

NORTHERN ILLINOIS UNIVERSITY

The Critical Period for the Development of Tactile Sensitivity

A Thesis Submitted to the

University Honors Program

In Partial Fulfillment of the

Requirements of the Baccalaureate Degree

With University Honors

Department of Educational Psychology, Counseling, and Special Education

By

Wendy L. Roos

DeKalb, IL 60115

December 1996

Student's Name: William Joseph L...

Approved by: Dr. Gaylen Kapperman

Department of: Educational Psychology, Counseling, & Special Education

Date: -----j-19--1--1--1(-----

HONORS THESIS ABSTRACT
THESIS SUBMISSION FORM

AUTHOR: Wendy L. Roos

THESIS TITLE: The critical period for the development of tactile sensitivity

ADVISOR: Dr. Gaylen Kapperman

ADVISOR'S DEPT: EPCSE

DISCIPLINE: Special Education - Visually Impaired

PAGE LENGTH: 27

BIBLIOGRAPHY: page 10

PUBLISHED: Hope to have published in future

COPIES AVAILABLE: Hard copy

ABSTRACT

The focus of this project was to ascertain whether or not there is a critical period, or "Window of Opportunity," in the development of the sense of touch, and its impact on an individual's braille reading ability. A proposed solution to this problem is needed in order to evaluate the need for beginning braille instruction as early as possible or tactile sensitivity training in low vision readers with the potential to lose their sight later on in life. The theoretical aspects of tactile sensitivity are first discussed to provide a background into the exploration of this topic. The research study designed to probe this issue is then discussed, along with the research findings. Finally, conclusions from this study are analyzed, as well as their implications for future research.

TABLE OF CONTENTS

	<u>Page</u>
Introduction	I
Review of the Literature	I
<i>The Study</i>	
Method	4
Subjects	4
Materials	5
Procedures	6
Results	7
Factors Affecting the Results	7
Conclusions	8
Bibliography	10
<i>Appendix</i>	
Appendix A: Consent Form	11
Appendix B: Taction Questionnaire	12
Appendix C: Observation Form	13
Appendix D: Age Demographics of Subjects	14
Appendix E: Secondary Conditions/Disabilities of Subjects	15
Appendix F: Mean Age of Subjects' Beginning Braille Instruction	16
Other Assorted Data from Taction Questionnaire	17

The greatest sense in our body is our touch sense. It is probably the chief sense in the processes of sleeping and waking; it gives us our knowledge of depth or thickness and form; we feel, we love and hate, are touchy and are touched, through the touch corpuscles of our skin (Montagu, 1).

--J. Lionel Taylor, *The Stages of Human Life*, 1921, p. 157

The sense of touch may be among the body's greatest senses, yet even to the present day it remains illusive in terms of our understanding. The physical anatomy of touch can be detailed, but which parts truly create which sensation still remains to be fully discovered, as well as how it impacts our daily interactions with our environment. The need for understanding becomes even more crucial to those who depend upon this sensory channel more than any other, the population of the visually impaired. Recent research has focused on the maturation of other senses and skills, such as visual processing, acquisition of languages, music ability, and mathematical processing, and whether or not there is an optimum period in their development (Begley, 55-62). As the sense of touch is the key to literacy for the visually impaired, the need to explore the existence of an optimum period for the development of the sense of touch is of the utmost importance, as its implications on education may be far ranging..

REVIEW OF THE LITERATURE

Maria Montessori was the first to define a "sensitive period" in relation to human development.. Her pioneering work with children led her to believe that during these special periods the individual would fixate on the acquisition of a particular skill. Once development in this area was accomplished, the fixation would fade away (Standing, 19). She also noted that this "fixation" would especially be important for the special needs child and their "explosions into exploration" (Orem, 44).

How this "sensitive period" relates to the development of the visually child has always been a question. Early literature on blindness notes the visually impaired to have special abilities, particularly with their senses of hearing and touch, to compensate for their "loss." Yet, it might not be the case of compensation, but differences in neural development..

Perceptions of sensations, such as actual, are dependent upon the brain's interpretation of the messages sent by the neurons. The area of the brain that specializes in the sense of touch is the

somatosensory cortex of the parietal lobe, found in the right cerebral hemisphere (Tortora & Anagnostakos, 351). Sensations from any part of the body received through the skin travel up the spinal column through the spinothalamic pathway to this portion of the brain. This pathway differentiates for experiences of pain, pressure, temperature, vibration, crude touch, and light touch, so that the messages may be interpreted appropriately. Within the skin layers themselves, particularly in the fingertips, are neural receptors to facilitate the sending of messages. These include Pacinian's corpuscles, believed to be responsible for responses to vibratory stimuli, Meissner's corpuscles, related to light touch, and Ruffini cylinders or Krause end bulbs, which may mediate experiences with hot and cold (Heller & Schiff, 34, 93). As these receptors are tiny and overlap each other, it is difficult to distinguish which receptors are accountable for which response. They are, however, very sensitive to stimulation, especially in the fingertips, where they are more concentrated than most any other section of the body.

Stimulation is important for the learning process. Montagu states, "We would expect that early tactile stimulation would in most respects be more important than later tactile stimulation in the development of the organism..." (180). There are two definitive reasons for this to be the case. The first, as stated by Florence and Kaas, is that, "Changes in the relative levels of sensory stimulation as a result of experience or injury produce modifications in sensory maps" (888). During early development the child is bombarded with a wealth of sensory experiences. The brain chooses a primary sensory channel through which to most efficiently gain information. For the average child, this primary sensory channel will be vision, as it provides the easiest and most accessible data. For the visually impaired child, it will be the sense of touch, as it provides more tangible data than the sense of hearing. Through this process, the brain creates its own sensory map, which is made up of the connections formed by the neural connections and relays in the somatosensory cortex (Ludell, 41). These pathways are strengthened through the myelination process, which can continue into early adolescence (Yakovlev & Lecours, 1967). This is what becomes known as the critical period. Brown, Hopkins, & Keynes note that, "After the critical period, plasticity on a major scale is lost and neuronal connections become more permanent" (6). It is theoretically still possible for the myelination process to occur into adulthood and old age, but not to the extent that occurs in childhood. Changing the sensory map becomes more difficult and almost requires a return to Montessori's "periods of fixation" in order for a change to be ultimately successful.

The process of creating the sensory map is essentially easier for the child than the adult. Mild tactile stimuli can easily produce changes in heart rate and motor behavior in an infant, which results in neural encoding but the same stimuli may barely be noticed by the adult (Santrock & Yussen, 131).

