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Brain Dominance and Speed Achievement in Keyboarding

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BRAIN DOMINANCE

AND SPEED ACHIEVEMENT IN KEYBOARDING

(TITLE)

BY

Janet Clapp Hasten

THESIS

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ABSTRACT

Students who want to compete successfully in today's marketplace must be proficient in the skill of keyboarding. But not all students of keyboarding are able to achieve the high levels of proficiency in speed. This study investigates one possible explanation for this perplexing and frustrating occurrence--how brain dominance affects learning a motor skill such as keyboarding. The purpose of this study was to determine if there is a relationship between a student's brain dominance preference and his/her ability to achieve speed in keyboarding. The Human Information Processing Survey, which determines brain dominance preference, was administered to high school students enrolled in a beginning keyboarding class. The results of the study showed that those students who exhibit right brain tendencies in cognitive processing were able to attain a higher average speed on three-minute timed writings. The study also contains practical recommendations for including right brain activities when teaching beginning keyboarding.

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Chapter 1

Introduction

Technological progress has allowed the computer to invade almost every facet of our lives. Computers can be found in offices, schools, homes, hospitals, manufacturing plants, and retail stores. The laptop allows us to take our computers with us whether we are traveling to the darkest jungle or to the Arctic Circle. Computers are used to program space flights as well as routine air flights. Police cars have computers built in so that a license number can be checked while a pursuit is in progress. It is a fact that today's students will be using computers in their jobs tomorrow. How is data most often input into computers? The major input device in the world today is the computer keyboard.

Therefore, it is very important that students who want to compete successfully in the modern marketplace be proficient in the skill of touch typing, which is commonly called keyboarding. During observations of students in keyboarding classes, educators have often wondered why some students who have good technique seem to have such difficulty in gaining speed as the year progresses. The foundation for growth has been laid

because the students possess the basic knowledge of the keyboard and have developed good technique, but some students never seem to achieve proficient levels of speed. Why does this happen? While pondering this question, this researcher read about the theory of brain dominance and how it affects students' learning styles. Could this be the answer to this perplexing question?

Individuals whose left hemisphere is dominate are described as serial, analytic, rational, and verbal. People whose right hemisphere takes the lead are described as global, visual, spatial, and holistic. Many times when a student is having trouble in keyboarding, the teacher suggests more drill and practice. Maybe the instructor should try to present the material in another style in an effort to reach students who have different cerebral hemispheric preferences.

Purpose and Need for the Study

While studies (Kolb, 1984; McCarthy, et al., 1989) on the effects of brain dominance and learning styles have been conducted, few of them deal with the area of vocational education. The purpose of this research is to determine if there is a relationship between a

student's brain dominance preference and his/her ability to gain speed in keyboarding. Very little research has been done concerning the attainment of a fine motor skill, such as keyboarding, and brain dominance preferences. Achelpohl (1991) conducted research to determine if the ability to touch typewrite was affected by brain dominance. However, it must be emphasized that she did not perform a statistical analysis of her data to determine if significant differences did exist. The focus of this research project is different than Achelpohl's investigations. This study is relating speed achievement in keyboarding to brain dominance preferences, rather than focusing on whether students' hemispheric preferences had an effect on their ability to become touch typists. There is a need for further study in this area.

If a relationship does exist between brain dominance and skill in keyboarding, perhaps innovative strategies could be devised which would allow students with different methods of processing information to reach their full potential in keyboarding. It is important that those in the teaching profession remember that each student is an individual who has inherited a set of characteristics that make him/her

unique. Each student also has a preferred brain dominance preference that when targeted by the instructor will allow the student to maximize his/her abilities. It is vital that teachers remember these innate differences in students and adjust their lesson plans accordingly. Effective teachers should use a variety of approaches when presenting material so that the needs of students with varying cognitive processes will be addressed.

Statement of the Problem

The problem to be studied in this research is the relationship between a student's brain dominance preference and his/her speed achievement during a year-long (36-week) Keyboarding I class at the secondary level. More specifically, the purpose of the study was to determine if there was a relationship between:

1. The student's brain dominance preference as classified by the Human Information Processing Survey (Torrance, Taggart, and Taggart, 1984a) into categories of left, right, integrated, or mixed dominance; and

2. The student's ability to achieve an average speed of at least 40 gwam on 3-minute timed writings taken during the fourth nine-week quarter of the school year.

The following null hypothesis will be tested: No significant difference will be found between brain dominance preferences and the ability to attain an average speed of 40 gwam on 3-minute timed writings after completing a full year of Keyboarding I.

Theoretical Basis for the Study

The theoretical basis for this research is the brain dominance theory developed by Roger Sperry and his colleagues. Briefly stated, this theory asserts that the brain is divided into two hemispheres--left and right. Each hemisphere engages in a different mode of processing information (Sperry, 1973). Individuals have a preferred or dominant hemisphere for processing cognitive information. This study will attempt to determine if this dominance preference has any effect on the development of speed in a fine motor skill, specifically keyboarding.

Delimitations

Speed was the only factor used in this study to measure skill in keyboarding. During the fourth nine-week grading period, the students were given a 3-minute timed writing every other week for a course grade. There were five 3-minute timed writings given during

this quarter. Timings were given on four consecutive days. Each day the students were given two attempts to pass the timing. The highest speed score attained each week was used as the data for this study.

Accuracy was not included as a factor in this research. Speed and accuracy are two separate aspects of keyboarding. McLean (1978) contends that they should not be worked on simultaneously, but the development of each of these functions should be focused upon separately. Also, West (1983, p. 135) reports that "error measures have negligible reliability."

Limitations

The survey instrument, Human Information Processing Survey, (Torrance, et al., 1984a) was designed for use with adults, and the population involved in this study was secondary school students. It was noted that some of the vocabulary would be too difficult for high school students. An attempt was made to overcome this limitation by giving the students definitions for terms that they did not understand. When a student asked the meaning of a word or phrase, the instructor gave the definition orally so that the whole class heard the same response.

It is assumed that the students responded to the survey accurately and truthfully.

Definition of Terms

Left brain--"This individual strongly prefers to deal with problems in an active, verbal, and logical manner. There is a modest preference for the right hemisphere showing that the 'intuitive' strategy will be used only when absolutely necessary." (Torrance, Taggart and Taggart, 1984b, p. 3).

Right brain--"This individual strongly prefers to deal with problems in a receptive, spatial, and intuitive manner. There is a modest preference for the left hemisphere showing that the 'logical' strategy will be used only when absolutely necessary." (Torrance, et al., 1984b, p. 3).

