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ABSTRACT

Using a stratified sample of 112 pupils in grades 4-12, a 2-year study was undertaken to (1) assess the outcomes of Optical-to-Tactile Converter (Optacon) training when carried out in various teaching arrangements, (2) identify predictors of Optacon success, and (3) observe the effect of Optacon training on student attitudes. In addition to measurement and evaluation, the project also included the development of appropriate instructional materials for training blind elementary and secondary students to read standard ink-print. Analyses of the data suggest that (1) elementary students performed as well as secondary students; (2) the performance of students taught individually was generally as good as that of students taught in groups of three; and (3) the involvement of student teachers under the supervision of a credentialled teacher did not result in lower student performance than in cases where a credentialled teacher was solely responsible for the training. A series of special cases is presented together with recommendations for educators and agencies. Excerpts from the instructional materials developed during the project are also included. (DGC)

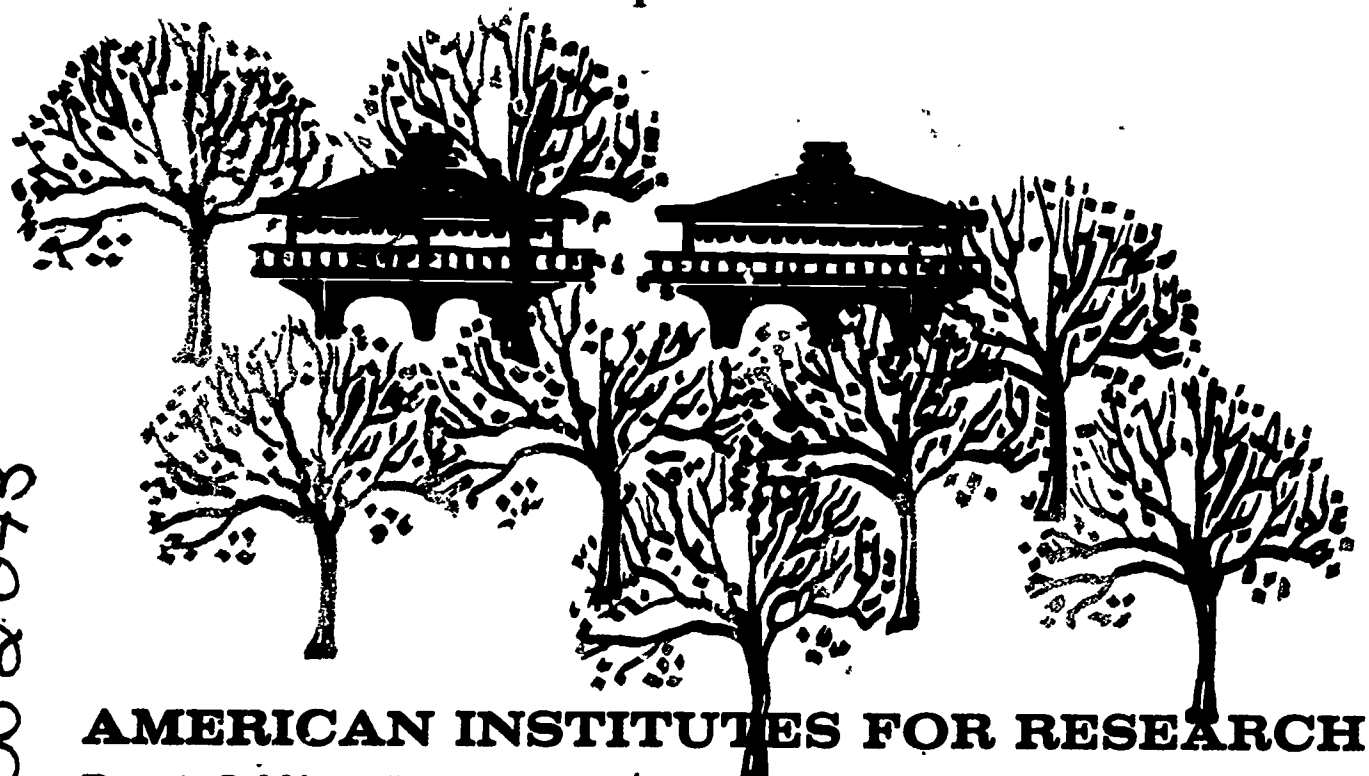
AIR-34500-9/74-FR

EDUCATIONAL EVALUATION OF THE OPTACON (OPTICAL-TO-TACTILE CONVERTER) AS A READING AID TO BLIND ELEMENTARY AND SECONDARY STUDENTS

FINAL REPORT

Contract No. OEC-0-72-5180

September 1974



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AIR-34500-9/74-FR

Educational Evaluation of the Optacon

(Optical-to-Tactile Converter)

as a Reading Aid to Blind Elementary and Secondary Students

Contract No. OEC-0-72-5180

Final Report

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Submitted to

Bureau of Education for the Handicapped
U.S. Office of Education
Washington, D.C.

September 1974

The research reported herein was performed pursuant to a contract with the Office of Education, U.S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

ABSTRACT

Educational Evaluation of the Optacon (Optical-to-Tactile Converter) as a Reading Aid to Blind Elementary and Secondary Students

Problem: At the outset of this project the Optacon had recently become commercially available and was being taught to blind adult purchasers. A two-year study was undertaken to assess the outcomes of Optacon training when carried out in various teaching arrangements, identify predictors of Optacon success, and observe the effect of Optacon training on student attitudes. In addition to measurement and evaluation, the project objectives also included the development of appropriate instructional materials for training blind elementary and secondary students to read standard ink-print. Instructional materials and tests were developed in the fall of 1972 and instruction was carried out from the spring of 1973 to the spring of 1974 with the cooperation of some 15 geographically distributed public school districts and residential schools.

Design: Altogether, 112 subjects were involved at some point during the study. With the exception of the special cases (differences in age, teaching mode, handicapping condition or other unique circumstances outside the defined population constraints), the sample was stratified and balanced by cohort group (grades 4-8 and 9-12), student/teacher ratio, and whether student teachers were involved. A substantial range of intelligence, tactile ability, braille reading ability, and English spelling ability was represented in the sample.

Criterion assessment included multiple measures of reading speed, accuracy and variety of usage with the Optacon, and measures of attitude toward the Optacon and toward the self. Predictor indices included measures of intelligence, braille ability, tactile ability, English spelling ability, and attitude toward self. Logs were maintained on learner progress. They yielded data on study time, utilization and mastery of instructional material. Equipment use data were made available to a concurrent engineering evaluation conducted by Franklin Institute Research Laboratories.

Analysis: Findings following an average of 58 hours of study time (spread over two semesters) indicate that high levels of accuracy in reading print were attained (mean 93%), at a mean reading speed of 12.3 WPM. Optacon reading was accomplished by youngsters even at the first grade level. The average reading speed should be viewed as conservative for a number of reasons indicated in the main body of the report.

By the end of the first semester it was determined that (a) the elementary grade level cohort did not perform significantly lower than the secondary level cohort except with regard to reading accuracy; (b) differences in Optacon performance of students taught singly and those taught in 3:1 student/teacher ratios were not significant, with the sole exception of accuracy of reading which showed 3:1 ratios performing better; and (c) the involvement of student teachers, under supervision of credentialed teachers, did not result in a lower level of student performance as compared to teaching accomplished solely by credentialed teachers.

