill is greater for lower FDI scores. Since no significant relationship between keyboarding and field dependence-independence was found hypothesis #2 must be accepted. There was no correlation between the field dependence-independence scores and keyboarding ability.

Since students who were deemed to have basic keyboarding skills had speed and accuracy scores of greater than 20 WPM the population was divided into two groups, those with basic keyboarding skills ( KEY ) and those without basic keyboarding skills ( NOKEY ). The comparison of the FDI means for each group is given in table 15. The results indicate students with basic keyboarding ability had lower FDI scores than students who had poor keyboarding abilities. The  $F ( 1,55 )$  ratio of 5.08 indicates the difference is significant at  $p < 0.05$ . Hypothesis #2.1 must be rejected.

**TABLE 15**  
**KEYBOARDING GROUP ANOVA**  
**FOR FIELD DEPENDENCE-INDEPENDENCE**

	KEY	NOKEY		
FDI MEANS	8.0	11.0		
N	33	24		

SOURCE OF VARIATION	DF	SS	MS	F
ROWS	1	128.6	128.6	5.08 *
RESIDUALS	55	1391.0	25.3	
TOTALS	56	1519.5		

\*  $p < 0.05$

A difference was observed in the field dependence-independence scores and basic keyboarding skills. Students who are field dependent are more likely to possess basic keyboarding skills.

**GRADES AND FIELD DEPENDENCE-INDEPENDENCE**

The relationship between field dependence-independence and higher scores in knowledge about and

ability with computers ( GRADES ) was examined to see if grades depended upon the field dependent-independent scores.

Table 16 gives a correlation coefficient between FDI and GRADES of  $r = 0.10$  and a coefficient of determination of  $r^2 = 0.01$ . This indicates 1 % of the variation in grades is due to the effect of field dependence-independence.

TABLE 16  
REGRESSION STATISTICS  
GRADES vs FIELD DEPENDENCE-INDEPENDENCE

	FDI	GRADES
MEANS	9.3	32.9

SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	39.4	39.4	0.61
RESIDUALS	57	3953.4	44.8	
TOTALS	58	3992.8		

COEFFICIENT OF CORRELATION	$r = 0.10$
COEFFICIENT OF DETERMINATION	$r^2 = 0.01$

Since  $F(1,57) = 0.61$  the relationship is not significant. Since no significant relationships were found hypothesis #3 must be accepted. There was no correlation between the field dependence-independence scores and grades.

Since the effects of field dependence-independence are most apparent for the extreme scores an ANOVA was performed to compare the means of the top and bottom thirds of the FDI scores with respect to grades. Since  $N = 59$  for the FDI and GRADE scores, the bottom third (  $FDI < 7$  ) resulted in a  $N = 21$  and the top third (  $FDI > 12$  ) resulted in  $N = 22$  because of tied scores.

Table 17 shows the means of the high FDI group are larger than the low FDI group in the predicted direction. However, since  $F(1,41) = 1.63$  variations in means found between field dependence-independence and grades was not significant.

TABLE 17  
**EXTREME GROUP ANOVA**  
**FIELD DEPENDENCE-INDEPENDENCE vs GRADES**

	FDI < 7	FDI > 12			
GRADE MEANS	32.4	35.6			
N	21	22			
SOURCE OF VARIATION	DF	SS	MS	F	
ROWS	1	106.6	106.6	1.63	
RESIDUALS	41	2680.8	65.4		
TOTALS	42	2787.4			

Since no significant relationships between field dependence-independence and grades were found hypothesis #3.1 is accepted. There was no difference in grades between the field dependent and field independent students.

**ATTITUDES AND KEYBOARDING SKILLS**

The relationship between basic keyboarding skills and attitudes was examined to see if attitudes were related to the keyboard scores.

**TABLE 18**

**REGRESSION STATISTICS**

**ATTITUDE vs KEYBOARD**

	KEY	ATTITUDE		
MEANS	18	123.9		
SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	861.8	861.8	2.23
RESIDUALS	56	21594.8	385.62	
TOTALS	57	22456.6		
COEFFICIENT OF CORRELATION		$r = 0.2$		
COEFFICIENT OF DETERMINATION		$r^2 = 0.04$		

Table 18 shows a correlation coefficient for KEYBOARDS and ATTITUDE of  $r = 0.20$  and a coefficient of determination of  $r^2 = 0.04$ . This means the variation in attitude due to the effect of keyboarding skill is 4

%. Since  $F ( 1, 56 ) = 2.23$  the relationship is not significant.

TABLE 19  
REGRESSION STATISTICS  
ANXIETY vs KEYBOARD

	KEY	ANXIETY		
MEANS	18	31.0		

SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	12.7	12.7	0.38
RESIDUALS	56	1843.8	32.93	
TOTALS	57	1856.5		

COEFFICIENT OF CORRELATION	$r = 0.10$
COEFFICIENT OF DETERMINATION	$r^2 = 0.01$

The test for attitude consists of the four subscale of anxiety, confidence, likeability, and usefulness. Table 19 shows the linear regression statistics with respect to keyboard skills and anxiety.

The coefficient of correlation for KEYBOARD and ANXIETY is  $r = 0.10$  and the coefficient of determination  $r^2 = 0.01$  indicates 1 % of the variation in anxiety was due to keyboard skill. The  $F ( 1, 56 )$  ratio of 0.38 means the relationship is not significant.

TABLE 20

REGRESSION STATISTICS  
KEYBOARD vs CONFIDENCE

	KEY	CONFIDENCE
MEANS	1.8	30.0

SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	108.4	108.4	2.89
RESIDUALS	56	2098.1	37.47	
TOTALS	57	2206.5		

COEFFICIENT OF CORRELATION	$r = 0.2$
COEFFICIENT OF DETERMINATION	$r^2 = 0.05$

Table 20 shows the linear regression statistics with respect to keyboard skills and confidence. The coefficient of correlation for KEYBOARD and CONFIDENCE is  $r = 0.20$  and the coefficient of determination  $r^2 = 0.05$  indicates 5 % of the variation in confidence was due to keyboard skill. The  $F ( 1, 56 )$  ratio of 2.89 means the relationship is not significant.

TABLE 21

REGRESSION STATISTICS  
KEYBOARD vs LIKEABILITY

	KEY	ANXIETY
MEANS	1.8	29.8

SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	47.6	47.6	1.31
RESIDUALS	56	2032.8	36.3	
TOTALS	57	2080.4		

COEFFICIENT OF CORRELATION	$r = 0.20$
COEFFICIENT OF DETERMINATION	$r^2 = 0.04$

Table 21 shows the linear regression statistics with respect to keyboard skills and likeability. The coefficient of correlation for KEYBOARD and LIKEABILITY is  $r = 0.20$  and the coefficient of determination  $r^2 = 0.04$  indicates 4 % of the variation in anxiety was due to keyboard skill. The  $F ( 1, 56 )$  ratio of 1.31 means the relationship is not significant.

TABLE 22

REGRESSION STATISTICS

KEYBOARD vs USEFULNESS

	KEY	USEFULNESS		
MEANS	1.8	33.2		
SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	72.0	72.0	3.93
RESIDUALS	56	1026.6	18.3	
TOTALS	57	1098.6		
COEFFICIENT OF CORRELATION	$r = 0.30$			
COEFFICIENT OF DETERMINATION	$r^2 = 0.09$			

Table 22 shows the linear regression statistics with respect to field keyboard skills and usefulness. The coefficient of correlation for KEYBOARD and USEFULNESS is  $r = 0.30$  and the coefficient of determination  $r^2 = 0.09$  indicates 9 % of the variation in usefulness was due to keyboard skill. The F ( 1, 56 ) ratio of 3.93 means the relationship is not significant.