Mixed brain--"This individual uses either a left dominant or a right dominant strategy depending on the situation. . . . The weak connection between the hemispheres suggests this person's tendency is to shift between left and right modes." (Torrance, et al, 1984b, p. 3).

Integrated brain--"This individual operates simultaneously in the left and right mode of processing without a clear preference for either. . . . However,

the strong connection between the hemispheres indicates that the real preference is for using both hemispheres together." (Torrance, et al, 1984b, p. 3).

Gross Words Per Minute (gwam)--Total words typed divided by total number of minutes keyed.

Kinesthetic ability--Being able to produce motion from moving joints, muscles, and tendons.

Teacher-paced dictation--"The teacher should . . . in the early lessons establish a uniform pace by calling the letters, other characters, and spaces for the students and encourage them to keep up with the pace of the dictation (Robinson, Hoggatt, Shank, Ownby Beaumont, Crawford, and Erickson, 1993).

Time-interval pacing--An activity where the student tries to finish a line of type in 30 seconds. The teacher calls time at the end of the 30 second interval. As students progress in speed, the time can be shortened to 20 seconds.

Timed Writing--A method of evaluation in keyboarding where students key straight-copy material for a specified length of time, such as 1, 2, 3, or 5 minutes. All timings used in this study were 3 minutes in length.

Chapter 2

Review of Literature

The review of literature dealing with the topic of brain dominance and the ability to gain speed in keyboarding will be divided into three parts. First, the opinions of several authorities on the best way to teach students touch typewriting will be cited. Second, literature will be introduced that traces the development of the theory of brain dominance in student's learning styles. Third, studies will be mentioned which have combined these two aspects in dealing with vocational education.

Learning to Touch Typewrite

There is some variation between authorities on the best method of teaching students to touch typewrite. Calhoun and Robinson (1992) emphasize that technique is the basis for building skill in keyboarding. Proper technique should be emphasized from the first day the students begin to learn this skill. Once proper technique is mastered, then the students should attempt to build speed and finally concentrate on accuracy. Calhoun and Robinson also state that eyes must be kept on the copy after the initial instructional period.

Premature emphasis on non-visual typing led to anxiety and stress for students (McLean, 1978). McLean states that teachers cannot expect students to make responses automatically until they have had time to learn the correct response. Educators need to remember that kinesthetic ability, like any skill, will vary among individuals, and time should be given to allow students to master a response before introducing new keys.

West (1983), who is a respected researcher in the field of business education especially in typewriting/keyboarding, felt that decreased speed and accuracy could result if students were prematurely forced to type by touch. His recommendations included the following points: (1) A casual attitude should be taken toward keyboarding watching. (2) Do not permit students to refer to textbook diagrams or wall charts. Allow students to look at the keyboard to locate a key but encourage them to look away before actually striking the key. (3) Place the focus on speed. When typing for more speed, the student will not have time to look at their hands.

Utilizing as many senses as possible is important when learning a new skill (Chiri, 1987). Chiri agrees

that students should be permitted to look at their fingers at "appropriate" times. Her definition of appropriate is when students are learning a new key and are trying to "memorize/automatize" the location of that key.

The techniques learned in the first six weeks of keyboarding form the foundation for the expert typist according to Douglas, Blanford, and Anderson (1973). These authors emphasize that the student who looks at his/her hands is forming a handicap that will hinder the development of fast and accurate typing skills. They recommend that students be allowed to watch their fingers as they make the reaches to a new key. This initial step of watching the fingers will give them the confidence they need to later type a drill while their eyes remain on the copy.

Nichols (1987) also emphasizes the importance of good technique and eyes on copy in order to build good keyboarding skills. She recommends that during initial instruction teachers vocalize the letters being typed so that the students are using two senses to learn the key. This technique is sometimes called teacher-paced dictation. The students are hearing the letter spoken; they are seeing it as they watch the copy in the book,

and they are reinforcing these senses by actually typing the letter.

One researcher (Lewis, 1991) stresses the mental aspects of keyboarding as well as the physical. While keyboarding may require manual dexterity, many of the skills necessary to be proficient at keyboarding are developed in the mind. Lewis states that students need mental training or mental rehearsing of keyboarding skills. He relates this to athletes who mentally practice their actions in their mind's eye before they try the activity physically or speakers who mentally visualize the room, audience, etc., before they give their speech. Lewis feels that these same kinds of activities can help students learn to keyboard. He suggests that instructors ask their students to mentally type an exercise making all the reaches and keystrokes in their minds. Students can do these kinds of exercises as homework also. They should be encouraged to mentally "type" any printed manner they see whether it is on a bulletin board, a TV advertisement, or a friend's T-shirt.

The authors of Century 21 Keyboarding, Formatting, and Document Processing advise that the "process of effective teaching has several important aspects:

demonstrating, observing, confirming, and correcting; and pacing and feedback" (Robinson, et al., 1993, p. 5:1). They suggest that the teacher demonstrate a technique to the whole class as well as to small groups or individual students. Instructors are encouraged to praise what is good and correct what is lacking. It is also wise to remember to 'praise in public and correct in private'. This textbook also suggests that teachers focus on one technique at a time rather than overwhelming the student with a whole series of observations at once. Teacher pacing is a good model when students are learning the keyboard. A uniform rhythm and speed for students to imitate is established during teacher pacing. After students have learned the keyboard, time-interval pacing will help the students develop continuity and reduce the interval between keystrokes.

Until recently most students learned to touch type on a typewriter. However, today many students are learning to key on computers not typewriters. While many traditional teaching methods are still valid, there are changes that need to be made in instructional methods to adjust to the use of computers for keyboarding. When teaching students to keyboard on the

computer, more time will be required for introducing keys. In addition to the 26 letter and 10 number keys found on the typewriter, the computer keyboard also has approximately 25-plus command keys that need to be taught (Frankeberger, 1990). Fingering for the numeric pad should also be introduced to the students although this could be done in a later unit of study. Frankeberger also notes that oral instruction is not as effective when students use computers. When students are seated behind the computer screen, they are ready to respond to the material they see visually and may tune out the instructions given by the teacher.

When students use computers for keyboarding, it is natural for them to want to correct mistakes that they make when keying. Swanson (1990) states that allowing students to correct errors in the beginning stages of learning the keyboard is a grave mistake. She feels that early error correction would hinder speed achievement as the student needs to be encouraged to move their fingers as rapidly as possible. She likens the beginning typist who pauses every few strokes to correct errors to a runner who is trying to build endurance for a race but stops every few strides to tie his/her shoes. Also echoing this concern about error

correction and speed achievement is Frankeberger (1990) who emphasizes that care be taken when choosing software for timed writings. One criteria that she considers very important is that the correction key cannot be used during timings.