In Phase II, positive predictive relationships with Optacon reading (speed and accuracy were significant (p.=.01) with respect to intelligence and tactile ability. Sex, age, prior experience with print and English spelling appear somewhat related either to speed or to accuracy. Braille reading ability shows a slight relationship to Optacon reading accuracy. Self-concept was not a predictor of Optacon speed or accuracy. Accumulated study time was significantly correlated with the level of skill developed.

The variety of Optacon use for various kinds of reading was also assessed (bottle labels, excerpts from telephone books, etc.). In a predictive sense, the degree to which students attempted and were able to use the Optacon for specialized reading applications (e.g., labels, phone book) was positively associated only with information and arithmetic subtests of intelligence, tactile ability, age, sex, and inversely with number of years blind.

Findings related to attitudes indicated no major changes over the study period. Students' self-concept and attitude toward the Optacon did not change appreciably. Students' preference for the Optacon over other means for information acquisition declined after one year of study; this may have been partly attributable to a realistic appraisal of their developed abilities. Teachers overwhelmingly agreed that Optacon training should be offered in the curriculum.

The newly developed instructional materials were evaluated favorably by over 95% of the teachers in terms of meeting individual student needs. About 66% of the students also indicated that the materials were appropriate.

Interpretation and Implication: High levels of accuracy in reading were demonstrated with the Optacon. Estimates of mean reading speeds and the flexibility of use of the Optacon in various reading contexts were moderate but continued to rise in relation to additional study time. The Optacon skills which students have developed and the increased access to ink-print material of their choice is an important advance even though not sufficient to challenge braille or other means of information acquisition after only one year of study. Not only is it commendable in its own right, but it suggests strongly that Optacon instruction which begins early enough (i.e., the primary grades) may go far toward the improvement of one important living skill by the blind.

PREFACE

This report summarizes the research and development activities which took place over a two-year period in connection with the educational evaluation of the Optacon. An Interim Technical Report was prepared in September 1973 describing the work carried out to that date. Copies are available from the ERIC Document Reproduction Service, P.O. Box 90, Arlington, Virginia 22100. In an effort at making this Final Report complete, substantial portions of that document have been included here with some modifications for the sake of brevity and clarity. These sections describe the establishment of the study schools, the development of instructional materials and the Phase I findings.

It is the view of this writer that the project "broke ground" in three areas: 1) the development, empirical tryout and revision of Optacon instructional materials designed for three school-age groups, 2) the development, adaptation and application of measures that can be used in the schools for student selection for Optacon training and formative and summative evaluation of Optacon instruction , and 3) the exploration of the extent to which instruction in ink-print reading by the Optacon can be accomplished by elementary and secondary students. Experimentation took place in schools which had varying numbers of blind students and differing instructional strategies, and which were broadly representative of types of programs serving blind students.

Hopefully, the reader will be able to extract from this report the valuable information needed, whether one is an educator primarily interested in the materials and processes of Optacon instruction or a researcher primarily interested in the evaluative findings. Schools contemplating the inception of Optacon instruction may wish to contact AIR regarding the availability, for a limited period, of the instructional manuals appropriate to the age/grade level of blind students who plan to learn the Optacon in their school.

R.A.W.

ACKNOWLEDGMENTS

Advice and counsel was received from a number of key people in the fields of special education and sensory research. We particularly appreciated the perspectives on special education provided by Philip Hatlen, on educational design by Robert Gagné, on reading approaches by Mary Herman, and tactile phenomena by Emerson Foulke.

A special debt of gratitude is owed to Mrs. Marion Canfield, whose extraordinary talents as a teacher and willingness to experiment were major factors in our including certain case studies of an unusual and most interesting nature. She also deserves the primary credit for developing special draft instructional materials for one of those students, based on a whole word approach to the teaching of reading.

Early in the study, suggestions from Mr. Gale Lutz, of the San Diego schools, were quite helpful in alerting us to topical areas that needed to be included in the instructional materials, as well as some past problems and experiences in Optacon teaching that should be avoided or overcome in our own efforts.

We would like to sincerely thank the parents of those pilot students and special students whose participation required their being regularly transported by private car to teaching locations outside their school districts.

Any research project which is conducted in the field is dependent in a large measure on the willingness of school personnel to devote extra time and energy in the implementation of the innovation and in the collection of essential data. AIR project staff feel very fortunate to have had the cooperation and commitment of the personnel in the fifteen schools and school districts listed below, who have become friends as well as colleagues.

Azusa Unified School District, Azusa, California

Harold L. Heywood	Cheri Blackwell	Erna Maron
Lucille O. Potter	Esther Laschober	Pat Presley
		Pearl Steele

Berkeley Unified School District, Berkeley, California

Robert W. Whitenack
Nancy Rubin
Howard Schirmer
Ginny Soffa

Campbell Union Elementary School District, Campbell, California

Anthony Perreira
Marion Canfield
Susan Lalush

Campbell Union High School District, Campbell, California

Nick Montesana
Arta Jo Chambers
Virginia Braun
Linda Leong
Ben Sanematsu

Chula Vista City School District, Chula Vista, California

John F. Vugrin
Bonnie McConnell

Cincinnati Public Schools, Cincinnati, Ohio

Donald R. Waldrip
Muriel C. Lass
Mary Pinkelton
Nancy Dunn
Marilyn Meckes

Florida School for the Deaf and the Blind, St. Augustine, Florida

Walter S. Davis
MacDonald Johnstone
Pat Anderson
Susan Beck
John Cardinale
Charles Cowart
Richard Moore
LaRhea Sanford
Tuck Tinsley
Mrs. Washington

Houston Independent School District, Houston, Texas

Charles Meisgeier
Genevieve Yates-Campbell
Virginia Guillet
Ruth Reed

Logan School, Philadelphia, Pennsylvania

Muriel G. Korn
Marcella Balawender
Hilma Lewis
Carol Siegfried
Rose Skolnick

Overbrook School for the Blind, Philadelphia, Pennsylvania

David Olson
Mary Anne Sullivan
Mrs. Bender
Linda Christensen
Christi Hester
Elizabeth Costello
Marlene Frye
Barbara West

Palo Alto Unified School District, Palo Alto, California

Katherine Croke
Geri Chandler
Mary Ann Sklar

Perkins School for the Blind, Watertown, Massachusetts

Benjamin F. Smith
Carl J. Davis
L. Beauchamp
Warren Blumenfeld
Anne Buxton
Ray Condon
Charlene Howe
Dana Jackson
Mary Nelson
Patricia Pate
Karen Putzer
Helen Thiebaud
Carla Wirzburger

Salem Public Schools, Salem, Oregon

Ray A. Myers
Carroll C. Smith
Eva Southwell
Gary A. Todd

San Diego City Schools, San Diego, California

C. Robert Calhoun
Kathy Welter
Gale W. Lutz
Eva Diaz
Diane Doorlag
E. Specter

Visalia Unified School District, Visalia, California

Hugo Steigman
Keith Lindersmith

Finally, we appreciated the professional relationship enjoyed with Dr. Max Mueller, USOE Project Officer, during the conduct of this study. His understanding and support made it possible to achieve our objectives with efficiency and completeness.