As further noted by Clay:

The need for peripheral skin stimulation and contact exists throughout life, but it appears to be most intense and crucial in the early phase of reflex attachment. Ribble goes as far as to say that the nervous system of the infant requires some sort of stimulus feeding at this early period. Certainly the young child needs an optimum period for gratification of his sensual needs, which are both oral and tactile. This is why the preverbal years are considered a critical period for tactile learning. From this time on the needs for tactile contact decline, but tactile stimulation must still be age-graded according to the developmental needs of the human organism. (308)

Children are more receptive to physical contact and tactual stimuli and receive more of it than adults. As individuals progress toward adulthood, this contact is reduced, in part due to societal customs, and in part due to unperceived needs. This holds true for individuals who are visually impaired. Parents of visually impaired children are encouraged to provide their children with plenty of tactile stimulation in order to prepare them for literacy. Adults, however, who become visually impaired later in life, rarely receive these types of experiences. This would suggest that children who are visually impaired would have a better chance of being more responsive to tactual stimuli, such as braille, than those who are adventitiously blind. Axelrod's 1959 study on the effects of early blindness would dispute this notion from the sense that he found no significant difference between the performance of early-blinded vs. late-blinded on perceptual tasks when adjusted for the age difference, yet at the same time, statistics on the performance of adventitiously blinded braille readers would suggest otherwise (72). The changes in the sensory maps by adults can be made, but it requires both repetitive, ritualistic exposure, as seen with the play experiences of children, and time. Adult populations also have to problem of the degradation of Meissner's and Pacinian's corpuscles with age. As reported by Verrillo, with age comes accompanying reductions in size and number of Meissner's corpuscles, but an increase in the size of Pacinian's corpuscles, though they too decrease in number (66). The size increase of Pacinian's corpuscles, however, does not make them more responsive to stimuli, but less. This would suggest a reduction in the ability of these receptors to respond to low levels of vibratory sensation and light touch, as required in braille reading. Thus, it becomes even more important to have appropriate tactile experiences in childhood to create strong neural pathways in order to

counter the effects of age on the primary sensory receptors. Hence, the need to consider the existence of a critical period becomes even more relevant.

This review of the literature would suggest the theoretical possibility of a sensitive period for the development of the sense of touch. While the theoretical possibility is significant, it needs to be shown in practicality in order for it to be applicable. For these purposes, the following research study was designed.

The Study

METHOD

The hypothesis to be examined was whether or not there is a critical period in the development of the sense of touch or a "window of opportunity," and to identify factors affecting the optimum use of braille reading ability. The prediction was that the subjects' whose braille reading instruction began in early childhood would prove to be classified as those with faster reading speeds. These readers would also have good comprehension rates of the material and display few less than adequate braille reading practices. The hypothesis would be tested at the American Council of the Blind's 1996 National Convention in Tulsa, Oklahoma, with testing taking place June 29-July 3, 1996. This location was chosen because it would provide the best demographically unbiased sample.

SUBJECTS

Prior to using the examination materials at the American Council of the Blind's National Convention, the testing procedures were evaluated on six field test subjects. All of the field test subjects were female, and had a mean age of 27.83, from a range between 20-43. There were no problems in administering the test to any of these individuals, so no changes were made.

Ninety-five individuals who were in attendance at the American Council of the Blind's National Convention participated in this study. Most of the subjects volunteered to be a part of the study, while the rest agreed after hearing a brief explanation of the study and what their participation would involve. Of the ninety-five subjects, the data from only ninety-three of the subjects could be used. From the remaining ninety-three subjects, fifty-seven were female (61.29%) and thirty-six were male (38.71%). Subjects' state of origin included at least twenty different states, comprising all

of the geographic regions of the United States, including Alaska and Hawaii. The subjects' mean age was 48.27, from a range between 21-78 years of age (Appendix D). Eighteen of the ninety-three subjects (19.35%) had a secondary condition or disability, but none significant enough to bar them from participation in this study (Appendix E). The two most common conditions were slight hearing losses and mild cases of arthritis. Only subjects that had identified themselves as braille readers were asked to participate.

MATERIALS

Two major types of materials were used in the process of testing the participating subjects, a series of forms and a reading sample. The most important of these was the reading sample. The purpose of the reading sample was to verify information subjects would be asked to provide about themselves in the forms that preceded the reading sample and to ascertain the subjects' reading speeds. A reading sample had to be chosen that would take into account the variety of people and age groups who would be doing the reading. The sample was taken from the book, In the Eye of the Storm, by Max Lucado, pages 55-57, with a total of 876 words in the passage and had an average reading level of sixth to eighth grade. The testing period for the reading was three minutes long, so the examiner could get minute readings for each of the three minutes and then a three minute average. This aided the process of determining the veracity of each subject's reading speed. With the passage at 876 words, the maximum number of words per minute a subject could read was 296.

Three forms were used to gain information about the subjects involved in this study. The first was a consent form, which explained the purpose of the study, what the subjects would be required to do, and that their participation was voluntary, and they were free to withdraw from the study at any time (Appendix A). The examiner had signature guides on hand to aid the subjects in signing the consent form. The subjects were also notified that the examiner would not be identifying them by name on any part of the study and that on all other forms they would be classified by number.

The second form was entitled "Taction Questionnaire" (Appendix B). The purpose of this form was to gain background information about the subjects' braille reading experiences, such as the age at which they started to learn to read braille, who provided their instruction and number of years of instruction, and their particular braille reading habits. If the subject was unable to provide an answer to a question, the examiner moved onto the next question. In most cases, the subjects were

able to provide very detailed information.

The third form to be used as an observation form (Appendix C). This form was used by the examiner to verify the information given by the subjects about their reading practices and also for recording their reading speed during the testing process. Comprehension questions to be asked of the subjects following their reading of the passage were included on this form. The subjects received a check mark if they responded correctly, a minus sign if they answered the question incorrectly. Based on their number of correct responses, the examiner determined their general comprehension abilities and later verified them through statistical analysis.

PROCEDURE

Subjects were tested at the examiner exhibition booth in the Tulsa Convention Center, Exhibition Hall B. The examiner's booth was at the end of a line of exhibits, so as to have a less distracting environment for testing, but the sales of an exhibit to the left of the booth often provided distraction. The examiner sought to minimize this distraction as much as possible. Subjects came up to the booth, and after agreeing to participate, were invited to have a seat at the examiner's table. They would be first asked to sign the consent form and would be made aware of their rights through aiding the study. Each subject was asked if they wanted the whole consent form read to them, or have it summarized. In most cases, subjects opted for a summary. Upon signing the consent form, the subject was provided a copy of the form that they could keep.