Davison (1990) conducted a study that attempted to measure the difference between keying on typewriters and on computers. One group of students learned to key on typewriters and then were switched to computers after six weeks. The second group learned to key on computers and then switched to typewriters. She found that there was no difference in speed achievement on timed writings between the groups after eight weeks. However, students who used the computers were more accurate because they were allowed to correct errors. It should be noted that the typewriters used were electric and had no error correction devices. This could explain the higher accuracy in the computer group. Davison felt that the students using computers may have been able to attain higher speeds, but they were losing time when they stopped to correct errors.

Not all researchers agree on the issue of error correction during timed writings, however. Schmidt and White (1989) feel that changes and improvements in

equipment warrant changes in our thinking in the area of error correction. They recommend that errors be corrected as part of the keyboarding input process since this is the manner in which students will use their skills.

Brain Dominance Theory

When learning a psychomotor skill such as keyboarding, does the dominance of one hemisphere of the brain over the other have an effect on acquiring proficiency in this area? Much has been written about the theory of brain hemisphericity and its implications for education. As the following review will demonstrate, not all experts agree on the validity of this theory.

An extensive overview of the theory of brain dominance is provided by Rubenzer (1982). He states that interest in brain research began thousands of years ago when the Egyptians noted that language impairment developed after an injury to the left side of the head. Rubenzer further states that Goethe in 1796 was the first researcher to document studies in brain dominance when he noted the correlation between lesions in the left hemisphere of the brain and speech impairment.

Roger Wolcott Sperry, who won a Nobel Prize in the area of physiology and medicine in 1981, is generally credited with beginning the current research in the field of brain hemisphericity (Trevarthen, 1990). He started his work in the 1950s and continued it through the 1970s. He and his fellow researchers were working to reduce the seizures suffered by severe epileptic patients. They cut the corpus collasum which connects the two hemispheres of the brain. At first, the split-brain patients seemed normal, but follow-up studies showed some differences from normal functioning (Sperry, 1973). Verbal reactions would occur when the left hemisphere was stimulated. When the right hemisphere was stimulated, the patient would respond using the left hand. However, over time some of these separated functions were acquired by the ipsilateral (or same) hemisphere (Gazzaniga and Sperry, 1967). Sperry (1973) concluded that each hemisphere of the brain controlled certain functions, but more complete processing could be formed when the hemispheres worked together.

Gazzaniga (1967) studied how hemispheric separation affected mental capacities. He found that the left brain was superior to the right in verbal

language tasks. The right brain was capable of responding nonverbally, and it excelled in tasks involving visual construction. He found that each hemisphere processed information in its own way but shared the information with the other hemisphere.

In an occasional paper on instructional methodologies, McCarthy, Leflar, and Lieberman (1989, p. 27) offer the following characteristics for individuals demonstrating left brain dominance:

Rational
Responds to verbal instructions
Likes controlled systematic experiments
Prefers established, certain information
Objective
Looks at differences
Analyzes
Exhibits primary reliance on language in thinking and remembering
Prefers objective tests
Sees cause and effect
Controls feelings
Prefers hierarchial authority
Excels in propositional language
Sees design details
Digitalized
Formal laws
Superior in:
- Writing
- Digit and letter recognition
- Nameable shapes
- Word recognition and recall
- Phonics discriminations
- Serial, analytic difference detection

The characteristics listed below would identify an individual with right brain dominance (McCarthy, et al.

1989, p. 27):

- Intuitive
- Responds to demonstrated instructions
- Likes open-ended, random experiments
- Prefers elusive, uncertain information
- Subjective
- Looks at similarities
- Synthesizes
- Exhibits primary reliance on images in remembering
- Prefers essay tests
- Sees correspondences
- Is free with feelings
- Prefers collegial authority
- Excels in poetic, metaphoric language
- Sees overall design form
- Patterned
- Paradigms--shared theories
- Superior in:
  - Drawing
  - Verbal material when imagery is used to code
  - Nonverbal dimensions: light, hue, depth
  - Photographs, schematic figures
  - Tactile discriminations
  - Rapid, global, identity matching

Bogen (1975) theorized that individuals rely on their preferred method of processing information to a greater degree when they are learning a new task. Therefore, according to Bogen, brain dominance would play a significant role when accomplishing a task for the first time.

There seems to be some disagreement about which hemisphere controls motor functions. As shown in the previous table, tactile discrimination is listed as a function of the right hemisphere. Fadley and Hosler

(1979, p. 10) concur with this distinction as they attribute the "integration of complex motor-coordination and sensitivity to sensory into relating to movement" as a function of the right hemisphere. Bogen (1975) also defines the right hemisphere as more kinesthetic. However, Beaton (1986, p. 129) states "that in the execution of certain types of movement or sequences of movement the left hemisphere is implicated to a greater extent than the right hemisphere."

Although the abundance of the literature revealed support for the theory of brain hemisphericity, there are some researchers that fail to give it any credence whatsoever. An example of a member from this school of thought is Shook (1986). He writes, "My thesis regarding the two-brain theory...is easily stated: it isn't so" (p. 173). He feels that we are in danger of "building an educational edifice on a foundation of theoretical quicksand" (p. 177). He says he really doesn't doubt that we have two hemispheres in our brain, but he feels that too much emphasis is being given to changing teaching methods without much basis in fact. Shook appears to be in the minority as the literature overwhelmingly supports the theory that

brain dominance does make a difference in how a person learns.

Two instructional methods (Kolb, 1984; McCarthy, et al, 1989) using the theory of hemispheric dominance as an integral part of their methodology have generated much discussion and debate in the educational community. Kolb (1984) developed a system called Kolb's Model of Learning Styles. Type 1 were classified as imaginative learners, Type 2 as analytic learners, Type 3 as common sense learners, and Type 4 as dynamic learners. There was a tendency for Type 2 and 3 learners to be left brain dominant while Type 1 and 4 were right brain dominant.

McCarthy, et al. (1989) developed a learning strategy called the 4MAT system. Her instructional methods also recognize that the two hemispheres of the brain provide different functions. McCarthy believes that schools need to stress "whole brain" thinking. The 4MAT system is an attempt to help teachers develop techniques that will appeal to all four learning styles which she describes in her methodology.