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INTRODUCTION

Research and development in reading devices for the blind has been and will continue to be a vital link in improved inward and outward communication with those who are handicapped through sensory deprivations. In terms of societal goals, high priority must be given to finding alternative means of reading which can alleviate the effects of the deprivation both in a functional and emotional sense. Many blind individuals have much greater potential to operate in a sighted world than is generally achieved and there is ample evidence to show that this failing is not due to lack of intellect or capacity for work. Nor is the hesitancy to undertake new experiences a sign of lack of motivation. Rather, these are consequences of a forced dependence on others--for spatial orientation, for conceptualizing the wholeness of places and things, and, of great importance, for distinguishing meaningful ink print materials, be they labels, phone books, or professional journals.

Various engineering groups have been active in the area of ink print readers, which convert optical images to either tactile or aural analogs. One of the tactile converters, the Optacon, was developed by Stanford University and the Stanford Research Institute, with federal support (Linvall, 1973). The Optacon device which was evaluated in terms of educational potential in the present study is a two-handed, battery powered, portable version. Figure 1 shows the main features of the device as well as ancillary devices intended primarily for training purposes, a tracking aid and a visual display. Also available are pacing devices which deliver tactile images at uniform rates.*

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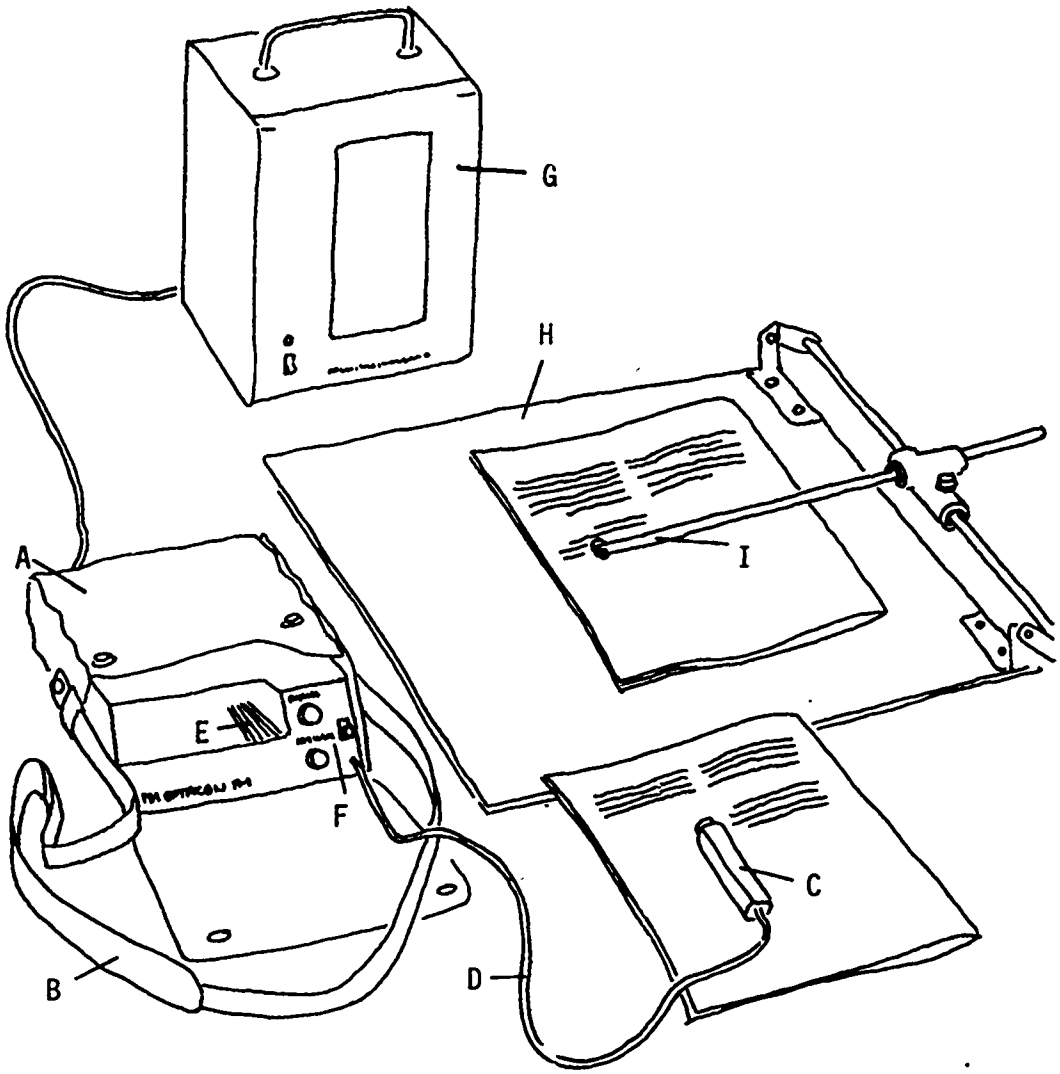
* The Optacon and associates devices are presently manufactured and marketed by Telesensory Systems, Inc., 1889 Page Mill Road, Palo Alto, California 94304.



A Leather-cased Optacon Electronics
B Shoulder Strap
C Camera or Light Probe, with Zoom
D Cable
E Tactile Array (Index Finger)
F On-Off, Threshold and Intensity Controls
G Visual Display
H Tracking Aid
I Tracking Aid Guide Bar-Camera Attachment

Figure 1. Components of the Optacon device as evaluated in this study.

Background of Related Optacon Studies

Studies reporting the results of Optacon training courses have been carried out in the United States, Sweden, Denmark, Germany, England, and Italy. Cross comparison of the results of these studies provides valuable data concerning the learning of the Optacon technique under conditions where the letter characters and language of the instructional materials differ greatly. Different Optacon courses are naturally not entirely comparable, but the reported results of training should nonetheless be able to give a certain concept of the effectiveness of the Optacon training.

The general instructional pattern in these studies is first to train the student in the recognition of the individual characters (large and small letters, figures, punctuation, etc.). This is followed by training in the recognition of isolated words formed from combinations of known letters learned to date, and ultimately to reading in context.

An early United States study conducted by the manufacturer, Telesensory Systems, Inc. (Weihl and Bliss, 1971), involved four adults ranging in age from 26-51 who received a concentrated 50-hour instructional program of 4 hours a day within a 12 day period of time. The mean Optacon reading speed developed was 8 WPM with a range from 5-10 WPM for the subjects.

An early Swedish study (Nelton, 1972), paralleling the foregoing study, produced very similar results. Five adults, aged 24-41, received 50 hours of Optacon instruction within a 10 day period of time. The average Optacon reading speed for the 5 subjects was 7 WPM with a range from 0.5-15 WPM.

A German study (Zierer, 1972) involving 13 young adults aged 19-31, used less instructional time (29 hours) but spread it out over a two-month period of time. The evaluation criterion was speed of reading words in isolation as opposed to reading words in context. The range for individuals was from 2-15 WPM with an average of 8 WPM.