The first part of the testing process was the Taction Questionnaire. Once the questionnaire was completed, the examiner would explain the instructions for the reading sample. The subjects were told that they would be reading the passage silently for three minutes, during which time the examiner would be verifying the information they provided on the questionnaire and also noting their reading speed. The examiner would evaluate speed by following along with the subjects as they read in a numbered passage, and timing with a stopwatch. Because the subjects would be reading silently, the examiner would ask a few basic comprehension questions after the reading, so as to assure the examiner that they understood the passage. Following the answering of the questions, the subjects would be told their reading speed. If the subjects had any further questions, the examiner addressed them at this time, and then thanked the subjects for their participation in the study.

RESULTS

The information obtained from the subjects illustrated the number of factors that can affect braille reading. Even those who could be classified as good braille readers demonstrated less than adequate reading practices, such as occasional scrubbing of dots or regressing when something was misread. Good readers could be classified by their reading rates, their comprehension abilities, their reading techniques, the location of their reading instruction, and their number of years of instruction. Since the purpose of this study was to ascertain a critical period of instruction, the data from reading speeds and number of years of braille reading instruction was correlated.

Subjects were first grouped into categories based on their reading speeds in increments of fifty words per minute (wpm): 0-50 wpm, 50-100 wpm, 100-150 wpm, 150-200 wpm, 200-250 wpm, and 250+ wpm. The division of subjects into these groups did not seek to label their reading ability as poor, average, or superior at this point, but to find a common numerical curve into which they might fall. Through this grouping, the number of subjects in each category provided a relatively normal bell curve.

After being grouped, each subject's age for beginning braille instruction was compared. A mean age for each category could then be derived. As shown from the data in Appendix F, the mean age progressively decreased as the subjects' reading speeds increased. There were individual subjects for which this did not appear to be the case, but nonetheless, overall data showed this to be true. By grouping the data in two other ways, by poor, average, and superior rankings, and by grouping of 100 wpm instead of 50, the means obtained in the original data set were further verified. The means for these groupings centered seven years of age. The mean age for all 93 subjects also centered around seven years of age, relating back to the other three groupings, and offering more support for the hypothesis.

FACTORS AFFECTING THE RESULTS

The two major factors affecting the results were distraction and cold. As mentioned previously, the exhibition booth next to the testing session had many visitors, and the noise could not always be minimized, in spite of the efforts of the individuals running the booth who were aware of the testing taking place. The exhibition hall also had many computer vendors in attendance demonstrating their products, often very loudly. All readers were asked if this might affect their

performance, and 23% of those tested indicated it could if it came up during testing. The final source of distraction came from other subjects coming up to the booth and expressing interest in the study in the middle of another subjects' reading sample. The examiner attempted to deal with these situations without greatly disturbing the subject's reading, but it still could impact and slightly slow down the reading. Distraction, in one form or another and however minor, occurred in 56% of all testing situations, so a percentage of error in the results should be figured in to account for this occurrence.

The second key factor to take into consideration was cold. Due to the number of computers in the exhibition hall and the heat that they generate, the hall was very well air conditioned. The computer vendors were, however, mainly located at the opposite end of the hall from the examiner's booth, so that the heat of the computers by no means improved the chilly nature of the hall. As a significant degree of coldness can lower tactile sensitivity, this was a concern. The exhibitors most affected by the cold did voice their concerns to the maintenance staff and for a few hours on one of the days of exhibition, the temperature was at a more tolerable level. Ten subjects were tested during this period. Unfortunately, the computer vendors then expressed it was too warm and the exhibition hall was returned to its previous cool temperature. As the exact degree of how this impacted subjects' reading speeds cannot be determined, a margin of error must be calculated for this.

CONCLUSIONS

The implications of this study suggest the need for further research in this area. If a critical period for developing the sense of touch exists, as this study certainly indicates that it does, then greater emphasis must be placed on teaching braille not only to totally blind children at an early age, but to those with the potential of losing their sight later on in their life. This would facilitate the ease of their learning process and aid in the process of developing more positive attitudes towards braille. Braille would not be viewed as a last resort, but an alternative medium, in the same manner that one would view learning a second language. This early introduction would not mean that these low vision children would have to, necessarily learn the entire braille code in the same time frame as a totally blind child is expected to learn it in order to gain literacy, but a gradual progression towards this goal would be highly effective, and take advantage of the critical period, which can extend to and through adolescence. Between ages five and seven years of age appears to be the optimum time frame for

beginning braille reading instruction, and it would be advisable to start a child toward braille literacy during this time frame.

A second conclusion that can be drawn from this study is the desperate need for tactile sensitivity training for adventitiously blind beginning readers. As it takes work to make changes in one's sensory map and establish new neural pathways to aid in tactual reading, it becomes apparent that the short periods often accorded to new adult braille readers is not sufficient. It is assumed that these readers only require minimal instruction so as to use braille for functional, daily living tasks, and many adventitiously blinded individuals hold negative attitudes about learning to use braille. However, if these primary psychological obstacles can be overcome, there should be no reason that adult readers cannot accomplish more in learning to read braille. Many of the adult readers tested in this study expressed the opinion that they were bad readers and not suitable candidates for this study based on their slow reading rates. They would explain that they had not received a lot of instruction in braille and really did not feel competent in using it as a reading medium. Yet, after testing they discovered that they read at least twice as fast as they thought they did, and had good comprehension rates. They walked away from the testing situations feeling more positive about their braille reading abilities, and on more than one occasion did the examiner hear the subject now boasting to friends or family. The possibility of promoting braille literacy among adult population based on the understanding that it takes time to "rewire" one's brain due to being past the critical period, versus just accepting the idea that adults cannot become as proficient of readers, is an encouraging one.

Overall, this is a promising area of research and promotes the need for braille literacy in an age where the issue is hotly debated. In order to have good, literate braille readers, they must take advantage of the window of opportunity, for learning, and pass this knowledge on to future generations.