Some researchers have found a relationship between brain dominance patterns and cultural affiliations. Taggart and Torrance (1984) feel that the traditional

Western style of teaching promotes left-hemisphere processing in students. The Western mindset is generally equated with left hemisphere dominance whereas those in the Eastern culture are more prone to show right hemisphere dominant traits. This feeling was also endorsed by Sperry (1973) who felt that current educational methods discriminated against the right hemisphere. A study done by Rhodes (1990) on an Indian reservation in Arizona compared the brain dominance and learning styles of the Navaho and Hopi Indian students, Navaho and Hopi Indian parents, Navaho workers in the school, and Anglo workers in the school. The results of his study (Rhodes, 1990, p. 35) showed that "the Anglos working on the reservation appear to be very close to the norms, while all populations of American Indians differ significantly from the norms either in brain dominance alone or in both dominance and learning style." This issue of culture and brain dominance patterns leads one to wonder if hemispheric preference is genetically based or is it a learned response from the type of training we receive as we go through school.

Several articles have been written that encourage educators to promote "whole brain" thinking among their

students. Although it may be natural for us to have a hemispheric preference when processing information, there are those who believe that "when the weaker side of the brain is stimulated and encouraged to cooperate with the stronger side, there is a greater increase in ability and effectiveness" (Sims, 1993, p. 249). Hermann (1981), who has conducted training programs for General Electric and other corporations, agrees that training can enable an individual to better utilize the non-preferred hemisphere for processing information. Training sessions should be designed so that activities using both hemispheres of the brain are included.

Brain Dominance and Vocational Education

In the past, the bulk of the research done in the area of brain hemisphericity has dealt with learning disabled students. However, now there is a trend to determine the impact of brain dominance on all students as well as employees.

The Sims (1993) article cited previously detailed how recognizing the brain dominance preferences of your employees would help when conducting training sessions for them. Government agencies and businesses are becoming interested in how brain dominance theory can enable their employees to fully utilize their innate

capabilities to be more productive on the job. The subject of hemispheric preference is starting to move from the theoretical to the practical realm.

The following studies have researched brain dominance theory and related it to vocational students. Petty and Holtzman (1991) conducted a study on learning styles and brain hemisphericity of technical institute students. They sampled 164 adult students and found that their brain dominance was significantly related to their learning styles. They concluded that instructors should vary their instructional style and provide opportunities for individualized instruction to meet the needs of all students.

Carthey (1993) conducted research which came to the same conclusions as the Petty and Holtzman study. He studied the relationship between learning styles and academic achievement in post-secondary business and accounting courses. His work showed that direct and inverse relationships did exist between these two factors, and he recommended that students in these courses be tested for hemispheric preferences so that instructors could adjust their teaching methods to better serve each student's needs.

Achelpohl (1991) conducted research to determine if the ability to touch typewrite was affected by brain dominance. She defined touch typing as "the ability to type with accuracy on a standard keyboard with proper technique, which includes keeping the eyes on the copy and not on the fingers" (Achelpohl, 1991, p. 8). Her definition of a non-touch typist was "a student who looks at their fingers five times or more during a three-minute timed writing" (Achelpohl, 1991, p. 8). The Human Information Processing Survey (Torrance, et al., 1984a) was used to determine the students' brain dominance preferences. Of the fifty students who were included in her study, 38 percent of the left-brained students were non-touch typists. Achelpohl concluded that left-brained males had the highest chance of not becoming touch typists. However, it must be emphasized that Achelpohl did not perform a statistical analysis of her data to determine if significant differences did exist.

More research needs to be conducted in the area of brain dominance and instructional methodologies for vocational students. The studies previously cited by Petty and Holtzman (1991), Carthey (1993), and Achelpohl (1991) have established a preliminary

foundation linking brain dominance and the acquisition of vocational skills. However, more investigation needs to be done to determine if these findings will hold up under further scrutiny. In her study Achelpohl (1991) used college students that had been taught to keyboard by three different instructors. Some of her findings may have been a result of different teaching methods and points of emphasis among the instructors rather than the influence of brain dominance preferences.

The focus of this research project is different than Achelpohl's investigations. This study is relating speed achievement in keyboarding to brain dominance preferences, whereas Achelpohl's study focused on whether students' hemispheric preferences had an effect on their ability to become touch typists.

Very few studies on brain dominance theory deal with the student acquiring a motor skill, such as keyboarding. This aspect of hemispheric preference deserves more investigation.

Framework for the Current Study

All of these previous studies were done with college students. The Petty and Holtzman study specifically used adult learners for their sample

population. It is the goal of this study to take a different approach than these earlier studies. This study will focus on students' speed achievement rather than on classifying them as touch typists or non-touch typists. It will also use high school students rather than college or adult learners.

If it could be determined that a relationship does exist between brain dominance and developing skill in keyboarding, this knowledge could have a major impact on the way keyboarding is taught in our schools. Learning strategies could be devised that would help students with different hemispheric preferences to develop keyboarding skill which is so necessary in our technological society.

Chapter 3

Research Methods and Procedures

Sample

The target population for this study is freshmen students at a high school in east central Illinois. The school houses Grades 9 through 12 with an approximate enrollment of 400 students. The selected sample was all students enrolled in the Keyboarding I classes for the 1994-95 school year. These students had no prior formal keyboarding instruction. At the end of the school year, 115 students were enrolled in Keyboarding I. Three students were absent on the day the testing instrument was administered. Two surveys were not usable because they were incomplete. Therefore, 110 students made up the total sample size.

At this high school the majority of students who take Keyboarding I are freshmen. The exact breakdown by class for those completing the testing instrument is: 1 senior, 3 juniors, 4 sophomores, and 102 freshmen. At this high school only 7 members of the 114 member freshmen class were not enrolled in Keyboarding I during the 1994-95 school year. Therefore, this is a highly representative sample

(89.5%) of the total population of the freshmen class at this school.

Permission was granted by the administration of the school district to perform this research study in their high school. A copy of the letter explaining the research and requesting permission to conduct the study, as well as a copy of the reply from the superintendent, is included in Appendix A.

Testing Instrument

The research edition of the Human Information Processing Survey (HIPS) was administered to the students participating in this study. The test authors were E. Paul Torrance, William Taggart, and Barbara Taggart. It is published by the Scholastic Testing Service, Inc. According to their description, the purpose of this test is to "assess processing preference--left, right, integrated, or mixed brain functioning."

The Human Information Processing Survey has received mixed reviews concerning its reliability and validity. Denny and Wolf (1980a) reported a Cronbach KR-21 reliability coefficient of .84. They also did two studies (1980ab) that aimed to test the concurrent validity of this instrument. In the first study, a

coefficient correlation of .50 was found for the right hemisphere scores and a correlation of -.25 was found for the left hemisphere scores (both were significant at the .01 level). In their first study the HIPS test scores were being compared to the scores on Baird's Preconscious Activity Scale. In their second study, the coefficient of correlation for the right hemisphere scores was .64, and correlation for the left hemisphere scores was -.61. The HIPS test was still being compared with the Preconscious Activity Scale.