The Research Centre for the Education of the Visually Handicapped at the University of Birmingham, England, has recently completed a very

comprehensive series of studies (Tobin, et al, 1973) with several different groups of participants. The instructional program ranged from 10-30 hours, concentrated in a relatively short period of time (10 to 12 days). One group consisted of 6 adults who were working professionals or semi-professionals and lived in London. The Optacon reading speed for these 6 adult professional workers was 7.3 WPM with a range from 0.6-15.3 WPM. A second group consisted of 16 adults or older teenagers who worked as laborers or attended a vocational training and assessment unit in Birmingham. This group did not respond as well to the instructional program as did the London professional group. The mean reading rate was only 3.6 WPM with a range from 0.1-11.3 WPM. A third group consisted of 8 girls, aged 16-18, at Chorleywood resident grammar school for blind girls. This group responded very well to the basic instructional program with a mean reading rate of 11.2 WPM and a range from 3.5-20 WPM. Of the three groups, the Chorleywood girls developed the fastest Optacon reading speed and the Birmingham group the slowest.

In this British study, the final Optacon reading speeds were comparable to the early T.S.I., Swedish and German studies, yet much less instructional time was involved. The British study used specifically developed instructional materials that differed in some essential points from the T.S.I. manual, which had been used as the model for the previously mentioned studies. However, five of the London students were trained with the T.S.I. manual; and only one with the British version. In the British manual the lower case letters were taught first and thereafter the capitals. In addition, there was substantially more word and text material presented relatively early. Readings were systematically built up according to a pattern of learning characteristics, discovering and identifying letters, and learning to read words and text.

Optacon studies have also recently been completed in Sweden and Denmark (Marmullin and Nilsson, 1973). The test subjects who participated in the study were 18 participants who attended Optacon courses in Furulund (8 individuals), Goteborg (5 individuals) and Copenhagen (5 individuals) in the spring, 1973. A variety of study materials was used to supplement

the T.S.I. manual. The course involved 60 hours of instructional time. At Furulund the course was concentrated into 15 days, whereas at the other two sites it was spread out over 6 or 7 months. The mean reading rates for these three groups were 7.1, 5.7 and 7.4 WPM respectively. The study reported an accuracy level for these tested rates at from 91% to 95%.

A recent Optacon study has been reported from Italy (Bertora, et al, 1974). In 1971/1972 the study involved 2nd to 4th grade elementary classes which had both boys and girls between 9 and 12 years of age. In 1972/1973 the training was conducted with volunteer students of the upper classes up to university level (ages between 12 and 25). In this experiment motorized control over the stimulus, through the use of a pacing device, presented the characters with uniform speed, regulated to the subject's level of skill. In 7 of 10 cases the students at the end of the course had surpassed reading rates of 25 WPM, and, in fact, the average reading rate reached was 27.4 WPM with a range from 10-42 WPM. It should be noted that the individual who achieved 42 WPM by automatic pacing had participated in both experiments over the two year period of study.

Naturally, the different Optacon courses and training programs described here are not entirely comparable but nonetheless the results are surprisingly consistent. On the average, the reading speed results were low, about 7-8 WPM. The Tobin and Bertora studies reported that the reading rate can be almost doubled if the students do not need to guide the camera themselves but, rather, are tested at externally controlled speeds. With respect to the question of how reading capability develops after the completion of the basic course, the Tobin study produced data that the reading rate was thought to nearly double during the first 1-15 weeks of further practice and instruction, but after that the increase was slow.

A pronounced characteristic in all the studies was the very great inter-individual differences in developed reading rate. Since the differences are so great, it is important to find the major factors that are related to good performance. One or more of the studies suggest

that young people, individuals with high IQ's, who have good Braille reading ability and good tactile ability, with a good short term memory and good verbal (spelling) abilities will presumably also become good Optacon readers.

One other factor that seemed to have a great effect on Optacon reading capability is the graphic configuration of the material. For example, the reading of sentences printed in a simple and distinct typeface (sans serif) is faster than sentences in a typeface more typical of books.

The conclusions given in these studies apply essentially to initial basic training with the Optacon. Other methods of teaching, and considerably longer training, could yield quite different results.

The American Institutes for Research Study

Prior to this study the main focus of instruction and use of the Optacon in this country was with adults who acquired their own Optacon and received concentrated individual training their use. A number of critical questions needed investigation to determine the potential of the device under "real world" educational conditions when:

- students are at different grade levels and vary in intellectual and other abilities,
- student/teacher ratios vary and Optacon equipment is shared,
- credentialed teachers or student teachers under supervision serve as instructors,
- the setting for instruction varies, and
- the time available for instruction is constrained by school schedules.

The principal objectives of this study were:

- To conduct a field investigation in which the evaluation design would allow comparison of certain treatment

variables, i.e., elementary vs secondary school level, student/teacher ratio, involvement of student teachers.

- To investigate possible predictive relationships between success in reading with the Optacon and measured intelligence, tactile ability, braille reading ability, English spelling ability, and self-concept.
- To establish the levels of reading speed and accuracy that are typically attainable and to relate these to study time.
- To develop appropriate instructional materials at the elementary and secondary levels for teaching the tactile recognition of Arabic numerals, English letters, words and sentences, as well as reading of such material in a variety of formats, contexts, and typestyles.
- To explore the diversity of applications for which the students might find the device useful once their initial or basic instruction has been completed and they can pursue independent study.

METHODS

Instructional Materials Development

Initially, project staff analyzed a number of widely used approaches in the teaching of character recognition, including those for sighted children, learning disabled children, and physically handicapped children, for their applicability to the instructional design to be used in this study. Some consideration was also given to general approaches in the teaching of second languages since the students in this study were already established readers but were largely using the braille code.

The instructional strategy subsequently developed for the Optacon training materials was reviewed by Dr. Robert Gagné, a leading authority in instructional design, learning hierarchies, and educational research; Professor Philip Hatlen, coauthor of a text on reading by the blind and a nationally known special education teacher-educator; and Professor Mary Herman, experienced teacher in the lower grades and specialist in the teaching of remedial reading for the handicapped. It was then tried out with pilot subjects at the elementary and secondary grade levels as a check on its workability.

Elementary and Secondary Materials: Inherent within these instructional materials were design characteristics which reflected certain principles of learning generally considered to be essential for efficient mastery of the task at hand. Thus, immediate positive reinforcement was stressed throughout; instructional provision was made for both drill and practice and prompt application of the newly learned material in meaningful form; allowance was made within the materials for diagnostic and remedial looping geared to individual needs; and the materials were structured so that bright learners could move rapidly and selectively ahead without penalty. After pretesting various alternatives, the IBM Selectric typeface Letter Gothic was selected as most suitable (the typeface used here).

The resulting AIR/Optacon Instruction Manual included both student and instructor materials, which were placed in three-ring binders in order that single pages could be taken out and affixed to the tracking aid for study purposes. These instructional materials were submitted to the U.S. Office of Education as a separate product of this project, following their revision in Phase II of the project. Inasmuch as they contain a complete rationale and instructions for their use, they will not be extensively described here. The complete Table of Contents for these materials is shown in Appendix A-1.