BIBLIOGRAPHY

- Axelrod, S. (1959). *Effects of early blindness: Performance of blind and sighted children on tactile and auditory tasks*. New York: American Foundation for the Blind.
- Begley, S. (1996). Your child's brain. *Newsweek*, 55-62.
- Brown, M.e, Hopkins, W.G., & Keynes, R.j. (1991). *Essentials of neural development*. Cambridge: Cambridge University Press.
- Clay, V.S. (1966). The effect of culture on mother-child tactile communication. Ph.D. diss., Teachers College, Columbia University, New York.
- Florence, S. L. & Kaas,j.H. (1995). Somatotopy: Plasticity of sensory maps. In MA Arbib (Ed.), *The handbook of brain theory and neural networks*. Cambridge: Massachusetts Institute of Technology.
- Heller, MA & Schiff,W. (1991). *The psychology of touch*. Hillsdale: Lawrence Erlbaum Associates, Inc.
- Ludel, j. (1978). *Introduction to sensory processes*. San Francisco: W.H. Freeman & Company.
- Montagu, A. (1971). *Touching: The human significance of the skin*. New York: Columbia University Press.
- Orem, R.C. (1969). *Montessori and the special child*. New York: G.P. Putnam's Sons.
- Santrock,j. & Yussen, S.R. (1987). *Child development: An introduction*. Dubuque: W.M.C. Brown Publishers.
- Standing, E.M. (1957). *Maria Montessori: Her life and her work*. New York: Hollis & Carter Limited.
- Tortora, G.j. & Anagnostakos, N.P. (1984). *Principles of anatomy and physiology*. New York: Harper & Row Publishers, Inc.
- Verrillo, R.T. (1982). Effects of aging on the suprathreshold responses to vibration. *Perception & Psychophysics*, 32 (1), 61-68.
- Yakovlev, P.I. & Lecours, A. (1967). The myelogenetic cycles of regional maturation of the brain. In A. Minkowski (Ed.), *Regional development of the brain in early life*. Oxford: Blackwell Scientific.

APPENDIX A

CONSENT FORM-ADULT (Age 18 or older)

The Critical Period for the Development of Tactile Sensitivity

You are invited to participate in this research study involving the gathering of information on your background training in braille reading and your current braille reading ability.

The purpose of this study is to examine whether or not there is a critical period in the development of the sense of touch and to identify factors affecting the optimum use of braille reading ability.

Your participation in this study will be completed in two parts. First, you will be asked some basic background questions, such as chronological age, age of onset of visual impairment, and when you learned to read braille. Then you will be asked to read a passage in braille, during which time the examiner will be noting your methods for reading braille. Following your reading you may be asked a few questions to check your understanding of the passage.

The only foreseeable risk to you in participating in this study is that you may feel some discomfort reading in front of the examiner, but the examiner would ask that you relax and enjoy the experience.

Participating in this study benefits not only the research this examiner is doing, but you, the participant, as well. Aiding this research will help in determining whether or not teachers will need to change some of their methods of teaching braille reading in order to further emphasize certain aspects of tactile development. This is a critical part of encouraging braille literacy in both children and adults. You can have the personal satisfaction that you have made a significant contribution to the future of braille literacy in the United States.

Although information obtained during this study may be in the future published in scholarly journals or presented at conferences, any information which could identify you will be kept strictly confidential, as your name will not be recorded, nor any identifying characteristics of your personality.

Participation in this study is voluntary. Your decision to participate will not affect you, and you are free to withdraw from participation at any time without penalty or prejudice.

I agree to participate in this research study and acknowledge that I have received a copy of this consent form.

Signature of Subject

Date

APPENDIX B

TACFION QUESTIONNAIRE

- * Subject No.: _____ Date: _____
- * Gender: _____ M _____ F
- * Age: _____
- * Number of Years had Visual Impairment if the number of years is not the same as your age:

- * Condition that caused V.I. (if applicable): _____
- * Any secondary conditions/disabilities (For example, any neuropathy, diabetes, cognitive impairment, orthopedic): _____
- * Is English your first language for speaking/reading? If no, what is your primary language?

- * Age at which you began to learn to read braille: _____
- * Number of Months/Years of instruction: _____
- * Who provided your instruction (i.e., an itinerant or resource room teacher, a residential school, a rehabilitation specialist, a correspondence course, self-taught, or other):

- * Do you read braille with one or both hands? With one finger, two fingers, three fingers?
Which is your preferred hand, your right or your left hand?

- * Estimate how many words per minute you think you read: ~ _____
- * Is braille your primary reading medium? _____ Y _____ N
If no, what types of things do you use braille for? _____

- * Do you use standard size or jumbo braille? _____
- * Do you have any reading habits or practices that help speed up your reading? If so, please explain what these are. _____

- * Do you have any reading practices or habits that could interfere with your reading speed?

- * Estimate the number of hours per week that you use braille to read: _____
- * Do you have any experience reading with the Optacon? _____ Y _____ N. If yes, how much experience (For example, number of times you have used it and/or at what age did you first use it)? Do you use it regularly, and if so, how many hours per week, and for what purpose?



APPENDIX D

AGE DEMOGRAPHICS

1. 49 (M)	41. 24 (M)	81. 24 (F)
2. 43 (M)	42. 36 (M)	82. 28(F)
3. 45 (M)	43. 29 (M)	83. 63 (F)
4. 44 (F)	44. 61 (F)	84. 67 (F)
5. 63 (M)	45. 31 (F)	85. 49 (F)
6. 44 (M)	46. 42 (M)	86. 63 (F)
7. 47 (F)	47. 27 (M)	87. 64 (F)
8. 47 (M)	48. 43 (F)	88. 45 (F)
9. 64 (M)	49. 77 (F)	89. 39 (F)
10. 73 (M)	50. 43(F)	90. 45(F)
11. 43 (F)	51. 69 (M)	91. 60 (F)
12. 38 (F)	52. 43 (M)	92. 75 (M)
13. 64 (F)	53. 35 (F)	93. 64 (F)
14. 45 (M)	54. 42 (M)	94. 49 (F)
15. 42 (F)	55. 44 (F)	95. 41 (F)
16. 45 (F)	56. 33 (M)	
17. 43 (F)	57. 47 (F)	
18. 44(F)	58. -----	
19. 47 (F)	59. 43 (F)	20-29 yrs. = 9 (9.68%)
20. 48 (M)	60. -----	30-39 yrs. = 9 (9.68%)
21. 44 (M)	61. 60 (F)	40-49 yrs. = 44 (47.31 %)
22. 62 (M)	62. 50 (M)	50-59 yrs. = 5 (5.38%)
23. 57 (F)	63. 32 (M)	60-69 yrs. = 19 (20.43%)
24. 42 (F)	64. 48 (F)	70-79 yrs. = 7 (7.53%)
25. 58 (F)	65. 50 (F)	
26. 42 (F)	66. 46 (F)	
27. 30 (F)	67. 43 (F)	
28. 46 (M)	68. 40 (F)	
29. 41 (F)	69. 63 (F)	
30. 78 (F)	70. 72(M)	
31. 54 (M)	71. 31 (M)	
32. 63 (F)	72. 43 (M)	
33. 47 (F)	73. 44(M)	
34. 44 (F)	74. 68 (M)	
35. 63 (F)	75. 72 (F)	
36. 21 (F)	76. 62 (F)	
37. 43 (M)	77. 48 (M)	
38. 23 (M)	78. 69 (M)	
39. 75(F)	79. 23 (F)	
40. 43 (M)	80. 26 (M)	