Table 23 indicates no relationships were found between keyboard and attitudes including the subscales of anxiety, confidence, likeability, and usefulness.

TABLE 23

SUMMARY

KEYBOARD and ATTITUDES

<u>TEST</u>	<u>r</u>	<u>r<sup>2</sup></u>	<u>F</u>
ATTITUDE	0.20	0.04	2.23
ANXIETY	0.10	0.01	0.38
CONFIDENCE	0.20	0.04	2.89
LIKEABILITY	0.20	0.04	1.31
USEFULNESS	0.30	0.09	3.93

Since no significant correlation was shown between keyboarding skills and attitudes, hypothesis 4 must be accepted.

Since basic keyboarding ability was defined as the ability to achieve 20 WPM or more the mean scores and ANOVA statistics with respect to keyboarding and attitudes for the basic keyboarding ( KEY > 20 ) and the unskilled keyboarding ( KEY < 20 ) groups was calculated.

TABLE 24

GROUP ANOVA

KEYBOARD vs ATTITUDE

	KEY > 20	KEY < 20		
ATTITUDE MEANS	129.3	123.4		
N	32	26		
<hr/>				
SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	500.8	500.8	1.28
RESIDUALS	56	21955.8	392.1	
TOTALS	57	22456.6		

Table 24 shows the means of the attitude scores for the unskilled group were lower than the means of the skilled group as predicted. However the  $F(1,56)$  ratio of 1.28 indicates the variation is not significant. The test for attitude consists of the four subscale of anxiety, confidence, likeability, and usefulness. The relationship between basic keyboarding skills and anxiety was examined to see if anxiety was related to the keyboard scores.

TABLE 25

GROUP ANOVA

KEYBOARD vs ANXIETY

	KEY > 20	KEY < 20		
ANXIETY MEANS	31.6	31.3		
N	32	26		
<hr/>				
SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	1.1	1.1	0.03
RESIDUALS	56	1855.4	33.1	
TOTALS	57	1856.5		

Table 25 shows the mean scores and ANOVA

statistics with respect to keyboarding and anxiety for the basic keyboarding ( KEY > 20 ) and the unskilled keyboarding ( KEY < 20 ) groups. The means of the anxiety scores for the unskilled group were approximately the same as the means of the basic group. The F ( 1,56 ) ratio of 0.03 indicates the variation is not significant.

The relationship between basic keyboarding skills and confidence was examined to see if confidence was related to the keyboard scores. Table 26 shows the mean scores and ANOVA statistics with respect to keyboarding and confidence for the basic keyboarding ( KEY > 20 ) and the unskilled keyboarding ( KEY < 20 ) groups. The means of the confidence scores for the unskilled group were lower than the means of the basic group, as the hypothesis suggests. However, the F ( 1,56 ) ratio of 1.38 indicates the variation is not significant.

TABLE 26  
GROUP ANOVA  
KEYBOARD vs CONFIDENCE

	KEY > 20	KEY < 20		
CONFIDENCE MEANS	29.7	31.6		
N	32	26		
<hr/>				
SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	52.9	52.9	1.38
RESIDUALS	56	2153.6		
TOTALS	57	22.6.5		

The relationship between basic keyboarding skills and likeability was examined to see if likeability was related to the keyboard scores. Table 27 shows the mean scores and ANOVA statistics with respect to keyboarding and likeability for the basic keyboarding ( KEY > 20 ) and the unskilled keyboarding ( KEY < 20 ) groups. The means of the likeability scores for the unskilled group were less than the means of the basic group as the hypothesis predicts. The F ( 1,56 ) ratio of 2.39 indicates the variation is not

significant.

TABLE 27  
GROUP ANOVA  
KEYBOARD vs LIKEABILITY

	KEY > 20	KEY < 20		
LIKEABILITY MEANS	29.2	31.7		
N	32	26		
<hr/>				
SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	85.1	85.1	2.39
RESIDUALS	56	1995.4	35.6	
TOTALS	57	2080.4		

The relationship between basic keyboarding skills and usefulness was examined to see if usefulness was related to the keyboard scores. Table 28 shows the mean scores and ANOVA statistics with respect to keyboarding and usefulness for the basic keyboarding ( KEY > 20 ) and the unskilled keyboarding ( KEY < 20 ) groups. The means of the usefulness scores for the unskilled group were lower than the means of the basic group. The F ( 1,56 ) ratio of 1.12 indicates the

variation is not significant.

TABLE 28

GROUP ANOVA

KEYBOARD vs USEFULNESS

	KEY > 20	KEY < 20		
USEFULNESS MEANS	32.9	34.2		
N	32	26		

SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	23.0	23.0	1.12
RESIDUALS	56	1190.0	20.5	
TOTALS	57	1213.0		

Table 29 summarizes the F ratios for the variation between the means of the skill keyboarding group ( KEY > 20 ) and the unskilled keyboarding group ( KEY < 20 ) and attitudes including the subscales of anxiety, confidence, likeability, and usefulness. The variations in means found between keyboard skill and attitudes including the subscales of anxiety,

confidence, likeability, and usefulness were not significant.

**TABLE 29**

**SUMMARY**

**KEYBOARD GROUPS AND ATTITUDES**

<b><u>TEST</u></b>	KEY < 20	KEY > 20	<b><u>F</u></b>
	<b><u>MEAN</u></b>	<b><u>MEAN</u></b>	
ATTITUDE	123.4	129.3	1.28
ANXIETY	31.6	31.3	0.03
CONFIDENCE	29.7	31.6	1.38
LIKEABILITY	29.2	31.7	2.39
USEFULNESS	32.9	34.2	1.12

Since no significant relationships between keyboard skill and attitudes were found hypothesis #4.1 is accepted. There was no difference in attitudes about and learning of computers for the keyboarding and non-keyboarding students.

**KEYBOARDING AND GRADES**

The relationship between basic keyboarding skills and grades was examined to see if grades was related to the keyboard scores.

**TABLE 30**  
**REGRESSION STATISTICS**  
**KEYBOARD vs GRADES**

	KEY	GRADES		
MEANS	17	32.3		
SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	40.8	40.8	0.55
RESIDUALS	56	4470.3	74.5	
TOTALS	57	4511.1		
COEFFICIENT OF CORRELATION		$r = 0.10$		
COEFFICIENT OF DETERMINATION		$r^2 = 0.01$		

Table 30 shows a correlation coefficient for KEYBOARDS and GRADES of  $r = 0.10$  and a coefficient of

determination of  $r^2 = 0.01$ . This means the variation in grades due to the effect of keyboarding skill is 1%. Since  $F(1, 56) = 0.55$  the relationship is not significant and hypothesis #5 must be accepted. There was no correlation between keyboarding and grades.

Table 31 shows the mean scores and ANOVA statistics with respect to keyboarding and grades for the basic keyboarding (KEY > 20) and the unskilled keyboarding (KEY < 20) groups.

TABLE 31  
GROUP ANOVA  
KEYBOARD vs GRADES

	KEY > 20	KEY < 20		
GRADE MEANS	34.5	31.6		
N	36	26		
<hr/>				
SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	123.9	123.9	1.69
RESIDUALS	60	4387.2	73.1	
TOTALS	61	4511.0		

The means of the grade scores for the

unskilled group were lower than the means of the basic group as the hypothesis suggests. However, since  $F ( 1,60 ) = 1.69$  the variation is not significant.