An overview of the contents of these materials places in perspective the kinds of learning experiences that were engaged in by the subjects of the study. Initial experience is given in the discrimination of basic vertical, horizontal, diagonal, and circular shapes. Letters are introduced in the approximate order of their frequency in words. Lessons within the various instructional units were addressed to specific skills development. For example, in Units 3-9 dealing with the alphabet, lessons were included for capital letters, for lower case letters and for a mixture of the two; while in Unit 14 some eight lessons were included for gaining experience in reading diverse materials, including a tape recorder guarantee, a library catalog card, a pamphlet, a booklet, a reference book and a portion of a newspaper. Unit 15, concerned with remediation, could be bypassed completely if the learner had no difficulty in recognizing or discriminating among different numerals and letters.

As students completed the manuals they moved into independent reading. AIR sent monthly "notes" to the schools which could be used as supplemental reading. Mainly, the students chose local materials of special interest and set goals for themselves as to how rapidly and how many pages they wanted to read.

Sample pages from the various instructional units in a student manual are

shown in Appendix A-2. Appendix A-3 shows an example of instructor materials. Appendix A-4 shows the monthly goal planning sheet and criterion exercises as used in Phase II.

Primary Materials: On an experimental basis, instruction was attempted with several first and second grade children who were learning to read and spell. On the premise that letter by letter decoding was slow and might not be essential for beginning readers, it was decided that a "whole word" approach would be used. This proved to be quite feasible insofar as this limited number of special cases was concerned. Appendix B-1 shows the Table of Contents for the Primary Whole Word Approach manual. Appendix B-2 shows a sample of student's materials and Appendix B-3 a sample of the instructor's materials.

Instructional Plan

Instruction took place during three semesters. Phase I consisted of one semester (February to May, 1973).* Phase II consisted of two semesters (October 1973 to May 1974). At the outset of the 1973 spring semester, AIR project staff conducted one and one-half day training sessions at each of the cooperating schools. These sessions were intended to (a) familiarize teachers with the instructional materials package, both in terms of content and in the way that instruction should proceed; (b) explain the nature of the testing program, the instruments, procedures for administration, and reporting requirements; and (c) demonstrate the use of Optacon equipment in a teaching

* The reader who may be interested in the full details of the Phase I study, Weisgerber, R.A., Crawford, J.J., Everett, B.E., Lalush, S.E., and Rodabaugh, B.J. Educational Evaluation of the Optacon (Optical-to-Tactile Converter) as a Reading Aid to Blind Elementary and Secondary Students. Interim Technical Report, Phase I. Palo Alto, Calif.: American Institutes for Research, September 1973. (AIR-34500-9/73-ITR), may obtain a copy from ERIC Document Reproduction Service (EDRS), P.O. Box 90, Arlington, Virginia 22100.

situation. (In addition to AIR's one and one-half day of training, Telesensory Systems, Inc., the manufacturer, was responsible for instruction of the teachers in the operation and care of the equipment itself.) Each site was revisited by AIR staff during the semester to observe and advise on instructional procedures as they were being employed.

Some 46 Optacons and lesser amounts of ancillary training equipment were made available for purposes of this educational evaluation. At each site, "learning stations" were established to which the students reported for instruction (a suggested half hour daily during regular school hours.) However, at several sites, an itinerant teacher transported equipment between schools daily to meet with several students. Elementary and secondary level students were necessarily taught separately, since the lesson materials were designed to be age-relevant and were thus somewhat different in content.

A key instructional treatment variable was the student/teacher ratio. Ratios of 1:1 were conducted in tutorial fashion, with the teacher observing the visual display and assisting the individual student to work with an Optacon. Where 3:1 ratios were implemented, however, the instruction proceeded somewat differently, with three Optacons being connected in a master/slave mode. Thus, only one of the three students would be tracking the camera, and it was this Optacon which would be attached to the visual display. The other two students using the slave machines would only be feeling the image as transmitted from the master Optacon and be unable (directly) to control the rate or clarity of presentation. This instructional procedure meant that even though the operation of the master Optacon could be rotated among the three students, there was, necessarily, a certain "lock-step" quality to the three students' movement through the basic units. Also, while it would appear economical (in terms of requirements for teacher time) to teach several students at once, it was evident that in a 3:1 ratio students would have proportionately less opportunity to receive personalized help. Once the students in the 3:1 groups had achieved mastery of the first nine

instructional units dealing with numerals and the alphabet, they were allowed to study separately even though they still had to share the teacher's time.

The principal objective of all initial first semester instruction was the completion of the basic manual since it was structured so as to develop skills thought most crucial to Optacon reading fulfillment. In the second semester, the students who had begun training in the spring completed the manual and began a program of individual study using materials of their own selection together with supplemental monthly materials supplied by AIR. Throughout the second and third semesters students became less dependent on the teachers for close tutorial help. More and more they spent their Optacon study time reading silently and privately, only calling on the teacher when special difficulties were encountered, especially in the vocabulary and the format of some materials.

During the latter stages of the study, when many students were in the third semester of instruction,the teachers were heavily involved in helping students locate materials appropriate to their interests and abilities. As will be mentioned elsewhere in this report, a number of novel ideas were forthcoming which helped to sustain student motivation.

Evaluation Plan

Population: For reasons of practicality, necessitated by the limited numbers of tracking aids and visual displays available to the researchers, schools were not considered for participation unless there were enough qualified blind students in attendance to warrant establishment of a learning station. Among the schools who expressed willingness to participate, preference was given to those who were located at points providing geographical balance to the overall study and providing future demonstration capability. Efforts were also made to include at least some schools that employed each of the different instructional philosophies of residential, public itinerant and public resource schools. Altogether, 15 schools and school districts,

with some 112 blind students, were involved.

To be qualified for inclusion in the main study, schools were asked to nominate students who were braille readers at 50 WPM or more, who had no additional handicaps that would interfere with learning, who were within the range of grades 4-12 and had parental or institutional consent. In actuality, about one-fourth of the students nominated by the schools fell below the 50 WPM braille standard.

A limited number of students who, on one or more of the criteria, were inappropriate to be included in the main study were observed as special cases to further test the potential of the Optacon.

Instruments: Data collection was accomplished through administration of the following measures (administration guidelines and specimens of these measures, other than the standard intelligence tests, are included in Appendix C).

- A measure of intellectual functioning. Intellectual functioning is a student characteristic which may be related to learning to read with the Optacon. Accordingly, the verbal scales from the Wechsler Intelligence Scale for Children (WISC) and the Wechsler Adult Intelligence Scale (WAIS) were administered orally by qualified persons, or scores were obtained from records if administration had been within 18 months. The WISC was used with students up through the age of 15; the WAIS for ages 16 and up. These instruments have an extensive history of use with blinded subjects, both for research and in applied educational settings.

- A measure of tactile discrimination. Inasmuch as the Optacon is an optical-to-tactile converter, the student's ability to discriminate tactually may be an important variable in learning to read with the Optacon. The Tactile-Kinesthetic Form Discrimination Test (Hammill and Crandall, 1969), was used and is referred to in this study as the tactile ability test. The test consists of geometric forms embossed as three-dimensional figures on thin plastic sheets. Common geometric forms are represented. Subjects are asked to either identify the form which is different from the others in a set or to identify a form which matches an example. The test has been previously used with blind subjects for experimental purposes.