APPENDIX E
ANY SECONDARY CONDITIONS/DISABILITIES

1.	41.	81.
2.	42.	82.
3.	43.	83. Arthritis
4.	44.	84. Diabtetes; Cornary Vascular Disease (wheelchair)
5. Triple bypass	45.	85.
6.	46. Deaf	86.
7.	47.	87.
8.	48.	88.
9.	49. Arthritis; Slight Hearing Impaired	89.
10.	50.	90.
11.	51.	91. Arthritis
12.	52.	92. Hypertension
13.	53.	93. Neopathic right finger; carpal tunnel
14.	54.	94.
15.	55.	95.
16.	56.	
17.	57.	
18.	58.	
19.	59.	
20. Moderate hearing loss	60.	
21. Mild hearing loss	61.	
22.	62. Diabetes; Some Neuropathy	
23.	63.	
24.	64.	
25.	65.	
26.	66.	18 subjects = 19.35% of subjects
27.	67.	
28.	68.	
29.	69. SlightArthritis	
30.	70. SlightArthritis	
31.	71.	
32.	72.	
33.	73. Slight hearing impaired	
34.	74. SlightArthritis	
35.	75.	
36.	76.	
37. Hearing Impaired	77.	
38.	78.	
39. Arthritis	79. Arthritis	
40.	80.	

APPENDIX F

MEAN AGE AT WHICH SUBJECTS BEGAN BRAILLE INSTRUCTION

<u>Below 50 WPM</u>	<u>50-100WPM</u>	<u>100-150WPM</u>	<u>150-200 WPM</u>	<u>200-250 WPM</u>	<u>250+</u>
5. 23	6. 6	1. 8	2. 7	4. 5	16. 5
8. 8	9. 15	3. 5	12. 4	11. 6	17. 6
13. 25	10. 15	7. 6	15. 6	21. 6	
14. 24	22. 10	18. 5	19. 7	24. 6	Mean = 5.5
38. 22	25. 7	26. 4Y2	20. 6	28. 6	
56. 15	30. 7	27. 5	23. 7	55. 5	
92. 12	35. 12	34. 7	29. 5Y2	64. 6	
	42. 8	36. 5	31. 5	65. 6	
Mean = 18.43	46. 8	37. 14	32. 5	67. 6	
	47. 4	39. 6	33. 7	68. 8	
	49. 10	40. 5	41. 5	73. 6	
	50. 6	44. 3	43. 6	82. 3	
	51. 6	52. 8	45. 4	85. 5 Y2	
	62. 6	53. 5	48. 9		
	70. 12	59. 10	54. 5Y2	Mean = 5.73	
	72. 6	61. 5	57. 8		
	75. 10	63. 5	66. 6		
	77. 6	74. 6	69. 5		
	79. 6	76. 6	71. 6		
	80. 4	83. 6	78. 6		
	81. 5	86. 6	87. 6		
	84. 5 Y2	89. 5	88. 6		
		91. 37	90. 5Y2		
	Mean = 7.93	93. 6			
		94. 6	Mean = 5.98		
		95. 6			

Mean = 7.33

Readers grouped 0-100 wpm (29 subjects) = 10.47
 Readers grouped 100-150wpm (26 subjects) = 7.33
 Readers grouped 150-250+ wpm (38 subjects) = 5.71

Readers grouped 0-100 wpm (29 subjects) = 10.47
 Readers grouped 100-200 wpm (49 subjects) = 6.69
 Readers grouped 200-250+ wpm (15 subjects) = 5.7

Average Age of Beginning Instruction for all 93 subjects = 7.71

SPEED DEMOGRAPHICS

I. 101	41. 178.6	81. 94.6
2. 183	42. 77.3	82. 242.6
3. 131	43. 181	83. 149
4. 248	44. 118	84. 61
5. 33.6	45. 184.3	85. 229.6
6. 75	46. 66	86. 129.6
7. 108	47. 91.3	87. 163.3
8. 47	48. 166.6	88. 188.3
9. 72	49. 83.3	89. 122.3
10. 64	50. 98.3	90. 183.6
II. 205.6	51. 49.6	91. 105.6
12. 177	52. 134.6	92. 47.3
13. 13	53. 141.3	93. 128.6
14. 17	54. 170	94. 116.6
15. 150.6	55. 224.6	95. 148
16. 253	56. 35	
17. 263	57. 196	
18. 140.6	58. ----	
19. 186.6	59. 126.6	
20. 177	60. ----	
21. 209.6	61. 134.3	Below 50 wpm = 7
22. 80	62. 79.6	50-100 wpm = 22
23. 153.3	63. 102.3	100-150 wpm = 26
24. 206.3	64. 238	150-200 wpm = 23
25. 88.6	65. 222	200-250 wpm = 13
26. 142	66. 168.3	250+ wpm = 2
27. 115.3	67. 229.3	
28. 215	68. 229.3	
29. 184.3	69. 189	
30. 97	70. 92.3	
31. 159.6	71. 153.6	
32. 169.3	72. 71.3	
33. 164.6	73. 211.6	
34. III	74. 109.6	
35. 51.3	75. 76.6	
36. 142.3	76. 129	
37. 110	77. 97	
38. II	78. 161	
39. 140	79. 91	
40. 139.3	80. 89.6	