The means of the keyboarding group are larger than the non-keyboarding group in the predicted direction. However, since  $F ( 1,60 ) = 1.69$  the variation in means found between keyboard groups and grades was not significant.

Since no significant relationships between keyboard groups and grades were found hypothesis #5.1 is accepted.

#### ATTITUDES AND GRADES

The relationship between attitudes and scores in knowledge about and ability with computers (GRADES) was examined to see if grades depended upon the attitude scores. Table 32 gives a correlation coefficient of  $r = 0.17$  and a coefficient of determination of  $r^2 = 0.03$ . This means a 3 % variation in grades was due to the effect of attitudes. Since  $F ( 1,58 ) = 1.73$  the relationship is not significant.

TABLE 32  
REGRESSION STATISTICS  
ATTITUDE vs GRADES

	ATTITUDE	GRADES		
MEANS	123.9	32.6		
<hr/>				
SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	121.6	121.6	1.73
RESIDUALS	58	4088.1	70.5	
TOTALS	59	4209.7		
<hr/>				
COEFFICIENT OF CORRELATION	r = 0.17			
COEFFICIENT OF DETERMINATION	r <sup>2</sup> = 0.03			
<hr/>				

The test for attitudes contains four subscales of anxiety, confidence, likeability, and usefulness. The relationship between anxiety and scores in knowledge about and ability with computers (GRADES) was examined to see if grades depended upon the anxiety scores.

Table 33 gives a correlation coefficient of  $r = 0.10$  and a coefficient of determination of  $r^2 = 0.01$ . This means 1% of the variation in grades was due to the effect of anxiety. Since  $F ( 1,58 ) = 0.35$  the relationship is not significant.

TABLE 33  
REGRESSION STATISTICS  
ANXIETY vs GRADES

	ANXIETY	GRADES		
MEANS	31.0	32.6		
SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	24.9	24.9	0.35
RESIDUALS	58	4184.8	72.2	
TOTALS	59	4209.7		
COEFFICIENT OF CORRELATION	$r = 0.10$			
COEFFICIENT OF DETERMINATION	$r^2 = 0.01$			

The relationship between confidence and scores in knowledge about and ability with computers (GRADES) was

examined to see if grades depended upon the confidence scores.

TABLE 34  
REGRESSION STATISTICS  
CONFIDENCE vs GRADES

	CONFIDENCE	GRADES		
MEANS	30.0	32.6		
SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	176.5	176.5	2.54
RESIDUALS	58	4033.1	69.5	
TOTALS	59	4209.6		
COEFFICIENT OF CORRELATION	$r = 0.2$			
COEFFICIENT OF DETERMINATION	$r^2 = 0.04$			

Table 34 gives a correlation coefficient of  $r = 0.20$  and a coefficient of determination of  $r^2 = 0.04$ . This means 4% of the variation in grades was due to the effect of confidence. Since  $F ( 1, 58 ) = 2.54$  the

relationship is not significant.

TABLE 35  
REGRESSION STATISTICS  
LIKEABILITY vs GRADES

	LIKEABILITY	GRADES
MEANS	29.7	32.6

SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	124.4	124.4	1.77
RESIDUALS	58	4085.3	70.4	
TOTALS	59	4209.7		

COEFFICIENT OF CORRELATION	$r = 0.17$
COEFFICIENT OF DETERMINATION	$r^2 = 0.03$

The relationship between likeability and scores in knowledge about and ability with computers (GRADES) was examined to see if grades depended upon the likeability scores. Table 35 gives a correlation coefficient of  $r = 0.17$  and a coefficient of determination of  $r^2 = 0.03$ .

This means a 3 % variation in grades was due to the effect of likeability. Since  $F ( 1,58 ) = 1.77$  the relationship is not significant.

**TABLE 36**  
**REGRESSION STATISTICS**  
**USEFULNESS vs GRADES**

	USEFULNESS		GRADES	
MEANS	33.2		33.3	
SOURCE OF VARIATION	DF	SS	MS	F
LINEAR REGRESSION	1	90.9	90.9	1.28
RESIDUALS	58	4118.8	71.0	
TOTALS	59	4209.7		
COEFFICIENT OF CORRELATION $r = 0.15$				
COEFFICIENT OF DETERMINATION $r^2 = 0.02$				

The relationship between usefulness and scores in knowledge about and ability with computers (GRADES) was examined to see if grades depended upon the usefulness scores. Table 36 gives a correlation coefficient of  $r$

= 0.15 and a coefficient of determination of  $r^2 = 0.02$ . This means 2 % variation in grades was due to the effect of usefulness. Since  $F ( 1,58 ) = 1.28$  the relationship is not significant. Table 37 summarizes the coefficients of correlation and determination and the F ratios for the relationships between attitudes, including the subscales, and grades.

**TABLE 37**  
**SUMMARY**  
**ATTITUDES AND GRADES**

<u>TEST</u>	<u>r</u>	<u>r<sup>2</sup></u>	<u>F</u>
ATTITUDE	0.17	0.03	1.73
ANXIETY	0.10	0.01	0.35
CONFIDENCE	0.20	0.04	2.54
LIKEABILITY	0.17	0.03	1.77
USEFULNESS	0.15	0.02	1.28

Table 37 indicates no relationships were found between attitudes and grades including the subscales of anxiety, confidence, likeability, and usefulness.

Since no significant relationship between attitudes, including the subscales, was found, hypothesis #6 was accepted. There was no correlation between attitudes about and learning of computers and grades.

#### **ATTITUDES vs FIELD DEPENDENCE-INDEPENDENCE/KEYBOARDING**

The relationship between field dependence-independence and keyboarding skill on attitudes was investigated to find if any significant interaction was present. Table 38 gives the attitude means for each group combination of field dependent (FD), field independent (FI), basic keyboarding skills (KEY) and no basic keyboarding skills (NOKEY).

To analyze the simple main effects we graph the KEY/NOKEY attitude scores for the FD level and FI level of scores. Figure 1 shows the line depicting the simple main effects are not parallel indicating an interaction may be present.