- A measure of braille reading. Braille reading speed and comprehension were used in the study to determine whether the student's previous braille reading competency is related to his developed ability with the Optacon. Adapted portions of the reading subtest of the Comprehensive Tests of Basic Skills were prepared and then transcribed into braille with the publisher's permission. The passages chosen were checked for difficulty level using the Fog Index (Klare, 1963) and found to be at the 4.5, 8.6 and 11.7 grade equivalents, providing a range of difficulty suitable for the fourth through twelfth graders in the study.

- A measure of accuracy in English language spelling. In order to qualify, the students in this study were to be braille readers. Braille contains many contractions which are spelled differently from a word, or part of a word, in typical written English. The Diagnostic Spelling Test was

developed to determine whether the student used braille contractions as the basis for his spelling or in fact had general spelling problems. It was orally administered. Test items consist of words having typical braille contractions which are spelled differently from their form in written English. The data from this measure yielded a student "readiness" characteristic and the relationship between this measure and reading competency with the Optacon was explored.

- A measure of student attitude toward education and self-concept. Two major purposes of this attitudinal measure were: (1) to indicate whether there was a relationship between the initial state of these attitudes and Optacon reading competency, and (2) to indicate whether learning to use the Optacon brought about changes in blind students' attitudes toward their own potential as learners. The instrument selected was an adaptation of a measure, the Would You test, developed by AIR and previously used in an Office of Education supported project (Weisgerber, Coles and Everett, 1972). This test was presented in braille form to the blind students.

- A measure of student attitude toward the Optacon. An Optacon attitude inventory was developed especially for the project and produced in braille form. The inventory was used to examine whether there was a change in student attitude toward the Optacon over the period of the project. The instrument focuses upon present feelings toward the Optacon, the use the subject believes might be made of it in the future, the perceived importance of the Optacon relative to other devices, the perceived ease of use of the equipment, and the appropriateness of learning materials the student has used during the project.

- Activity log. A weekly record of teaching/learning progress was kept throughout the study by the teachers. This log provided a record of criterion performance, time spent per unit, and the teacher's evaluation of the adequacy of the materials and learner performance, and any special problems occurring. During Phase I the log also was used to collect information about the amount of equipment use and any associated problems for transmittal to the engineering evaluation contractor, Franklin Institute Research Laboratories.

  In Phase II the progress of students was reported on a monthly basis. The activity log provided a means for recording study time according to the day/week in which it occurred and whether it took place in or out of school. As in the prior semester, teachers were again asked to evaluate student performance in tracking technique, tactile technique, word attack and interest level and to make any anecdotal remarks which would explain what took place during the month.

- Criterion measures of Optacon reading. A multi-part criterion measure of performance on the Optacon was administered to determine speed and accuracy in reading with the Optacon as well as the range of uses to which students were able to apply their Optacon skills. The various parts consisted of:

  1. Several samples of reading speed,using brief paragraph selections to be read aloud. The selections were formed from the 300 most commonly used words taken from the American Heritage Word Frequency Book (Carroll, J.B., Davis, P., and Richman, B., 1971).
  2. Several samples of reading speed,involving short paragraphs utilizing vocabulary drawn from the instructional materials.
  3. A sample of reading speed adapted from the Comprehensive Tests of Basic Skills, an abbreviated version of that used

in the initial braille reading assessment. The sample consists of one paragraph at or below the learner's grade level.

4. A second sample of reading speed using an additional adapted passage from the CTBS consisting of a paragraph at or slightly above the learner's grade level.

5. Seven items concerning possible home and school applications of the Optacon, including reading other typefaces, locating a phone number from a page of the telephone book, reading a newspaper headline, reading a catalog price, finding a page in a table of contents, and distinguishing labels from harmful and harmless pharmaceutical goods.

To place the above measures in meaningful perspective, essential background information was accumulated on each subject relative to sex, age, duration of blindness, experience with typing or print, and physical handicaps other than blindness.

The scaling of the measures for analysis purposes is described in Appendix D.

Procedures for Data Collection

AIR personnel visited each site and held orientation sessions with the teachers involved to explain the purpose of the study, the nature of the instructional materials and the importance of adhering to the plan for data collection for the entire duration of the study. Table 1 shows the evaluation plan for the study, including the treatment groups and sequence of test administration. Each teacher was given a packet containing instructional materials, data collection instruments and a guide to their use (Appendices A, B & C). With the exception of the intelligence test, all measures were administered by the teachers.

AIR staff also visited the cooperating schools each semester to observe the students' reading of typical materials and make note of students' and teachers' views about Optacon training.

TABLE 1

EVALUATION PLAN FOR PHASE I AND PHASE II

Groups	N*	Predictor Tests	PHASE I: Measures During First Semester	PHASE I: End of First Semester Measures	PHASE II: N*	PHASE II: End of Second Semester Measures
Elementary Cohort 1:1 Ratio	17	A, B, C, D, E	F, H	C, G, H	21	C, G, H
1:3 Ratio	19					
Secondary Cohort 1:1 Ratio	19	A, B, C, D, E	F, H	C, G, H	37	C, G, H
1:3 Ratio	16					
Special Cases	10	A, B, C, D, E	F, H	C, G, H	5	C, G, H

Measures consist of:

- A Braille Reading Ability
- B Tactile Ability (Tactile-Kinesthetic Form Discrimination)
- C Attitude toward Education and Self-Concept (Would You)
- D Diagnostic Spelling Test
- E Intellectual Functioning, verbal scales
- F Activity Log: time and performance
- G Optacon Reading Criterion: speed, accuracy and variety
- H Attitude toward Optacon

* The different N's in Phase I and Phase II are attributable to attrition and promotion in grade level. See Appendix E.

Limitations of the Study

The conduct of this study was constrained by several considerations that should be kept in mind as the following Results section is reviewed. These considerations, and their collateral limitations, are:

- Selection of subjects could not be accomplished on a random basis since several cooperating schools had to involve all of their students who met the qualifying criteria. This restriction was imposed by the larger study requirement of a sufficient number of cases at each site to warrant the assignment of a complement of the limited Optacon training equipment.
- While representation from residential, public itinerant, and public resource programs was purposely sought, there is no assurance that the schools selected are truly representative of those respective programmatic approaches. Residential schools, for example, vary considerably in the type of students served and the three residential schools cooperating in this study were not selected to represent these differences.
- The ideal amount of daily Optacon study during the regular school year day was constrained by the press of other school coursework. A decision was made at the outset that after-school study sessions were unsuitable partly because of possible student fatigue and also because of the psychological burden it would place on teachers and students (even if they volunteered) and the special problems of transportation and general logistics. During the second semester one school did attempt some after-school instruction but it did not result in an efficient and regular instructional program. It might be well to think of Optacon instruction as analagous to mobility training, in which the allocation of specially trained professionals and appreciable blocks of time are advisable to accelerate the achievement of functional performance.

RESULTS FOR THE MAIN STUDY

Longitudinal Cases: Overall Performance (February 1973 - March 1974)

Longitudinal measurement data were obtained for 58 cases (i.e., those persons who had received instruction in both the first and second semester and who had taken the second criterion test). This consisted of 21 elementary students and 37 secondary students (some students had moved from one category to the other with the change of school year). (See Appendix E) For comparative purposes, Phase I results have been recomputed based only on longitudinal participants. The differences between these results and those contained in the Interim Technical Report are generally minor.