COMPREHENSION RATES

1. 5/5 100%	41. 6/8 75%	81. 4/5 80%
2. 8/8 100%	42. 5/5 100%	82. 8/10 80%
3. 7/7 100%	43. 8/8 100%	83. 7/7 100%
4. 9/10 90%	44. 6/6 100%	84. 3/3 100%
5. 1/1 100%	45. 9/9 100%	85. 6/10 60%
6. 3/4 75%	46. 3/3 100%	86. 6/6 100%
7. 5/6 83.3%	47. 5/5 100%	87. 7/8 87.5%
8. 2/2 100%	48. 8/8 100%	88. 5/7 71.4%
9. 3/3 100%	49. 3/4 75%	89. 3/6 50%
10. 3/3 100%	50. 3/5 60%	90. 7/8 87.5%
11. 6/9 66.6%	51. 4/4 100%	91. 5/5 100%
12. 7/8 87.5%	52. 7/7 100%	92. 0/2 0%
13. 0/1 0%	53. 7/7 100%	93. 7/7 100%
14. 2/2 100%	54. 6/8 75%	94. 5/6 83.3%
15. 7/7 100%	55. 9/10 90%	95. 6/7 85.7%
16. 9/10 90%	56. 1/2 50%	
17. 7/10 70%	57. 6/9 66.6%	
18. 6/6 100%	58. ----	
19. 7/8 87.5%	59. 4/6 66.6%	
20. 8/8 100%	60. ----	
21. 7/9 77.7%	61. 7/7 100%	
22. 4/4 100%	62. 3/5 60%	
23. 7/7 100%	63. 5/5 100%	
24. 7/8 87.5%	64. 5/10 50%	
25. 5/5 100%	65. 10/10 100%	
26. 6/8 75%	66. 5/8 62.5%	
27. 4/6 66.6%	67. 10/10 100%	
28. 4/9 44.4%	68. 7/10 70%	
29. 5/9 55.5%	69. 8/8 100%	
30. 3/5 60%	70. 5/5 100%	
31. 7/7 100%	71. 8/8 100%	
32. 5/7 71.4%	72. 1/3 33.3%	
33. 8/8 100%	73. 8/9 88.8%	
34. 4/6 66.6%	74. 6/6 100%	
35. 1/2 50%	75. 4/4 100%	
36. 7/7 100%	76. 5/6 83.3%	
37. 4/6 66.6%	77. 3/5 60%	
38. 1/2 50%	78. 6/8 75%	
39. 6/7 85.7%	79. 4/5 80%	
40. 5/7 71.4%	80. 3/5 60%	

AGE AT WHICH SUBJECTS BEGAN BRAILLE INSTRUCTION

1. 8	41. 5	81. 5
2. 7	42. 8	82. 3
3. 5	43. 6	83. 6
4. 5	44. 3	84. 5 Y2
5. 23	45. 4	85. 5Y1
6. 6	46. 8	86. 6
7. 6	47. 4	87. 6
8. 8	48. 9	88. 6
9. 15	49. 10	89. 5
10. 15	50. 6	90. 5 Y2
11. 6	51. 6	91. 37
12. 4	52. 8	92. 12
13. 25	53. 5	93. 6
14. 24	54. 5Y1	94. 6
15. 6	55. 5	95. 6
16. 5	56. 15	
17. 6	57. 8	
18. 5	58. ----	4 yrs. = 4 (4.3%)
19. 7	59. 10	5 yrs. = 17 (18.28%)
20. 6	60. ----	5 Y1yrs. = 5 (4.3%)
21. 6	61. 5	6 yrs. = 33 (35.48%)
22. 10	62. 6	7 yrs. = 6 (6.45%)
23. 7	63. 5	8 yrs. = 7 (7.53%)
24. 6	64. 6	
25. 7	65. 6	
26. 4Y1	66. 6	
27. 5	67. 6	
28. 6	68. 8	
29. 5Y1	69. 5	
30. 7	70. 12	
31. 5	71. 6	
32. 5	72. 6	
33. 7	73. 6	
34. 7	74. 6	
35. 12	75. 10	
36. 5	76. 6	
37. 14	77. 6	
38. 22	78. 6	
39. 6	79. 6	
40. 5	80. 4	

NUMBER OF YEARS OF BRAILLE INSTRUCTION

- | | | |
|----------------|-------------------|----------------|
| 1. 3 mos. | 41. 6 yrs. | 81. 4 yrs. |
| 2. 2-3 yrs. | 42. 2-6 mos. | 82. 5 yrs. |
| 3. 3-4 yrs. | 43. 1-2 yrs. | 83. 6 mos. |
| 4. 3 yrs. | 44. 3-5 yrs. | 84. 1 1/4 yrs. |
| 5. 3 mos. | 45. 2 yrs. | 85. 2-3 yrs. |
| 6. 2-3 yrs. | 46. 1 yr. | 86. 3 yrs. |
| 7. 1 yr. | 47. 3-4 yrs. | 87. 3 yrs. |
| 8. 2-3 yrs. | 48. 6 mos. | 88. 2 yrs. |
| 9. 1 yr. | 49. 3 yrs. | 89. 1-2 yrs. |
| 10. 1 mos. | 50. 2-3 yrs. | 90. 2-3 yrs. |
| 11. 2 yr. | 51. 7 yrs. | 91. 4 mos. |
| 12. 2-3 yrs. | 52. 6 mos. | 92. 6 mos. |
| 13. 3 mos. | 53. 2-3 yrs. | 93. 2-3 yrs. |
| 14. 2 mos. | 54. 2-3 yrs. | 94. 2-3 yrs. |
| 15. 2-3 yrs. | 55. 2-3 yrs. | 95. 2 1/2 yrs. |
| 16. 2-3 yrs. | 56. 2 mos. | |
| 17. 1-2 yrs. | 57. 2-3 yrs. | |
| 18. 2-3 yrs. | 58. ---- | |
| 19. 1-2 yrs. | 59. 1 1/2 mos. | |
| 20. 2-3 yrs. | 60. ---- | |
| 21. 2-3 yrs. | 61. 1-1 1/2 yrs. | |
| 22. 3 mos. | 62. 1 yr. | |
| 23. 1-2 yrs. | 63. 6 yrs. | |
| 24. 1-2 yrs. | 64. 2-3 yrs. | |
| 25. 2-3 yrs. | 65. 6 yrs. | |
| 26. 2-3 yrs. | 66. 2-3 yrs. | |
| 27. 1-2 yrs. | 67. 3 yrs. | |
| 28. 1 yr. | 68. 1 1/2 yr. | |
| 29. 2 yrs. | 69. 1-2 yrs. | |
| 30. 1 1/2 yrs. | 70. 1 1/2 yr. | |
| 31. 3 yrs. | 71. 3 1/2 -4 yrs. | |
| 32. 3 yrs. | 72. 2-3 yrs. | |
| 33. 2-3 yrs. | 73. 2-3 yrs. | |
| 34. 1 yr. | 74. 1 1/3 yrs. | |
| 35. 1 yr. | 75. 6 mos. | |
| 36. 3 1/2 yrs. | 76. 3 yrs. | |
| 37. 2 1/2 yrs. | 77. 2-3 yrs. | |
| 38. 3 mos. | 78. 2-3 yrs. | |
| 39. 1-2 yrs. | 79. 3 yrs. | |
| 40. 3-4 yrs. | 80. 3 yrs. | |