The review of the Human Information Processing Survey that appeared in the Tenth Mental Measurements Handbook (Conoley and Kraemer, 1989) was not flattering. However, this researcher felt that the review of the test which was written by J. P. Das was biased. Das evidently did not believe in the theory of brain dominance as is illustrated from the following quote from his review (Das, 1989, p. 363): "Put simply, it is a myth to attribute separate and distinct styles of thinking to the left and the right hemispheres of the brain."

Other testing instruments were investigated for use in this study. However, some, such as the Hermann Brain Dominance Test (Kraemer and Conoley, 1992), were

too long or complex to be administered in the 42 minute class periods. Others, such as the Lateral Preference Schedule (Kraemer and Conoley, 1992), required that the students answer questions about their parents' lateral preferences. Yet another, the Luria-Nebraska Neuropsychological Battery: Forms I and II (Kraemer and Conoley, 1992), was designed to diagnose cognitive deficits or brain impairments.

The vocabulary would have been a problem in any of the testing instruments investigated. A concern has already mentioned about the ability of some high school students to understand a portion of the vocabulary contained in the Human Information Processing Survey. An effort was made to compensate for this gap in understanding by providing students with definitions for some of the more difficult terms. Therefore, it was the professional opinion of this researcher that the HIPS test was the best one available for the study being conducted.

The test consists of 40 questions with 3 different answers from which to choose. Students were told to read each item completely then pick the choice that best described them. They were to circle the corresponding letter on the response sheet. The

literature describing the test states that it takes approximately 20 to 30 minutes to administer. Some of the students involved in this study were finished in 12 minutes, and all were finished within 30 minutes.

Method Used to Teach Students to Keyboard

The students were taught to keyboard using the method recommended by the Southwestern Publishing Company in their textbook Century 21 Keyboarding, Formatting, and Document Processing, Fifth Edition (Robinson, et al., 1993). The equipment available for the Keyboarding I students at this school were Panasonic electronic typewriters (Models E700, E601, and E603).

All five Keyboarding I classes were taught by the researcher. Each keyboarding section was the same length--42 minutes each day--and each class met five days per week. The same lesson plans were presented to each of the five class sections. Therefore, the methods used were consistent for all students in the sample.

The home row of keys was presented first. Two days were spent on learning the home row. Thereafter, two new keys (one for the left hand and one for the right) were presented on three consecutive days. After

this three-day period, a day of review was scheduled. This procedure continued until all keys had been learned.

When the students first learned the keys, they were asked to locate the key on their typewriters. Then they were told which finger made the reach to that key. They were asked to look at their hands while the reach was being made. They watched their hands while they typed the new key five times. Next the students were asked to keep watching their hands and type the characters that the instructor called out. These characters would be a mix of ones that the students had previously learned along with the new ones for that day. The characters were dictated at a pace of one character per second. After the instructor had dictated a line in this manner with the students watching their fingers make the reaches, then the students were asked to keep their eyes on their book while the same line was repeated. The instructor dictated the line again as the students watched their book as they keyed.

Administering the Timed Writings

After the second nine-week quarter began, students were given timed writings for a grade. When giving

instructions prior to each graded timed writing, the instructor told the students to relax and to type with control.

During the fourth nine-week grading period, the students were given a 3-minute timed writing every other week for a course grade. There were five 3-minute timed writings given during this quarter. Timings were given on four consecutive days. Each day the students were given two attempts to pass the timing. The highest speed score attained each week was used as the data for this study. The timed writings used as data in this study were scored on a gross words per minute basis and had difficulty factors controlled on the following levels:

1. 80 percent high-frequency words,
2. 5.7 average word length,
3. 1.5 syllabic intensity.

Typing speeds achieved by the students were divided into groups using a standard of 40 gwam as a measure of speed achievement. The basis for this choice was a recommendation from the authors (Robinson, et al, 1993) of the South-Western text used to teach this keyboarding course. The authors suggest that 40-45 gwam be used as the grading scale for a B on the

first timed writing that the students took during the fourth nine-week grading period. Since the timings taken during the last nine-weeks formed the data for this study, this 40 gwam standard was used.

Administering the Testing Instrument

Students were given the Human Information Processing Survey to complete on May 16, 1995. They were told the day before that they would be taking a survey that would help this researcher complete the master's degree program at Eastern Illinois University. The instructor stressed that there were no right or wrong answers and that this "survey" would not affect their grade in Keyboarding I in any way. The instructor used the term "survey" on purpose so as not to cause "test anxiety" in the students. The instructor told them that their answers would vary because the instrument was designed to show the way that each student preferred to learn.

The survey instrument, Human Information Processing Survey, was designed for use with adults, and the population involved in this study was secondary school students. It was noted that some of the vocabulary would be too difficult for high school students. An attempt was made to overcome this

limitation by giving the students definitions for terms that they did not understand. When a student asked the meaning of a word or phrase, the instructor gave the definition orally so that the whole class heard the same response. When students asked what the following words meant, they were given these definitions:

Conform--Being like others

Nonconform--Being different than others

Impromptu--Made up on the spur of the moment; not rehearsed

Affective Interaction--Expressing emotions or feelings to someone

Intuitive--Gaining understanding through instincts or intuition

Sequential--One thing follows another in sequence, such as a, b, c, d, or 1, 2, 3, 4.

Spatial--Has to do with space or taking up space

Open Ended Assignment--An example would be a report where the student can choose the topic to write about and there is no set number of pages required.

Well-Structured Assignment--An example would be to write a report on Abraham Lincoln that was at

least three pages in length typed in double space.

The survey was administered at the beginning of the class period. When the students finished, they brought their response sheet to the instructor's desk. They were then given a study guide to help them prepare for the final exam in Keyboarding I. They could use the remainder of the class period to work on the study guide. This provided a quiet, yet constructive, activity for students who finished the testing instrument early. They could work independently on the study guide so that other students still completing the survey would not be distracted.

The testing instrument was administered at the end of the school year because the students would be more mature and may have acquired some of the vocabulary contained in the survey. This researcher also did not want to influence or alter a student's ability to learn keyboarding skills by making them nervous or excited about being in a research project.

Analysis of Data

The response sheets were hand scored by the researcher using the key in the Administrator's Manual of the test. The raw scores obtained were then

transferred to the profiles form where the standard score was determined. Ten percent of the hand scored response sheets and profile forms were randomly checked for accuracy by the academic advisor for this research study.

A standard score of 120 or over in a category indicates a hemisphere of preference. If no category has a score of 120 or above, then the individual is identified as having mixed brain preference. While 120 is the minimum score needed to indicate hemispheric preference, scores can be as high as 155 if the individual is extremely left or right brain dominant.