The first and most meaningful outcome is that of student performance in reading ink print material. Table 2 shows the reading rates, accuracy and variety of use results at the end of 24 hours (first semester) and 58 hours (second semester) for those tests taken by all main study participants. This roughly equates to one school year of study, assuming instructional sessions run 20 to 30 minutes and absence or other factors interfere with some sessions.

Reading Rates: Inspection of Table 2 indicates that students continued to gain in reading speed during the second semester, on the average about 5 WPM gained for materials read aloud. After 58 hours the mean rate was 12.3 with a range from 2.1 to 37.2 WPM. Measured reading rates varied according to the type of material being read and whether the reading was silent or aloud. Not surprisingly, paragraphs based on the common 300 words proved easiest to read, at an average 14 WPM. This reflects the ability of many students to recognize the whole word rather than depending on letter by letter decoding. Passages constructed of words which had been previously studied in the instructional materials were only slightly more difficult at a 13.5 WPM average. The Comprehensive Tests of Basic Skills standardized test passage that was common to all students was at the 8.6 grade level of difficulty and was read at an average 10.9 WPM. The abstractions in the passage perhaps made contextual cueing more difficult and, in any case, it was more difficult for students at the lower grade levels because of the vocabulary used.

TABLE 2

SUMMARY OF OPTACON READING CRITERION RESULTS*

CRITERION	AFTER 24 HOURS N=54		AFTER 58 HOURS N=58	
	MEAN	STD.DEV.	MEAN	STD.DEV.
WORDS PER MINUTE				
SILENT	N.A.	N.A.	13.5	7.9
ALOUD	7.5	5.1	12.3	7.3
COMMON WORDS	7.6	5.8	14.0	8.9
VOCABULARY WORDS	8.4	5.1	13.5	7.7
STD. TEST PASSAGE (ORION)	7.1	4.9	10.9	6.9

	MEAN	STD.DEV.	MEAN	STD.DEV.
PERCENT OF WORDS READ ACCURATELY				
ALOUD	89.4	11.3	93.0	7.7
COMMON WORDS	87.9	17.5	95.2	6.4
VOCABULARY WORDS	89.6	12.9	94.1	7.5
STD. TEST PASSAGE (ORION)	85.5	15.3	91.0	10.3

	% OF STUDENTS SCORING ACCEPTABLY	% OF STUDENTS SCORING ACCEPTABLY
VARIETY OF USE ITEMS		
ITALIC PRINT	38	71
BOOK PRINT	42	78
TELEPHONE NUMBER	27	36
NEWS HEADLINE	36	48
CATALOGUE ITEM	35	60
BOOK INDEX	35	52
MEDICINE LABELS	40	71

* Includes only those subjects who completed two semesters of study.

The importance of difficulty level in the instructional material as an influence on reading speed is made clear in Table 3. It should be recalled that all students had two standardized passages included in their criterion tests. Elementary students (grades (4-8) read a passage at the 4.5 grade equivalent of difficulty while the secondary students (grades 9-12) read a passage at the 11.7 grade equivalent of difficulty. Both groups also read the passage entitled "Orion". Table 3 clearly shows that elementary students read more rapidly on the "easier" of their two passages and the same was true for secondary students.

Where both groups read the same material there was virtually equal performance for all of the students. However, when elementary students were reading material at their grade level and the secondary students were doing likewise, the elementary students seem to read appreciably faster, on the order of 6 WPM or more. Although it would appear that elementary students read relatively faster, this inference may be unwarranted in view of the fact that elementary students had devoted higher amounts of time to Optacon study than secondary students (an average 65 hours vs 54 hours). The positive relationship between study time and attained reading skills is discussed more fully elsewhere in this report, but may well account for the difference noted here.

The reader should realize that the rates shown in Table 2 and Table 3 are probably conservative for at least two reasons. First, students generally read faster in their lesson material than they did on the tests. Second, the emphasis on accuracy almost certainly caused the students to read more slowly than if this were not being measured. A check was made on whether reading speed was being held down by the requirements for word for word reading accuracy that are imposed on the students when reading aloud. After silent reading, the students were asked to state what the passage was about, indicating enough key words and overall meaning to the teacher in order that she could verify that the passage(s) had been read rather than skimmed. The teacher then certified on the criterion test that the passage had been read and understood. Only certified passages were included in the calculations shown in Table 2 for silent reading, in which the students read roughly 1 WPM faster than when reading aloud.

TABLE 3

COMPARISON OF READING SPEEDS FOR ELEMENTARY AND SECONDARY STUDENTS ON STANDARDIZED TEST PASSAGES (SECOND CRITERION TEST)

GRADE LEVEL DIFFICULTY OF PASSAGE	ELEMENTARY			SECONDARY		
	Mean WPM	Std. Dev.	N	Mean WPM	Std. Dev.	N
4.5	14.4	7.8	21	N.A.	N.A.	N.A.
8.6 (ORION)	11.3	7.0	21	11.6	7.2	37
11.7	N.A.	N.A.	N.A.	8.0	4.8	37

Reading Accuracy: Table 2 also displays the relative accuracy of reading at the end of the first and second semesters of study (after 24 and 48 hours, respectively). While accuracy was in the 85 to 89 percent range at the first testing, a quite respectable range, it moved upward to a 91 to 95 percent range, an even more impressive range.

In interpreting these results it is clear that, when reading narrative material, Optacon students at all levels made very few mistakes in word recognition. Even in those instances where words were marked as wrong, the alternative word given was often similar (e.g., live/like) or the word was a strange one (e.g., Orion). It seems clear that the context and syntax of sentences supplied later clues which would retrospectively clarify some ambiguous words, hence for all practical purposes, students were reading with at least as much correctness as is necessary for general meaning.

Indirectly, this is borne out by the data in Table 2 showing 13.5 WPM read silently. The increased speed for silent reading may not be great in absolute terms, but it is appreciable in view of the fact that initial instruction was generally aloud and silent reading practice had not been extensive.

Variety of Use in Reading: One assumes that a major potential value of the Optacon would be in allowing the blind reader to gain useful information from a variety of materials, not simply those that were printed in clear, non-serifed type and in narrative format. Table 2 indicates students' level of success in dealing with seven such tests of variety of use where flexibility, tracking and manipulation of Optacon controls become critical. In each kind of item the students progressed sharply from one semester to the other in this ability. Book print, which was the least "different" from the basic instructional materials, was read acceptably by 78% of the students, while italics were more difficult. Items requiring some searching and scanning (catalogue item, medicine labels, book index) were also accomplished by a majority of the students. However, items in which the quality of print was degraded (telephone book entry, news headline) were still quite difficult, with fewer than half the students correctly identifying them.

In interpreting these results it is appropriate to keep in mind two things. First, the requirements to reach acceptability varied from item to item (see scaling description in Appendix D), as a function of the need for precision. Thus, in identifying the telephone number, the student not only had to recognize the name of the person to be "called" from among similar names, but he had to correctly read all numbers...one wrong digit would not correctly complete the call. Second, the reading of labels and other unusual print materials was not emphasized in instruction until the second semester. Further practice on applications of greatest use to students, such as book indexes, would likely raise the percent of acceptable identifications appreciably. Figure 2 shows graphically the growth in the students' ability to read various items in print form after 24 and 48 hours of study.