WHERE SUBJECTS RECEIVED BRAILLE INSTRUCTION

1. Residential	41. Itinerant	81. Residential
2. Resource Room	42. Residential	82. Itinerant
3. Residential	43. Residential/Mother	83. Self-taught
4. Residential	44. Itin./Residential	84. Residential
5. Rehab. Specialist	45. Assoc. for Blind;Self-taught	85. Residential
6. Mother/Resource Room	46. Resource Room	86. Residential
7. Residential	47. Resource Room	87. Residential
8. Residential	48. Itinerant	88. Residential
9. Residential	49. Residential	89. Itinerant
10. Residential	50. Itin./Resource Room	90. Resource Room
11. Resource Room	51. Resource Room	91. Rehab. Specialist
12. Resource Room	52. Resource Room	92. Residential
13. Correspondance;Self-taught	53. Resource Room	93. Resid.;Self-taught
14. Rehab. Specialist	54. Resource Room/Rehab.	94. Residential
15. Resource Room	55. Resource Room	95. Resource Room
16. Resource Room	56. Itinerant	
17. Resource Room	57. Resource Room	
18. Itinerant	58. ----	
19. Residential	59. Residential	Residential = 45 (48.39%)
20. Residential	60. ----	Resource Room = 23 (24.73%)
21. Residential	61. Residential	Itinerant = 8 (8.6%)
22. Residential	62. Residential	Rehab. Specialist = 4 (4.3%)
23. Residential	63. Resource Room	Other = 13 (13.98%)
24. Resource Room	64. Resource Room	
25. Residential	65. Resource Room	
26. Residential	66. Residential	
27. Residential	67. Braille Tutor	
28. Resource Room	68. Itinerant	
29. Resource Room	69. Residential	
30. Residential	70. Residential	
31. Residential	71. Residential	
32. Residential	72. Residential	
33. Residential	73. Residential	
34. Residential	74. Resource Room	
35. Residential	75. Residential	
36. Resid/Itin. & parents	76. Residential	
37. Residential	77. Resource Room	
38. Rehab. Specialist	78. Residential	
39. Residential	79. Itinerant	
40. Resid/Resource Room	80. Residential	

READING WITH ONE OR BOTH HANDS

- | | | |
|----------|----------|----------|
| 1. Both | 41. One | 81. One |
| 2. Both | 42. One | 82. Both |
| 3. One | 43. Both | 83. Both |
| 4. One | 44. One | 84. One |
| 5. One | 45. One | 85. Both |
| 6. Both | 46. One | 86. Both |
| 7. One | 47. Both | 87. Both |
| 8. Both | 48. One | 88. Both |
| 9. Both | 49. Both | 89. Both |
| 10. One | 50. One | 90. Both |
| 11. One | 51. Both | 91. One |
| 12. Both | 52. Both | 92. One |
| 13. Both | 53. Both | 93. Both |
| 14. One | 54. Both | 94. Both |
| 15. Both | 55. Both | 95. One |
| 16. Both | 56. One | |
| 17. Both | 57. Both | |
| 18. Both | 58. ---- | |
| 19. Both | 59. Both | |
| 20. One | 60. ---- | |
| 21. Both | 61. One | |
| 22. Both | 62. One | |
| 23. Both | 63. Both | |
| 24. One | 64. Both | |
| 25. Both | 65. Both | |
| 26. One | 66. Both | |
| 27. Both | 67. Both | |
| 28. Both | 68. Both | |
| 29. Both | 69. One | |
| 30. One | 70. One | |
| 31. Both | 71. Both | |
| 32. Both | 72. Both | |
| 33. Both | 73. One | |
| 34. Both | 74. Both | |
| 35. One | 75. Both | |
| 36. Both | 76. One | |
| 37. Both | 77. One | |
| 38. One | 78. Both | |
| 39. Both | 79. One | |
| 40. Both | 80. One | |

One Hand = 35 (37.63%)

Both Hands = 58 (62.37%)

PREFERRED READING HAND

1. Right	41. Right	81. Left
2. Right	42. Right	82. Right
3. Left	43. Left	83. Left
4. Right	44. Left	84. Right
5. Right	45. Right	85. Right (Like Both)
6. Left	46. Left	86. Right
7. Left	47. Right	87. Right
8. Right	48. Left	88. Right
9. Right	49. Right	89. Right
10. Right	50. Left	90. Right
11. Left	51. Right	91. Right
12. Left	52. Right	92. Right
13. Left	53. Right	93. Right
14. Right	54. Left	94. Right
15. Left	55. Right	95. Right
16. Left	56. Right	
17. Right	57. LIKE BOTH	
18. Left	58. ----	
19. Right	59. Left	Left Hand = 34 (36.56%)
20. Left	60. ----	Right Hand = 58 (62.37%)
21. Right	61. Right	Like Both = 1 (1.08%)
22. Right	62. Right	
23. Left	63. Right	
24. Right	64. Right	
25. Left	65. Left	
26. Right	66. Right	
27. Left	67. Right	
28. Right	68. Right	
29. Right	69. Left	
30. Left	70. Left	
31. Left	71. Left	
32. Right	72. Right	
33. Right	73. Right	
34. Right	74. Right	
35. Left	75. Right	
36. Right	76. Right	
37. Left	77. Left	
38. Left	78. Left	
39. Left	79. Right	
40. Left	80. Right	

BRAILLE PRIMARY READING MEDIUM

1. Yes	41. Yes	81. No
2. Yes/tape	42. No	82. Yes
3. Yes	43. No	83. No
4. Yes	44. Yes	84. No
5. No	45. Yes	85. No
6. Yes	46. Yes	86. Yes
7. Yes	47. No	87. Yes
8. No	48. Yes	88. Yes
9. No	49. No	89. Yes
10. No	50. Yes	90. No
II. Yes	51. Yes	91. Yes
12. No	52. No	92. No
13. No	53. Yes	93. Yes
14. Yes	54. Yes	94. Yes
15. Yes	55. No	95. Yes
16. Yes	56. No	
17. Yes	57. No	
18. Yes	58. ----	
19. Yes	59. Yes	Yes = 64 (68.8%)
20. Yes	60. ----	No = 29 (31.2%)
21. Yes	61. Yes	
22. Yes	62. No	
23. Yes	63. No	
24. Yes	64. Yes	
25. No	65. Yes & cassettes	
26. Yes	66. Yes	
27. Yes	67. Yes	
28. No	68. Yes	
29. Yes	69. Yes	
30. Yes	70. Yes & cassettes	
31. Yes	71. No	
32. Yes	72. No	
33. Yes	73. Yes	
34. Yes	74. Yes	
35. Yes & cassettes	75. Yes	
36. Yes	76. Yes	
37. No	77. No	
38. No	78. Yes	
39. Yes	79. Yes	
40. Yes	80. Yes	