**TABLE 38**  
**TABLE OF MEANS**  
**FIELD DEPENDENCE-INDEPENDENCE AND KEYBOARD**  
**and**  
**ATTITUDES**

	KEY	NOKEY	MEANS
FD	133.9	122.3	128.0
FI	127.3	125.8	126.5
MEANS	130.6	124.0	

**FIGURE ONE**

ATTITUDES  
 FDI/KEY GROUPS

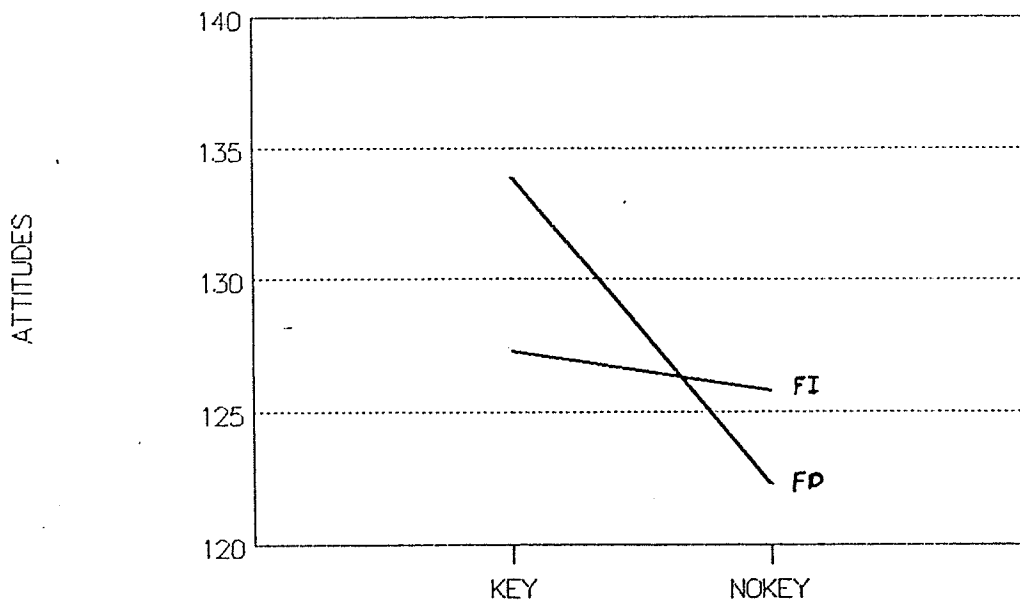


Table 39 summarizes the results of the statistical analysis of main effects and interaction.

**TABLE 39**  
**FACTORIAL ANALYSIS**  
**FIELD DEPENDENCE-INDEPENDENCE AND KEYBOARD**  
**and**  
**ATTITUDES**

SOURCE OF VARIATION	DF	SS	MS	F
KEYBOARD (A)	1	418.8	418.8	0.89
FDI (B)	1	20.3	20.3	0.04
KEYBOARD X FDI	1	257.1	257.1	0.55
S/AB	35	469.7		

Since no statistical relationship is shown hypothesis 7 must be accepted. There was no difference in attitudes about and learning of computers for the field dependent-keyboarding and field independent-

**GRADES vs FIELD DEPENDENCE-INDEPENDENCE/KEYBOARDING**

The relationship between field dependence-independence and keyboarding skill on grades was investigated to find if any significant interaction was present.

**TABLE 40**

**TABLE OF MEANS**

**FIELD DEPENDENCE-INDEPENDENCE AND KEYBOARDING  
and  
GRADES**

---

	<u>KEY</u>	<u>NOKEY</u>	<u>MEANS</u>
FD	37.2	27.2	32.2
FI	34.2	35.3	34.7
MEANS	35.7	31.2	

---

Table 40 gives the grade means for each group combination of field dependent (FD), field independent (FI), basic keyboarding skills (KEY) and no basic keyboarding skills (NOKEY).

To analyze the simple main effects we graph the KEY/NOKEY grades for the FD level and FI level of scores. Figure 2 shows the line depicting the simple main effects are not parallel indicating an interaction may be present.

**FIGURE 2**

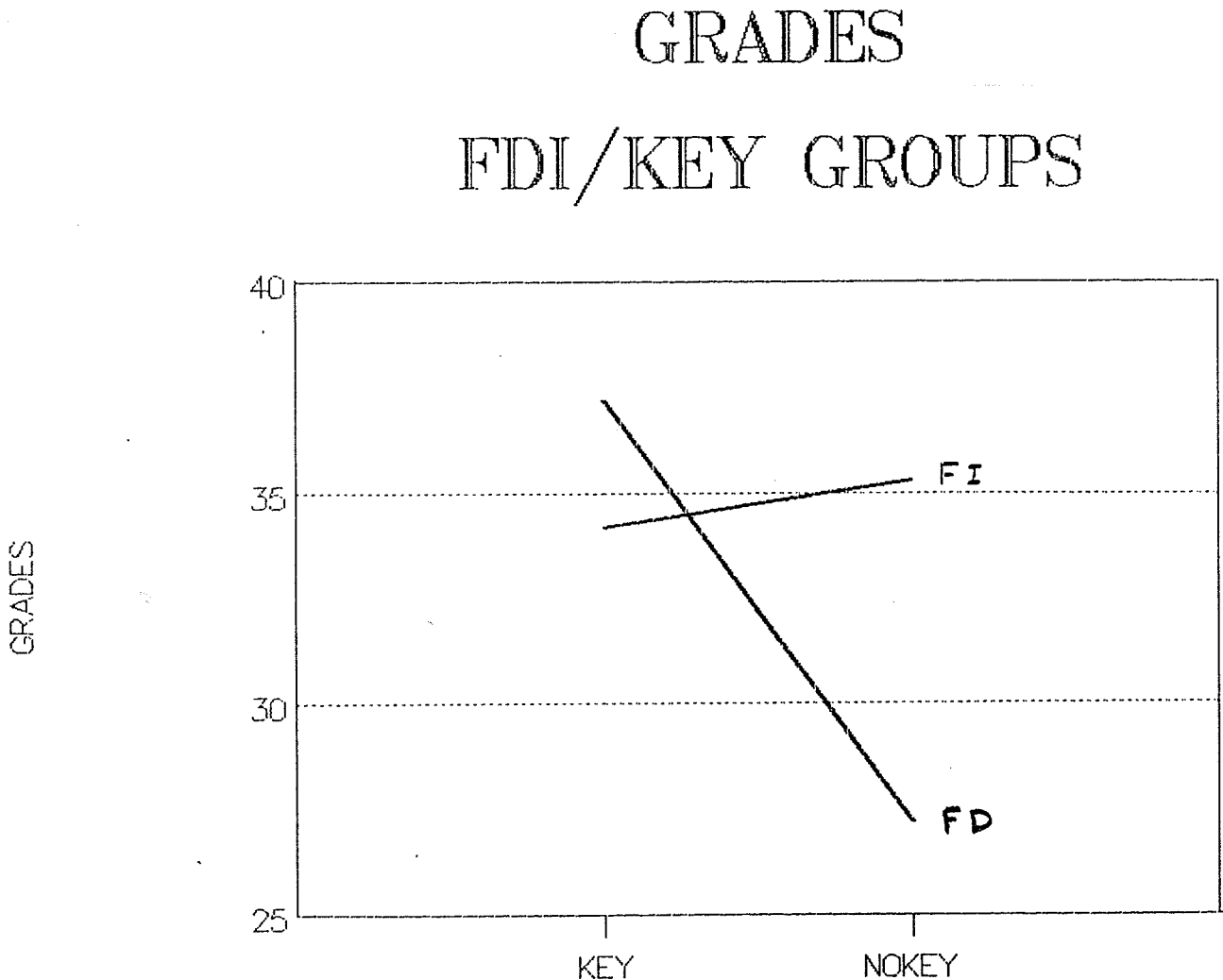


Table 41 summarizes the results of the statistical analysis of main effects and interaction.

**TABLE 41**  
**FACTORIAL ANALYSIS**  
**FIELD DEPENDENCE-INDEPENDENCE AND KEYBOARD**  
**and**  
**GRADES**

SOURCE OF VARIATION	DF	SS	MS	F
KEYBOARD (A)	1	291.6	291.6	5.40 *
FDI (B)	1	158.4	158.4	2.93
KEYBOARD X FDI	1	381.0	381.0	7.06**
S/AB	50	2699.3	54.0	

\*  $p < 0.05$

\*\*  $p < 0.01$

The factorial analysis indicates a significant interaction exists between field dependence-independence and keyboarding skill on grades. Since  $F(1, 50) = 7.06$ ,  $p < 0.01$ , we reject hypothesis #8.