The hemispheric preference of each student in the study was one variable used for data analysis. The other variable used for analysis was the average speed attained on the five timed writings given during the fourth nine-week grading period. The timed writings were scored using the gross words a minute (gwam) method. Five strokes were counted per word.

The average speed obtained on these timed writings by each student was compared with his/her brain dominance preference to see if a relationship existed between cerebral hemispheric preference and speed achievement in keyboarding.

Data was entered into the SPSS statistical analysis computer program. Frequencies were established. To test the null hypothesis, a Chi square and a one-way ANOVA analyses were performed. A Tukey HSD test was run to determine between which groups, if any, the differences occurred. The significance level was set at .05.

Chapter 4

Findings

The purpose of this study was to investigate the relationship between a student's brain dominance preference and his/her ability to attain speed in keyboarding. In reporting the findings of the research, data pertaining to the respondents, such as brain dominance preference and the range of speed on timed writings, will be presented first. Then a statistical analysis of the data will be given and discussed.

Respondent Data

There were 110 students involved in this study. Table I shows their brain dominance preferences by category as determined by the Human Information Processing Survey. This testing instrument categorizes brain dominance as either left, right, integrated, or mixed.

TABLE I

BRAIN DOMINANCE PREFERENCES OF STUDENTS

Brain Dominance	Number of Students	%
Left	13	11.8
Right	27	24.5
Integrated	16	14.5
Mixed	54	49.1
Total	110	100.0

Of the 110 participants in the study, 13 students (11.8%) were left brain dominant. Right brain tendencies were shown by 27 students (24.5%). Sixteen students (14.5%) showed integrated brain preferences. Mixed brain dominance was shown by 54 students (49.1%).

Speed attained on the five timed writings given to the students during the fourth nine-week grading period were averaged to obtain the mean speed score. The range of the mean was from 19.6 gwam to 61.4 gwam. The textbook used in this keyboarding course, Century 21 Keyboarding, Formatting, and Document Processing (Robinson, et al., 1993), recommended that 40-45 gwam be used for a B grade for speed achievement at the

beginning of the fourth nine-weeks. Therefore, 40 gwam was established as the standard when determining whether a student had succeeded in achieving speed in the Keyboarding I course.

Table II shows frequencies and percentages of students who averaged at least 40 gwam on 3-minute timed writings and those who averaged less than 40 gwam on 3-minute timed writings taken during the fourth nine-week grading period.

TABLE II

FREQUENCY OF MEAN SCORES

Value	Frequency	Percent
<40 gwam	59	53.6
>40 gwam	51	46.4
Total	110	100.0

There were 59 students (53.6%) that did not achieve an average speed of at least 40 gwam on the five timed writings. Fifty-one students (46.4%) did attain an average of 40 gwam or more on the timings taken during the fourth nine-week grading period.

Statistical Analysis of Data

The statistical analysis was performed using the SPSS computer program. A one-way analysis of variance was run to determine if typing speed achievement was different for students with dissimilar brain dominance preferences (See Table III). The significance level was set a priori at the .05 level.

TABLE III

RESULTS OF ONE-WAY ANOVA TABLE

MEAN TYPING SPEED DIFFERENCES

BY BRAIN DOMINANCE PREFERENCE

Source	DF	F Probability
Between Groups	3	.0097*
Within Groups	106	

Brain Dominance Preference	Frequency	Mean Typing Speed	Standard Deviation
Left	13	38.1077	8.3676
Right	27	42.4444	7.3166
Integrated	16	37.9750	8.8287
Mixed	54	36.0296	7.7090

n = 110

* p <.05

The null hypothesis tested in this study is stated as follows:

> No significant difference will be found between brain dominance preferences and the ability to attain an average speed of 40 gwam on 3-minute timed writings after completing a full year of Keyboarding I.

The null hypothesis is rejected. There was a statistically significant difference ($.0097 < .05$) between typing speed achieved by students and their brain dominance preferences.

Table III shows that the mean typing speed achieved by left brain dominant students was 38 gwam. Students with right brain tendencies attained a mean typing speed of 42 gwam. Those students who exhibited integrated brain preferences achieved a mean typing speed of 38 gwam. The mean typing speed attained by mixed brain dominant students was 36 gwam.

The Tukey HSD test indicated between which groups significant differences occurred. Students who exhibited right brain tendencies and those who exhibited mixed brain tendencies measured statistically different on their mean typing speeds achieved.

A Chi-square test was performed to show the mean speeds achieved by students in each brain dominance preference category (See Table IV).

TABLE IV

CONTINGENCY TABLE

MEAN TYPING SPEED ACHIEVED

BY BRAIN DOMINANCE PREFERENCE

	BRAIN DOMINANCE PREFERENCES			
MEAN TYPING SPEED	**LEFT**	**RIGHT**	**INTE-GRATED**	**MIXED**
< 40 GWAM	53.8	29.6	43.8	68.5
> 40 GWAM	46.2	70.4	56.3	31.5

r = .00850*

n = 110

* p <.05

Slightly over half (53.8%) the left brain dominant students did not achieve an average speed of 40 gwam on the five timed writings taken during the fourth nine-

week grading period. Only 29.6% of students who showed right brain tendencies did not attain 40 gwam. Of the students exhibiting integrated brain preferences, 43.8% did not achieve an average speed of 40 gwam. Slightly over two thirds (68.5%) of the students who were mixed brain dominant did not attain an average speed of 40 gwam.

Almost half (46.2%) of those students identified as left brained dominant achieved an average speed of 40 gwam or more on timings taken during the fourth nine-week quarter. Nearly three-fourths (70.8%) of right brain dominant students achieved this goal. Of those students exhibiting integrated brain dominance, 56.3% achieved the 40 gwam standard. Only 31.5% of students showing mixed brain preferences reached an average speed of 40 gwam.

Chapter 5

Summary, Conclusions, and Recommendations

Summary

The purpose of this study was to determine if a relationship existed between brain dominance and speed achievement in keyboarding. The target population was all freshmen students at a high school in east central Illinois with an approximate enrollment of 400 students. The sample was 110 Keyboarding I students at a high school in east central Illinois. The majority (102) of those students were freshmen who had no prior formal instruction in keyboarding.

Each class section was taught using the same instructional methods. Five 3-minute timed writings were given during the fourth nine-week grading period. The mean scores on these five timed writings were used as an indication of each student's level of speed achievement in Keyboarding I.

The Human Information Processing Survey (Torrance, et al., 1984a) was administered to determine brain dominance preference. The researcher had a concern that the vocabulary contained in the testing instrument may be too difficult for some high school students. Therefore, the decision was made to administer the

survey during the last month of the school year in the hope that the students may have added new words to their vocabulary during the course of the year. The researcher also provided definitions for words appearing in the testing instrument that the students did not understand.