NUMBER OF HOURS PERWEEK SPENT READING BRAILLE

1. 5	41. 5	81. 5-10
2. 3-4	42. 1-5	82. 30
3. 42	43. 10-12	83. 10
4. 20	44. 10-20	84. 10-15
5. 1	45. 20-30	85. 1 V2-2
6. 1	46. 10+	86. 3
7. 7-10	47. 21	87.5-10
8. 0	48. 28-35	88. 45-50
9. 1 hr.ayr.	49. 5	89. 5
10. 15-20	50.5-10	90. 15
11. 30-40	51. 12	91. 5-10
12. 1-2	52. 1	92. 6
13. 0	53. 10-20	93. 3-4
14. 1 V2-2	54. 50	94. 5-6
15. 20	55. 10-20	95. 2
16. 30-35	56. 1-2	
17. 5-6	57. 42	
18. 20	58. -----	
19. 7-20	59. 20	
20. 6	60. -----	
21. 7-10	61. 20	
22. 2-3	62. 75-80	
23. 5	63. 15	
24. 8+	64. 20	
25. 50	65. 30-40	
26. 10	66. 10-20	
27. 25	67. 5-10	
28. 2-3	68. 5-10	
29. 7-8	69. 7-8	
30. 10	70. 2-3	
31. 24	71. 2	
32. 10-20	72. 35	
33. 32	73. 38	
34. 10-15	74. 30	
35. 5-6	75. 30	
36. 3-5	76. 20	
37. 1 hr. a month	77. 10	
38. 1-2	78. 6-10	
39. 10-15	79. 4-5	
40. 20	80. 8	

EXPERIENCEWITH THE OPTACON

I. Yes	41. Yes	81. Yes
2. Yes	42. Yes	82. Yes
3. Yes	43. Yes	83. Yes
4. Yes	44. No	84. No
5. Yes	45. Yes	85. Yes
6. Yes	46. Yes	86. No
7. Yes	47. Yes	87. Yes
8. Yes	48. Yes	88. Yes
9. No	49. Yes	89. No
10. Yes	50. Yes	90. Yes
II. Yes	51. Yes	91. No
12. Yes	52. Yes	92. Yes
13. No	53. Yes	93. Yes
14. No	54. Yes	94. No
15. Yes	55. Yes	95. Yes
16. Yes	56. Yes	
17. Yes	57. Yes	
18. Yes	58. ----	
19. No	59. Yes	Yes = 70 [75.27%]
20. Yes	60. ----	No = 23 (24.73%)
21. Yes	61. Yes	
22. Yes	62. Yes	
23. No	63. Yes	
24. No	64. No	
25. No	65. Yes	
26. Yes	66. Yes	
27. No	67. Yes	
28. Yes	68. Yes	
29. Yes	69. Yes	
30. No	70. Yes	
31. Yes	71. Yes	
32. Yes	72. Yes	
33. No	73. No	
34. Yes	74. Yes	
35. Yes	75. Yes	
36. No	76. Yes	
37. Yes	77. Yes	
38. No	78. Yes	
39. No	79. No	
40. No	80. Yes	

BRAILLE READERS WITH SPEEDS UNDER 100 WPM
 29 SUBJECTS
 VS. AGE AT WHICH BEGAN BRAILLE INSTRUCTION
 VS. NUMBER OF YEARS OF BRAILLE INSTRUCTION

5.	33.6	23	3 mos.	Mean Age for beginning braille instruction = 10.47
6.	75	6	2-3 yrs.	
8.	47	8	2-3 yrs.	
9.	72	15	1 yr.	
10.	64	15	1 mos.	
13.	13	25	3 mos.	
14	17	24	2 mos.	
22.	80	10	3 mos.	
25.	88.6	7	2-3 yrs.	
30.	97	7	1 1/2 yrs.	
35.	51.3	12	1 yr.	
38.	11	22	3 mos.	
42.	77.3	8	2-6 mos.	
46.	66	8	1 yr.	
47.	91.3	4	3-4 yrs.	
49.	88.3	10	3 yrs.	
50.	98.3	6	2-3 yrs.	
51.	49.6	6	7 yrs.	
56.	35	15	2 mos.	
62.	79.6	6	1 yr.	
70.	92.3	12	1 1/2 yr.	
72.	71.3	6	2-3 yrs.	
75.	76.6	10	6 mos.	
77.	97	6	2-3 yrs.	
79.	91	6	3 yrs.	
80.	89.6	4	3 yrs.	
81.	94.6	5	4 yrs.	
84.	61	5 1/2	1 1/4 yrs.	
92.	47.3	12	6 mos.	

AGE DEMOGRAPHICS OF GOOD READERSVS. POOR READERS

2. 43 (M)	5. 63 (M)
4. 44 (F)	6. 44 (M)
11. 43 (F)	8. 47 (M)
12. 38 (F)	9. 64 (M)
15. 42 (F)	10. 73 (M)
16. 45 (F)	13. 64 (F)
17. 43 (F)	14. 45 (M)
19. 47 (F)	22. 62 (M)
20. 48 (M)	25. 58 (F)
21. 44 (M)	30. 78 (F)
23. 57 (F)	35. 63 (F)
24. 42 (F)	38. 23 (M)
28. 46 (M)	42. 36 (M)
29. 41 (F)	46. 42 (M)
31. 54 (M)	47. 27 (M)
32. 63 (F)	49. 77 (F)
33. 47 (F)	50. 43 (F)
41. 24 (M)	51. 69 (M)
43. 29 (M)	56. 33 (M)
45. 31 (F)	62. 50 (M)
48. 43 (F)	70. 72 (M)
54. 42 (M)	72. 43 (M)
55. 44 (F)	75. 72 (F)
57. 47 (F)	77. 48 (M)
64. 48 (F)	79. 23 (F)
65. 50 (F)	80. 26 (M)
66. 46 (F)	81. 24 (F)
67. 43 (F)	84. 67 (F)
68. 40 (F)	92. 75 (M)
69. 63 (F)	
71. 31 (M)	
73. 44 (M)	
78. 69 (M)	
82. 28 (F)	
85. 49 (F)	
87. 64 (F)	
88. 45 (F)	
90. 45 (F)	

Mean Age of Good Readers = 45.05
 II Males (28.9%),27 Females (71.1 %)
 20-29 yrs. = 3
 30-39 yrs. = 3
 40-49 yrs. = 25
 50-59 yrs. = 3
 60-69 yrs. = 4

Mean Age of Poor Readers = 52.93
 19 Males (65.5%), 10 Females (34.5%)
 20-29 yrs. = 5
 30-39 yrs. = 2
 40-49 yrs. = 7
 50-59 yrs. = 2
 60-69 yrs. = 7
 70-79 yrs. = 6