Interaction effects of field dependence-independence and keyboarding on grades were observed. To analyze the interaction we inspect the simple main effects (grade means) in Table 40. Students in the field dependent keyboarding group have grade means (37.2) which are significantly higher than students in the field dependent non-keyboarding group (27.2). Students in the field independent keyboarding group had grade means (34.2) which were not different from the field independent non-keyboarding grade means (35.3).

#### SEX DIFFERENCES

The attitudes of female students was compared with the attitudes of male students to determine if the differences in means were significant.

**TABLE 42**  
**MALE/FEMALE GROUP ANOVA**  
**ATTITUDES**

	FEMALE	MALE		
ATTITUDE MEANS	122.1	129.5		
N	29	31		
<hr/>				
SOURCE OF VARIATION	DF	SS	MS	F
SEX	1	822.8	822.8	2.00
RESIDUALS	58	23903.2	412.1	
TOTALS	59	24725.9		

Table 42 shows the mean scores and ANOVA statistics with respect to male/female attitudes. The means of the attitude scores for the female group were lower than the means of the male attitudes. However the F (1, 53) ratio of 2.00 indicates the variation is not significant.

The anxiety scores of female students was compared with the anxiety scores of male students to determine if the differences in means were significant.

**TABLE 43**  
**MALE/FEMALE GROUP ANOVA**  
**ANXIETY**

	FEMALE	MALE			
ANXIETY MEANS	29.8	33.1			
N	29	31			
<hr/>					
SOURCE OF VARIATION	DF	SS	MS	F	
SEX	1	160.1	160.1	5.09*	
RESIDUALS	58	1824.8	31.5		
TOTALS	59	1984.9			

\* p < 0.05

Table 43 shows the mean scores and ANOVA statistics with respect to male/female anxiety scores. The means of the anxiety scores for the female group were lower (indicating higher anxiety) than the means of the male anxiety scores. The F ( 1, 58 ) ratio of 5.09 indicates the variation is significant at p < 0.05.

The confidence of female students was compared with the confidence of male students to determine if

the differences in means were significant.

**TABLE 44**  
**MALE/FEMALE GROUP ANOVA**  
**CONFIDENCE**

	FEMALE	MALE		
CONFIDENCE MEANS	28.2	32.6		
N	29	31		
SOURCE OF VARIATION	DF	SS	MS	F
SEX	1	286.3	286.3	8.33*
RESIDUALS	58	1992.7	34.4	
TOTALS	59	2279.0		

P < 0.05

Table 44 shows the mean scores and ANOVA statistics with respect to male/female confidence scores. The means of the confidence scores for the female group were lower than the means of the male confidence. The F ( 1,58 ) ratio of 8.33 indicates the variation is significant at p < 0.05.

The likeability scores of female students was compared with the likeability scores of male students

to determines if the differences in means were significant.

**TABLE 45**  
**MALE/FEMALE GROUP ANOVA**  
**LIKEABILITY**

	FEMALE	MALE		
LIKEABILITY MEANS	30.1	30.3		
N	29	31		
<hr/>				
SOURCE OF VARIATION	DF	SS	MS	F
SEX	1	0.3	0.3	0.01
RESIDUALS	58	2407.8	41.5	
TOTALS	54	2408.1		

Table 45 shows the mean scores and ANOVA statistics with respect to male/female likeability scores. The means of the likeability scores for the female group were marginally lower than the means of the male attitudes. However the F ( 1,58 ) ratio of 0.01 indicates the variation is not significant.

The usefulness scores of female students was compared with the usefulness scores of male students to

determine if the differences in means were significant.

**TABLE 46**  
**MALE/FEMALE GROUP ANOVA**  
**USEFULNESS**

	FEMALE	MALE		
USEFULNESS MEANS	33.9	33.5		
N	29	31		
<hr/>				
SOURCE OF VARIATION	DF	SS	MS	F
SEX	1	2.2	2.2	0.11
RESIDUALS	58	1195.5	20.6	
TOTALS	59	1197.7		

Table 46 shows the mean scores and ANOVA statistics with respect to male/female usefulness scores. The means of the usefulness scores for the female group were marginally higher than the means of the male usefulness scores. However the F ( 1,58 ) ratio of 0.11 indicates the variation is not significant.

Table 47 summarizes the F ratios for the variation between means for the male and female attitudes, including the subscales of anxiety, confidence, likeability, and usefulness. The variations in means found between male and female attitudes were not significant. However, it was found that the variations between male and female anxiety scores and the male and female confidence scores were significant at  $p < 0.05$ .

**TABLE 47**

**SUMMARY**

**MALE AND FEMALE ATTITUDES**

---

	FEMALE	MALE	
<u>TEST</u>	<u>MEAN</u>	<u>MEAN</u>	<u>F</u>
ATTITUDE	122.1	129.5	2.00
ANXIETY	29.8	33.1	5.09 *
CONFIDENCE	28.2	32.6	8.33 *
LIKEABILITY	30.1	30.3	0.01
USEFULNESS	33.9	33.5	0.11

---

\* -  $p < 0.05$

The results indicate hypothesis # 9 must be rejected. Female students demonstrated different

attitudes with respect to anxiety and confidence than male students.

The grades of female students were compared with the grades of male students to determine if the differences in the means were significant. Table 48 shows the mean scores and ANOVA statistics with respect to male/female grades. The means of the grades for the female group were slightly higher than the means of the male grades. However the  $F(1, 66)$  ratio of 0.09 indicates the variation is not significant.

**TABLE 48**

**MALE/FEMALE GROUP ANOVA**

**GRADES**

	FEMALE	MALE		
MEANS	33.1	32.5		
N	33	35		

SOURCE OF VARIATION	DF	SS	MS	F
ROWS	1	6.4	6.4	0.09
RESIDUALS	66	4858.4	73.6	
TOTALS	68	4864.8		

Table 48 indicates no significant difference exists between the means of male and female grades. Therefore, hypothesis #10 must be accepted. There was no difference in grades between male and female students.

The attitudes of foreign (visa) students was compared with the attitudes of regular status students to determine if the differences in the means were significant. Table 49 shows the mean scores and ANOVA statistics with respect to visa/regular status attitudes.

**TABLE 49**  
**VISA/REGULAR GROUP ANOVA**  
**ATTITUDES**

	VISA	REGULAR		
ATTITUDE MEANS	123.3	126.9		
N	20	39		
SOURCE OF VARIATION	DF	SS	MS	F
SEX	1	176.6	176.6	0.41
RESIDUALS	57	2432.1	426.7	
TOTALS	58	24496.1		

The means of the attitudes for the visa group were lower than the means of the regular status students. However the  $F ( 1,57 )$  ratio of 0.41 indicates the variation is not significant.

The anxiety scores of foreign (visa) students was compared with the anxiety scores of regular status students to determine if the differences in means were significant. Table 50 shows the mean scores and ANOVA statistics with respect to visa/regular anxiety scores.

**TABLE 50**  
**VISA/REGULAR GROUP ANOVA**  
**ANXIETY**

	VISA	REGULAR		
ANXIETY MEANS	30.0	32.3		
N	20	39		
SOURCE OF VARIATION	DF	SS	MS	F
STATUS	1	75.1	75.1	2.24
RESIDUALS	57	1909.6	33.5	
TOTALS	58	1984.7		

The means of the anxiety scores for the visa group were lower (indicating higher anxiety) than the means of the regular students anxiety scores. The F ( 1, 57 ) ratio of 2.24 indicates the variation is not significant.