The mean scores of the timed writings and the students' brain dominance preferences were entered into the SPSS computer program for statistical analysis. Frequencies were established. To test the null hypothesis, a Chi square and a one-way ANOVA analyses were performed. A Tukey HSD test was run to determine between which groups, if any, the differences occurred. The significance level was set at .05. Based on the results of the statistical analyses, the null hypothesis was rejected.

Conclusions

Based on the findings in this study, it could be concluded that students in keyboarding courses should be tested for hemispheric preferences so that instructors could adjust their teaching methods to better serve each student's needs. There was a statistically significant difference ($.0097 < .05$) between typing speed achieved by students and their

brain dominance preferences. Therefore, the null hypothesis as stated below was rejected:

> No significant difference will be found between brain dominance preferences and the ability to attain an average speed of 40 gwam on 3-minute timed writings after completing a full year of Keyboarding I.

The null hypothesis was rejected based on the F probability (.0097) as determined by the one-way ANOVA and the Pearson Correlation Coefficient (.00850). Both of these measures show a statistically significant difference between brain dominance preferences and speed achievement in keyboarding. The Tukey test indicated that there was a significant difference between students with right brain dominance and those with mixed brain preferences. It can be concluded that right brain dominant students have the ability to achieve higher average speeds on timed writings than those who exhibit mixed brain preferences.

The contingency table (Table IV) shows that 70.4% of the students who were right brain dominant were able to achieve an average speed of 40 gwam or more on 3-minute timed writings taken during the fourth nine-week quarter of the school year. Only 29.6% of the students

who preferred the right hemisphere did not attain an average speed of at least 40 gwam. One could conclude from these findings that right brain dominance does aid in speed achievement in keyboarding. This conclusion confirms the findings of other researchers (McCarthy, et al, 1989; Bogen, 1975; Fadley and Hosler, 1979) as they indicated that individuals with right brain tendencies were superior in tactile and kinesthetic ability.

Also, according to McCarthy, et al. (1989), individuals who exhibit right brain preferences are superior in rapid, global identity matching. This trait would allow right brained students to visualize whole words at a glance instead of breaking them down into a sequence of letters while keyboarding. McLean (1978) described the process of keying letters in combinations as the ability to "type in chains". He asserts that speed is achieved in straight copy timings by developing the ability to key in chains that are produced as a single response rather than responding to individual letters.

In examining the results of the Chi square test as shown in Table IV, one finds that 68.5% of mixed brain dominant students did not achieve an average speed of

at least 40 gwam. Less than a third (31.5%) of those students who exhibited mixed brain preferences did attain this level of speed achievement.

Bogen (1975) asserts that individuals rely on their preferred mode of processing to a greater degree when they are learning a new task. Mixed brain dominant individuals are defined (Torrance, et al., 1984b) as those who use either the right or the left hemisphere. Depending upon the situation, these individuals will switch between hemispheric preference. Based on the findings in this study, it could be concluded that shifting between processing modes hinders speed achievement in keyboarding.

The Tukey test did not identify left brained or integrated brain dominant students to be statistically different from each other or from right brained or mixed brain individuals. Table IV shows that students exhibiting left brained tendencies were nearly equally divided between those who achieved an average speed of 40 gwam (46.2%) and those who did not attain this speed (53.8%). Students who showed integrated brain preferences also were divided near the midpoint; 56.3% of these students achieved an average speed of 40 gwam and 43.8% did not attain this goal. Based on the

findings in this study, it is unclear how left brain dominance and integrated brain dominance affect speed achievement in keyboarding.

Table I shows that 49.1% of the sample was identified as having mixed brain preferences. Table IV indicates that only 31.5% of these students achieved an average speed of at least 40 gwam on timed writings. Since such a large portion of the sample exhibited mixed brain tendencies and since these students had difficulty achieving speed in keyboarding, it could be concluded that activities should be included in the keyboarding course that would help these students acquire more proficiency in this skill. Since right brain dominant students exhibited the highest mean typing speed as shown in Table III, it could be concluded that activities which promote right hemispheric preferences would aid in speed achievement in keyboarding.

Recommendations for Classroom Instruction

What are the implications of this study for practical use? How will these findings help the business educator be more effective in teaching keyboarding? Almost three-fourths (70.4%) of the right brain dominant students achieved an average speed of 40

gwam or more on timed writings, and there was a statistically significant difference between typing speed achievement. Therefore, instructional methods should be used which promote right brain thinking when doing activities related to speed achievement.

Can brain dominance preferences of individuals be changed? The answer to this question is apparently both yes and no. Each individual is born with a unique genetic code. This code establishes our appearance, our talents, and our brain dominance preference. However, individuals do not live in a vacuum. The environment in which they live, grow, and learn has an effect on how talents, abilities, and brain dominance preferences develop. Based on the findings in this study, it could be very beneficial to provide an abundance of activities which promote right brained thinking in the keyboarding classroom so that by exercising this hemisphere speed achievement can be enhanced. Bogen (1975, p. 29) echoes this sentiment when he states, "It is likely that some anatomical asymmetry underlies the potential for hemisphere specialization, but it is also clear that the extent to which capacities are developed is dependent upon environmental exposure." Other researchers (Sims,

1993; Key, 1991) also embrace the theory that individuals can be taught to use methods or strategies that will enhance cognitive processing in their non-preferred hemisphere. What then are activities that will encourage or exercise right brained thinking in the keyboarding classroom?

Tactile/kinesthetic responses. McCarthy, et al. (1989) believes that students exhibiting right hemispheric preferences will be superior in tactile ability. Activities need to be provided in the keyboarding classroom that will allow non-right brained students the opportunity to develop adequate kinesthetic responses. The crucial time for the development of keyboarding skill is during the period when the keys are first learned. The following techniques will reinforce the development of the kinesthetic responses needed to learn the keyboard.

1. **Have students watch each finger as it makes the reach to a new key** (Chiri, 1987). Repeat this reach and watch the procedure a number of times (at least 5 or 6) until the kinesthetic response is recorded in memory. McCarthy, et al. (1989, p. 27) states that individuals who have a preference for the right hemisphere "respond to demonstrated instruction"

and "exhibit primary reliance on images in remembering". If students watch their fingers as they make the reach to a key, this provides a mental image that could help them remember the location of the key and the reach associated with it.

2. **Vocalize the letter being learned as the student makes the reach** (Nichols, 1987). The teacher can say the letter aloud but also encourage students to say the letter silently as they make the reach. Using multiple senses (sight, sound, and touch) increases the learning potential.