The confidence scores of foreign (visa) students was compared with the confidence scores of regular status students to determine if the differences in means were significant.

**TABLE 51**  
**VISA/REGULAR GROUP ANOVA**  
**CONFIDENCE**

	VISA	REGULAR		
CONFIDENCE MEANS	30.0	30.6		
N	20	39		
SOURCE OF VARIATION	DF	SS	MS	F
STATUS	1	5.9	5.9	0.14
RESIDUALS	57	2432.2		
TOTALS	58	2348.1		

Table 51 shows the mean scores and ANOVA statistics with respect to visa/regular confidence scores. The means of the confidence scores for the visa group were slightly lower than the means of the regular students confidence scores. The  $F ( 1, 57 )$  ratio of 0.14 indicates the variation is not significant. The likeability scores of foreign (visa) students was compared with the likeability scores of regular status students to determine if the differences in means were significant.

TABLE 52  
VISA/REGULAR GROUP ANOVA  
LIKEABILITY

	VISA	REGULAR		
LIKEABILITY MEANS	30.2	30.1		
N	20	39		
SOURCE OF VARIATION	DF	SS	MS	F
STATUS	1	0.0	0.0	0.0
RESIDUALS	57	2374.1	41.7	
TOTALS	54	2374.1		

Table 52 shows the mean scores and ANOVA statistics with respect to visa/regular likeability scores. The means of the likeability scores for the visa group were effectively the same as the means of the regular students likeability scores. The F ( 1, 57 ) ratio of 0.0 indicates the no variation. The usefulness scores of foreign (visa) students was compared with the usefulness scores of regular status students to determine if the differences in means were significant.

**TABLE 53**  
**VISA/REGULAR GROUP ANOVA**  
**USEFULNESS**

	VISA	REGULAR		
USEFULNESS MEANS	33.2	33.9		
N	20	39		
SOURCE OF VARIATION	DF	SS	MS	F
STATUS	1	6.4	6.4	0.31
RESIDUALS	57	1172.8		
TOTALS	58	1179.2		

Table 53 shows the mean scores and ANOVA statistics with respect to visa/regular usefulness scores. The means of the usefulness scores for the visa group were marginally lower than the means of the regular students usefulness scores. The  $F ( 1, 57 )$  ratio of 0.31 indicates the variation is not significant. Table 54 summarizes the F ratios for the variation between means for the visa and regular status student attitudes, including the subscales of anxiety, confidence, likeability, and usefulness.

**TABLE 54**

**SUMMARY**

**VISA AND REGULAR STATUS ATTITUDES**

---

	VISA	REGULAR	
<u>TEST</u>	<u>MEAN</u>	<u>MEAN</u>	<u>F</u>
ATTITUDE	123.3	126.9	0.41
ANXIETY	30.0	32.3	2.24
CONFIDENCE	30.0	30.6	0.14
LIKEABILITY	30.2	30.1	0.00
USEFULNESS	33.2	33.9	0.31

---

Since table 54 indicates variations in means found

found between foriegn (visa) students attitudes and regular status students attitudes, including the subscales, were not significant hypothesis #11 must be accepted. There was no difference in attitudes between foreign and regular students.

The grades of foreign (visa) students was compared with the grades of regular status students to determines if the differences in the means were significant.

**TABLE 55**  
**VISA/REGULAR ANOVA**  
**GRADES**

	VISA	REGULAR		
GRADE MEANS	38.2	31.1		
N	25	39		
SOURCE OF VARIATION	DF	SS	MS	F
STATUS	1	612.3	612.3	9.50 **
RESIDUALS	62	4252.6	64.4	
TOTALS	63	4864.8		

\*\* - p < 0.01

Table 55 shows the mean scores and ANOVA statistics with respect to visa/regular grades. The means of the grades for the visa group were higher than the means of the regular students grades. The F ( 1, 62 ) ratio of 9.50 indicates the variation is significant at  $p < 0.1$ . A significant difference exists between the means of visa and regular status student grades at a  $p < 0.01$  level. Therefore, hypothesis #12 must be rejected. There was a difference in grades between foreign and regular status students.

## V. RESULTS, DISCUSSION, AND CONCLUSION

There was no relationship between field dependence-independence vs attitudes, and field dependence-independence vs grades, and no variation in means of the attitudes or grades was found between the extreme groups (top and bottom thirds of FDI scores).

No correlation was established between FDI and keyboarding. However, when students were divided into the keyboarding/poor keyboarding groups it was found the keyboarding group had significantly lower FDI scores with  $F(1,55) = 5.08$   $p < 0.05$ .

No relationship was established between keyboarding and attitudes although the correlation between keyboarding and the sub-scale of usefulness approached significance for the  $F(1,20)$  ratio of 3.93. No variation in means was found when students were divided into keyboarding/poor keyboarding groups.

The relationship between keyboarding and grades was not significant and the grades of the keyboarding group were not significantly higher than the poor keyboarding group.

No correlation existed between attitudes, including

the subscales of anxiety, confidence, likeability, and usefulness, when compared to grades.

The comparison of the attitude means for the combination of field dependence-independence and keyboarding found the means of the field dependent/no keyboarding group to be less than the other groups in the expected direction. However, the difference was not significant. It should be noted the small N's for the field dependent/poor keyboarding (  $N = 10$  ) and the field independent/keyboarding group (  $N = 6$  ) make these results tentative.

The comparison of the grade means for the combination of field dependence-independence and keyboarding found the means of the field dependent/no keyboarding group to be less than the other groups in the expected direction. The difference was significant between the field dependent/keyboarding and the field dependent/poor keyboarding groups with  $F ( 1,28 ) = 23.20, p < 0.01$ . Also the difference was significant between the field dependent/ poor keyboarding group and the field independent/poor keyboarding with  $F ( 1,31 ) = 9.72, p < 0.01$ .

The comparison of the grade means also indicated

the field dependent/no keyboarding group to be less than the field independent/keyboarding group in the expected direction. The F ratio ( 1,20 ) = 3.93 approached significance. It should be noted the small N for the field independent/keyboarding group ( N = 8 ) make this result tentative.

Male students did not have more positive attitudes than the female students although the means of the male scores were higher than the females the difference was not significant. However, investigation of the variation of scores of the subscales revealed females had more anxiety,  $F ( 1,58 ) = 5.09, p < 0.05$ , and less confidence,  $F ( 1,58 ) = 8.33, p < 0.05$  than males. No significant differences were found between male and females for the subscales of likeability and usefulness.

There were no significant differences between males and females with respect to grades.

There was no significant difference between visa and regular students in the comparison of attitudes, including the subscales of anxiety, confidence, likeability, and usefulness. The grades of the visa students were significantly higher,  $F ( 1,62 ) = 9.50$ ,

$p < 0.01$ , than the regular students.

### DISCUSSION

No correlation was found between attitudes and field dependence-independence, keyboarding, or grades. In general students had positive attitudes towards computers and recognized their usefulness in modern society. Analysis of extreme groups of field dependence-independence again showed no significant results although the mean scores most often varied in the predicted direction.

Sex differences were observed for the anxiety and confidence subscales of the attitude test. Females had more anxiety and less confidence with computers than males. These findings are consistent with other studies in the areas of mathematics and science as predicted. If females demonstrate more anxiety and less confidence than males, we may need to find ways to encourage girls to pursue areas of personal interest which do not meet traditional expectations. Seminars and special events could be used to promote positive role models in the science and mathematics fields, and

female students should be provided with opportunities to interact with other female students who possess similar interests and aptitudes. Also, early introduction of computers, and experience with computers, have been shown to lead to more positive attitudes (Loyd & Gressard, 1984). Early use, and experience with computers for girls, could be used to alleviate some of the differences in anxiety and confidence we observe now.

Cultural differences in the study showed foreign students performed significantly better in grades than regular status students. These results are not unexpected and reflect a great motivation on the part of foreign students to achieve in order to continue their studies.

The construct of field dependence-independence was expected to influence attitudes, keyboarding, and grades. An examination of the data indicates that no correlation was found between FDI and attitude, keyboarding, or grade scores. A further examination of the extreme groups of FDI scores yielded no better results. However, it was found that students who had basic keyboarding skills were significantly more field

dependent than students who are not field independent. This significance was in the opposite direction than predicted which may suggest the characteristics associated with field independence cannot be assumed to be the same characteristics which would lead to greater proficiency in keyboarding. Field dependent students prefer a more social orientation, and perhaps, the interaction with a keyboard provides a kind of involvement with the environment preferred by this cognitive style. As well, it is possible field dependents would prefer the structure provided by the keyboard as opposed to field independent persons who would prefer to impose their own structure on the external field. Further research is necessary in this area in light of the effects of keyboarding with grades for field dependent students.

Students who were field dependent, and had basic keyboarding skills, had significantly higher grades than students who were field independent, and had poor keyboarding skills. The rationale of the hypotheses suggests that field dependent students would be distracted by the keyboard, they would find the computer impersonal, face frustration with ambiguous

tasks, be sensitive toward negative feedback from computer software and therefore, show more negative feelings and lower ability with computers. The results, with respect to grades, support this hypothesis for field dependent students who have no keyboarding experience. Field dependent students who have basic keyboarding skills seem to have found a mediating mechanism which helps alleviate the distractions presented by the immediate environment while working with computers. This conjecture is also supported by the observation of no effects of keyboarding on grades for students who are field independent. It seems students who are field independent do not require an external mediator to improve their abilities with computers. Students who were field independent and show poor keyboarding skills were able to perform as well as students who were field independent with basic keyboarding abilities. Field independent students possess greater analytical skills and would not be influenced or distracted by the keyboard. Their preference for discovery and their ability to impose structure where no inherent structure exists would suggest, as this study shows, that

keyboarding ability will neither help nor hinder their abilities with computers.

### CONCLUSION

Further research is suggested with respect to individual differences in cognitive style and the role of keyboarding. Careful consideration should be given to introducing keyboarding to as many students, as early as possible. If we fail to provide the necessary keyboarding skills to field dependent students we effectively restrict their choices, and opportunities in the modern culture where keyboarding and computers assume more predominant roles throughout the workforce and modern society on a daily basis.

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APPENDIX A

SURVEY OF ATTITUDES TOWARD LEARNING ABOUT  
AND WORKING WITH COMPUTERS

Brenda H. Loyd and Clarice P. Gressard  
University of Virginia

The purpose of this survey is to gather information concerning people's attitudes toward learning about and working with computers. It should take about five minutes to complete this survey. All responses are kept confidential. Please return the survey to your instructor when you are finished.

Please fill in the information below

1. Age: \_\_\_\_\_ 2. Sex: male (✓) female ( )  
3. Date: \_\_\_\_\_  
4. Current Course enrollment: Data 202 ( )  
Computer Science 205 ( )  
Other ( )

COMPUTER ATTITUDE SCALE

Below are a series of statements. There are no correct answers to these statements. They are designed to permit you to indicate the extent to which you agree or disagree with the ideas expressed. Place a check mark in the parentheses under the label which is closest to your agreement or disagreement with the statements.

	Strongly Agree	Slightly Agree	Slightly Disagree	Strongly Disagree
1. Computers do not scare me at all.	( )	( )	( )	( )
2. I'm no good with computers.	( )	( )	( )	( )
3. I would like working with computers.	( )	( )	( )	( )
4. I will use computers many ways in my life.	( )	( )	( )	( )
5. Working with a computer would make me very nervous.	( )	( )	( )	( )

- |   |     |     |     |     |
|---|-----|-----|-----|-----|
| 6. Generally I would feel OK about trying a new problem on the computer.  | ( ) | ( ) | ( ) | ( ) |
| 7. The challenge of solving problems with computers does not appeal to me.  | ( ) | ( ) | ( ) | ( ) |
| 8. Learning about computers is a waste of time.   | ( ) | ( ) | ( ) | ( ) |
| 9. I do not feel threatened when others talk about computers.   | ( ) | ( ) | ( ) | ( ) |
| 0. I don't think I would do advanced computer work.   | ( ) | ( ) | ( ) | ( ) |
| 1. I think working with computers would be enjoyable and stimulating.   | ( ) | ( ) | ( ) | ( ) |
| 2. Learning about computers is worthwhile.  | ( ) | ( ) | ( ) | ( ) |
| 3. I feel aggressive and hostile toward computers.  | ( ) | ( ) | ( ) | ( ) |
| 4. I am sure I could do work with computers.  | ( ) | ( ) | ( ) | ( ) |
| 5. Figuring out computer problems does not appeal to me.  | ( ) | ( ) | ( ) | ( ) |
| 5. I'll need a firm mastery of computers for my future work.  | ( ) | ( ) | ( ) | ( ) |
| 7. It wouldn't bother me at all to take computer courses.   | ( ) | ( ) | ( ) | ( ) |
| 3. I'm not the type to do well with computers.  | ( ) | ( ) | ( ) | ( ) |
| 9. When there is a problem with a computer run that I can't immediately solve, I would stick with it until I have the answer. | ( ) | ( ) | ( ) | ( ) |
| 1. I expect to have little use for computers in my daily life.  | ( ) | ( ) | ( ) | ( ) |
| 6. Computers make me feel uncomfortable.  | ( ) | ( ) | ( ) | ( ) |
| 4. I am sure I could learn a computer language.   | ( ) | ( ) | ( ) | ( ) |
| 8. I don't understand how some people can spend so much time working with computers and seem to enjoy it.                     | ( ) | ( ) | ( ) | ( ) |

- 24. I can't think of any way that I will use computers in my career. ( ) ( ) ( ) ( )
- 25. I would feel at ease in a computer class. ( ) ( ) ( ) ( )
- 26. I think using a computer would be very hard for me. ( ) ( ) ( ) ( )
- 27. Once I start to work with the computer, I would find it hard to stop. ( ) ( ) ( ) ( )
- 28. Knowing how to work with computers will increase my job possibilities. ( ) ( ) ( ) ( )
- 29. I get a sinking feeling when I think of trying to use a computer. ( ) ( ) ( ) ( )
- 30. I could get good grades in computer courses. ( ) ( ) ( ) ( )
- 31. I will do as little work with computers as possible. ( ) ( ) ( ) ( )
- 32. Anything that a computer can be used for, I can do just as well some other way. ( ) ( ) ( ) ( )
- 33. I would feel comfortable working with a computer. ( ) ( ) ( ) ( )
- 34. I do not think I could handle a computer course. ( ) ( ) ( ) ( )
- 35. If a problem is left unsolved in a computer class, I would continue to think about it afterward. ( ) ( ) ( ) ( )
- 36. It is important to me to do well in computer classes. ( ) ( ) ( ) ( )
- 37. Computers make me feel uneasy and confused. ( ) ( ) ( ) ( )
- 38. I have a lot of self-confidence when it comes to working with computers. ( ) ( ) ( ) ( )
- 39. I do not enjoy talking with others about computers. ( ) ( ) ( ) ( )
- 40. Working with computers will not be important to me in my life's work. ( ) ( ) ( ) ( )