3. **Have students close their eyes and make the reach to a new key**. Students should say the letter silently to themselves as they make this reach with their eyes closed. By closing their eyes and blocking out other visual distractions, students can focus more on the "feel" of the reach. They can visualize in their mind the letter and the kinesthetic response necessary to type that letter. Lewis (1991) felt that this type of mental training would aid in acquiring keyboarding skill. This activity helps promote the mental image that aids right brained dominant individuals in memory retention.

4. **Encourage "word responses" rather than "letter responses".** Once the keyboard has been learned, have the students focus on words rather than individual letters in words. McLean (1978) stated that speed achievement on straight copy would be increased through this process of keying in chains. This more global (right-brained) approach is a key factor in achieving speed as the keyboarding course progresses.

Closure. Bogen (1975, p. 27) notes that individuals with right brain dominance excel at "part-whole relationships" which can also be described as "gestalt formation" or "closure". In her research, Key (1991) has also found that closure is a function of those with right brain preferences. The following activities could encourage this type of thinking in the keyboarding classroom.

1. **Show the class a finished product, such as a letter.** Use the overhead to exhibit what the letter is to look like when it is finished. Point out how the different letter parts are positioned in relation to one another. The instructor may want to place several examples of finished letters on display in the classroom for a week or two before the letter formatting lesson is first presented. By observing

these letters in class before the actual lesson is presented, the students will have already begun to mentally prepare for the formatting lesson even before it is introduced. Once again, this more global (right brained) view allows students to establish relationships between various parts and visualize how they relate to the whole.

2. **Use computer programs that have error analysis capabilities.** These programs have the ability to point to specific errors that are being made and thus causing mistakes in finished copy. When a problem area is identified by these programs, then a student can go back and concentrate on making the reach associated with the error correctly and relearn or reinforce the correct response. These programs could provide closure for students by associating the correct reach technique with error correction.

3. **Use anagrams or word search puzzles.** This activity promotes right brained thinking which is recommended by Key (1991), who is a secondary social studies instructor. For variety or as an introductory activity in the keyboarding classroom, students are given a list of anagrams (tac=cat, olin=lion, sked=desk) and then asked to key the words correctly.

The same procedure could be used with a word search puzzle. Ask the students to type all the words that they can find in the puzzle. Students may want to make up their own puzzles and should be encouraged to do so. If some of your students take this extra initiative, reward them by using their puzzles in class. These activities help students to form part-whole relationships which exercises right brain preferences.

4. **Make words from letters that students have learned to key**. This activity helps to add interest to the class when students are learning the keyboard as well as helping them develop closure. Make a list on the board or an overhead of all the letters that the students have learned to key so far. Then ask students to make up words using these letters. After they have been given time for the activity, ask students to share words that they have created. List some on the board and then have the class type these words.

5. **Compose sentences and paragraphs**. Once the keyboard has been learned, assign the students a topic and then ask them to write a paragraph containing at least five sentences about the topic or their feelings on the subject. A variety of topics could be used,

such as personality characteristics, careers, or famous quotes. These paragraphs could allow students to use their creativity, as well as improve their proofreading skills. These paragraphs could also provide closure because students could see how their keyboarding skills could be used to create a finished product that expresses their ideas and opinions.

It is important for any educator to remember to use a variety of approaches when teaching a lesson. Variety is important because it increases students' attention spans by breaking up the classroom routine. But most importantly, varying instructional methods allows educators to reach students with different learning styles based on different hemispheric preferences for processing information. Educators want to meet the needs of all students in their classrooms so that each student's abilities can be maximized. In keyboarding classes, however, it seems highly appropriate to provide an abundance of activities which promote right brained thinking so that by exercising this hemisphere speed achievement can be enhanced.

Recommendations for Further Study

Further study is needed in the following areas:

1. **This study could be replicated using computers instead of typewriters.** Computers may allow greater speed achievement among all categories of hemispheric preference. It would be interesting to see if right brain dominant students would consistently average higher speeds than other brain dominance categories when computers are used instead of typewriters.

2. **An experimental study could be conducted where right-brained activities were emphasized in one class of keyboarding students and a control group was taught in the more traditional manner.** The speed achievement of students in each class could be compared to see if the emphasis on right-brained activities had an effect on speed achievement.

3. **Develop a testing instrument for brain dominance preferences for use specifically with high school students.** The vocabulary in the testing instruments investigated by this researcher was somewhat difficult for some high school students. Also, many of the instruments available are for individuals with brain damage. Other instruments

tested personality or vocational interests rather than delineating between left and right hemispheric preferences.

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APPENDIX A

August 2, 1994

Mr. Russel Ross, Superintendent
Marshall Community Unit Schools
503 Pine Street
Marshall, IL 62441

Dear Mr. Ross:

As you know, I am currently working on my master's degree in business education. I have opted to take the thesis option in order to fulfill the requirements for my degree. The topic I have chosen to study is the relationship between brain dominance and the ability to achieve speed in keyboarding. I am requesting your permission to conduct the research for my study in my Keyboarding I classes at Marshall High School during the 1994-95 school year.

The techniques and teaching strategies used to teach my students to keyboard would not be affected during the study. The students would be asked to take a pencil and paper test to determine their brain dominance. The students' speed achievements on 3-minute timed writings taken during the fourth nine-week grading period would then be compared to their brain dominance preferences.

Dr. Cheryl Noll, associate professor in business education at Eastern Illinois University, is my academic advisor for my graduate work. She will be working closely with me during the course of my research project and plans to visit our school on several occasions throughout the year.

I have enclosed a copy of my research proposal for your reference. If you have any questions or concerns, please feel free to contact me (826-2126) or Dr. Noll (581-6933). Thank you for your consideration of my request.

Sincerely,

Janet Hasten

Marshall Community Unit Schools

217-826-5912
FAX 217-826-5170

DISTRICT # C-2 P.O. BOX 160 503 PINE STREET MARSHALL, ILLINOIS 62441

August 12, 1994

Mrs. Janet Hasten
1102 Ash Street
Marshall, IL. 62441

Dear Mrs. Hasten:

Thank you for sharing a copy of your research proposal with me. It sounds very interresting and I hope it proves to be a valuable experience for you. I'm happy to approve it and wish you the best of luck as you continue your master's degree work.

Sincerely,

Russel E. Ross
Superintendent of Schools

RER/pah

MARSHALL HIGH SCHOOL
806 N. Sixth Street
217-826-2395

MARSHALL JUNIOR HIGH SCHOOL
806 N. Sixth Street
217-826-2812

NORTH ELEMENTARY
1001 N. Sixth Street
217-826-2355

SOUTH ELEMENTARY
805 S. Sixth Street
217-826-5411