APPENDIX B

SAMPLE KEYBOARD TEST

TIME DRILLS

		GWAM	
DRILL 1 (NAME)	(TIME)	30 s	60 s
Lil has held all the staff at a set shift. It is.		20	10
I said it is ideal at Jade Lake. Lilie has a jet.		40	20
(10 words first line, 10 words second line, 20 words total)			
DRILL 2 (NAME)	(TIME)	30 s	60 s
Kal set the test last. Jake Sill has least sales.		20	10
Hide it as it is data. Di is at last at the site.		40	20
(10 words first line, 10 words second line, 20 words total)			
DRILL #3		GWAM	
Taste the old food to see if it is fit to eat. He		20	10
used the desk less after he sold it to Flora.		38	19
(10 words first line, 9 words second line, 19 words total)			
DRILL 4 (NAME)	(TIME)	30 s	60 s
He or she did it to us for her. Ask if Ted is due		20	10
at the office. He is here,			30 15
(10 words first line, 5 words second line, 15 words total)			

## DRILL 7 (NAME) (TIME)

Zaza told Heidie she could use the office address.  
Is it located at Suite 39 at 789 Jake Street East?  
Flo could tell a joke; Dia could tell a tall tale.  
Check that data first for the costs she asked for.

(10 words each line, 2 minutes to finish for 20 GWAM)

## EXTENDED TYPING

Each day everyone of us is faced with the problem of getting things done on a limited amount of time. The most effective business people are the ones who best solve this problem.

If we learn how to assume responsibility, we can enhance our value within the organization. As a result, our jobs become more of a challenge and more rewarding.

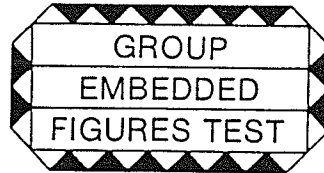
Did you realize that many errors in keying are the result of body positioning at the machine? If you find you are making frequent errors on the first-row keys, it may be because you are sitting too close to the machine. This makes the elbows stick out and moves the hands out of alignment.

Also, if you discover that you are making frequent errors in the third-row keys, it could be that you are sitting too far away from the machine. You should position yourself so that your arms fall loosely to the sides of your body. Place the chair so that there is only a handspan of space between body and machine.

Sometimes you will find errors are clustered on the right or the left side of the keyboard. It may be that you have forgotten to centre your body opposite the J key. If your keyboard is unattached, it may have shifted to the right or the left. Also, if you hold your elbows tight against your body rather than loosely, your hands will be out of alignment.

APPENDIX C

**GEFT SAMPLE**



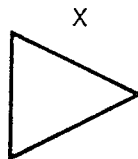
By Philip K. Oltman, Evelyn Raskin, & Herman A. Witkin

Name \_\_\_\_\_ Sex \_\_\_\_\_

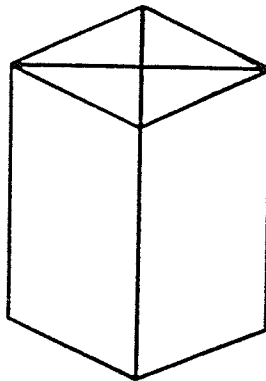
Today's date \_\_\_\_\_ Birth date \_\_\_\_\_

INSTRUCTIONS: This is a test of your ability to find a simple form when it is hidden within a complex pattern.

Here is a simple form which we have labeled "X":



This simple form, named "X", is hidden within the more complex figure below:



Try to find the simple form in the complex figure and trace it *in pencil* directly over the lines of the complex figure. It is the SAME SIZE, in the SAME PROPORTIONS, and FACES IN THE SAME DIRECTION within the complex figure as when it appeared alone.

APPENDIX D

SOFTWARE VALIDATION

Output given is from Lotus 1-2-3 program written by the author for linear regression and ANOVA comparison for sample data from Keppel & Saufley (1980).

ANOVA

KEPPEL & SAUFLEY (1980)  
PG 66-80

X	Y	X*2	Y*2
5.00	13.00	25.00	169.00
3.00	9.00	9.00	81.00
4.00	10.00	16.00	100.00
4.00	8.00	16.00	64.00
6.00	9.00	36.00	81.00
1.00	12.00	1.00	144.00
3.00	8.00	9.00	64.00
4.00	12.00	16.00	144.00
6.00	10.00	36.00	100.00
4.00	9.00	16.00	81.00
40.00	100.00	180.00	1028.00

SOURCE	DF	SS	MS	F
BETWEEN	1.00	180.00	180.00	67.50
WITHIN	18.00	48.00	2.67	
	19.00			

LINEAR REGRESSION

KEPPEL & SAUFLEY (1980), PG 324-341	x HEIGHT	y WEIGHT	x*2	y*2	x*y
SSx	150.0	56.0	22500.0	3136.00	8400.0
1749.73	154.0	54.0	23716.0	2916.00	8316.0
	168.0	55.0	28224.0	3025.00	9240.0
SSy	162.0	58.0	26244.0	3364.00	9396.0
1160.93	152.0	49.0	23104.0	2401.00	7448.0
	155.0	64.0	24025.0	4096.00	9920.0
SPxy	178.0	71.0	31684.0	5041.00	12638.0
	163.0	62.0	26569.0	3844.00	10106.0
1089.47	173.0	57.0	29929.0	3249.00	9861.0
	179.0	75.0	32041.0	5625.00	13425.0
SS lin reg	174.0	80.0	30276.0	6400.00	13920.0
	165.0	60.0	27225.0	3600.00	9900.0
678.35	182.0	75.0	33124.0	5625.00	13650.0
	183.0	70.0	33489.0	4900.00	12810.0
	160.0	60.0	25600.0	3600.00	9600.0
	2498.0	946.0	417750.0	60822.0	158630.0

MEANS	X	Y
	156.1	59.1

SOURCE	SS	df	MS	F
LIN REG	678.35	1.0	678.35	18.27
RESIDUAL	482.58	13.0	37.12	
TOTAL	1160.93	14.00		

R = 0.8                       $R^2 = 0.58$

APPENDIX E

LETTER OF CONSENT

Dear Participant:

The purpose of this study is to examine the relationship between a person's cognitive style, their keyboarding experience, and their attitudes towards learning about computers.

I am requesting you complete the three tests necessary for me to conduct the research:

1. Keyboarding - a short test of your accuracy and speed.
2. Attitudes - a survey of attitudes towards computers.
3. Embedded Figures Test - a simple selection of shapes and patterns from geometric figures which reflects your cognitive style.

Tests one and two are very short (5 - 10 min each) and will be administered in class now and at the end of the year. The embedded figures test will be given as time permits and is completed in 15 - 20 min. All test results are confidential and will only be used for the purposes of this research project. Students are able to withdraw from the project without penalty. Overall results of the research and any further information may be obtained by contacting:

Mr. D. Metz  
Rm 208 Wesley Hall  
University of Winnipeg  
786-9241

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CONSENT FORM

I \_\_\_\_\_ agree/disagree to participate in the above study.

SIGNED \_\_\_\_\_ DATE \_\_\_\_\_

Parents signature required if subject is under eighteen years old.