Affective Outcomes: Another potential benefit of Optacon training is attitudinal in nature. Presumably, a student with a new avenue for information acquisition might have a more favorable self concept, including the perception of self in relation to education. Furthermore, as the student gains familiarity with the Optacon he or she may shift in

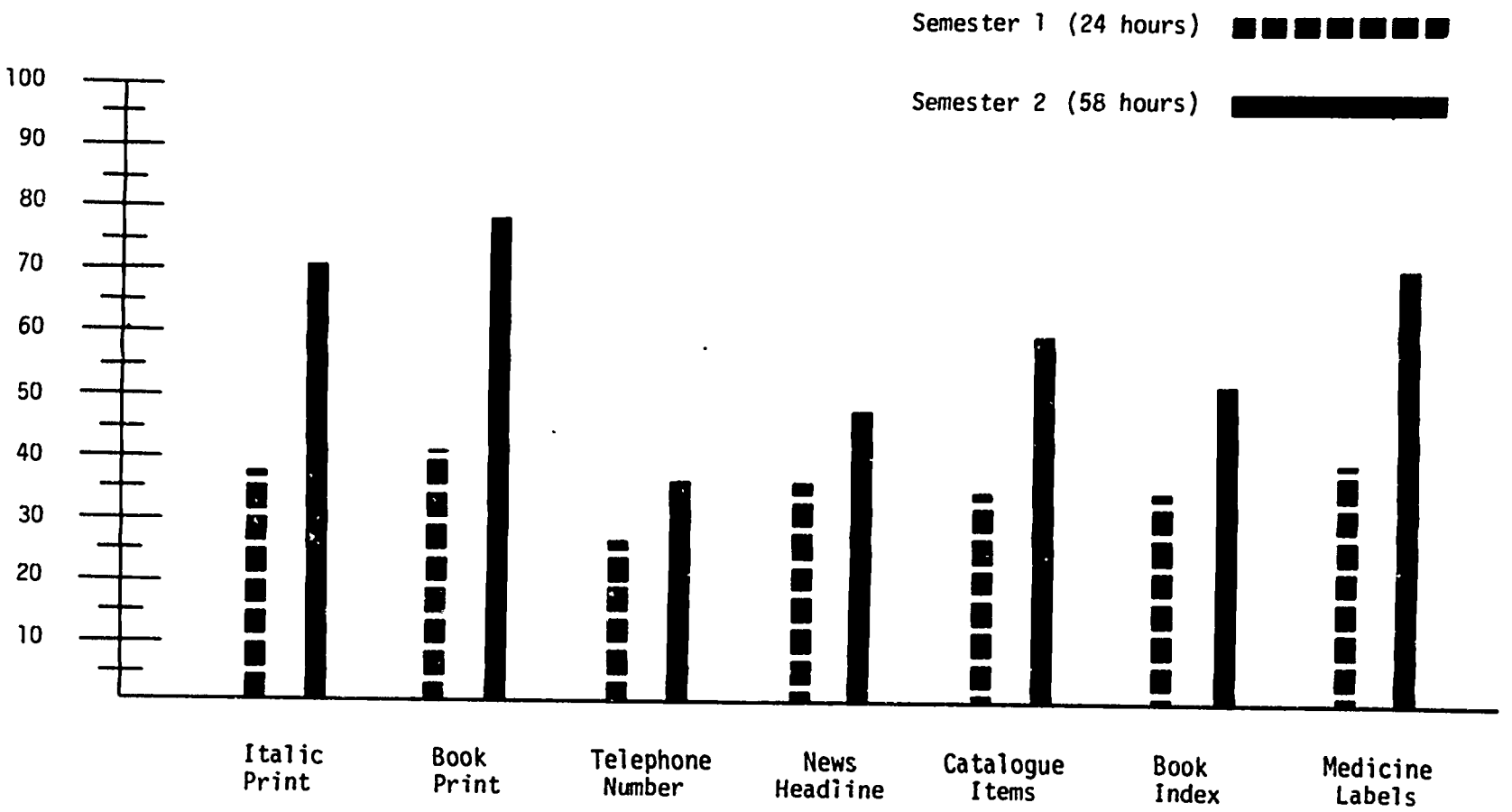


Figure 2 . Student growth on Variety of Use items after first and second semester.

attitude toward the device itself. In particular, they may develop a preference for it in relation to other reading alternatives when the reading material is accessible in various ways.

Table 4 shows the effects on these affective components as measured at three points in time during the course of the study. It is evident that self concept as defined by the measure used in this study remained unaffected by Optacon training. There is no evidence that the students felt differently about themselves and their educational capabilities as a result of this experience.

Although attitude toward the Optacon tended to decline slightly over the two semesters, this was not at a significant level and may reflect uncertainties of whether the Optacon might not be available to them in the coming year.

As shown in Table 4 , preference for the Optacon over other devices was at a middle level, with means near three on a five-point scale. This scale is derived from the student's ranking of the Optacon in relation to braille, tape, readers, and talking books, if he were given a choice about how to learn new lessons at school. This is an interesting finding, in that tape recordings and talking books were rated lower. However, preference for Optacon declined significantly over the period of the study. Whether this decline is attributable to disappointment with the Optacon as a tool or a realistic appraisal of their own modest skill in relation to the volume of school lessons to be learned is unclear. Anecdotal information obtained during site visits would suggest that both factors seem to be operating.

Developed Skills and Interests: Toward the end of training in May, 1974, AIR staff observed the students' level of developed skills and interest. Table 5 summarizes the AIR staff observations on over 50 students. Three quarters of the students had developed tracking skills that were average to excellent. Over 55% had developed average to excellent tactile techniques. Over 90% had developed average to excellent word attack skills, utilizing context and other cueing aids rather than relying solely on letter-by-letter spelling of words. Over 85% showed average to excel-

TABLE 4

COMPARISON OF ATTITUDES AT
BEGINNING, MIDDLE AND END OF STUDY

Measure	At beginning of 1st semester			At end of 1st semester			At end of 2nd semester			f
	Mean	Std. Dev.	N	Mean	Std. Dev.	N	Mean	Std. Dev.	N	Sig.
Self-concept *	58.5	7.4	56	58.4	8.6	54	58.0	8.7	58	---
Attitude toward * Optacon	24.9	7.5	53	23.4	7.3	54	21.2	6.9	58	---
Preference for * Optacon over other devices	3.2	1.3	53	3.1	1.3	53	2.2	1.2	58	.01

*Theoretical miupoints were 48, 27, and 3 respectively.

TABLE 5

OBSERVATION OF STUDENT PERFORMANCE BY AIR STAFF
AT CONCLUSION OF PHASE II

	Poor	Average	Excellent	N
Tracking Technique	23.1%	34.6%	42.3%	52
Tactile Technique	13.2	18.9	67.9	53
Word Attack	9.6	21.2	69.2	52
Interest Level	13.7	52.9	33.3	51
Manipulation of Controls	2.0	58.0	40.0	50

lent interest in the way they approached Optacon study. And very nearly all of the students had learned to manipulate the controls of the Optacon at average to excellent levels.

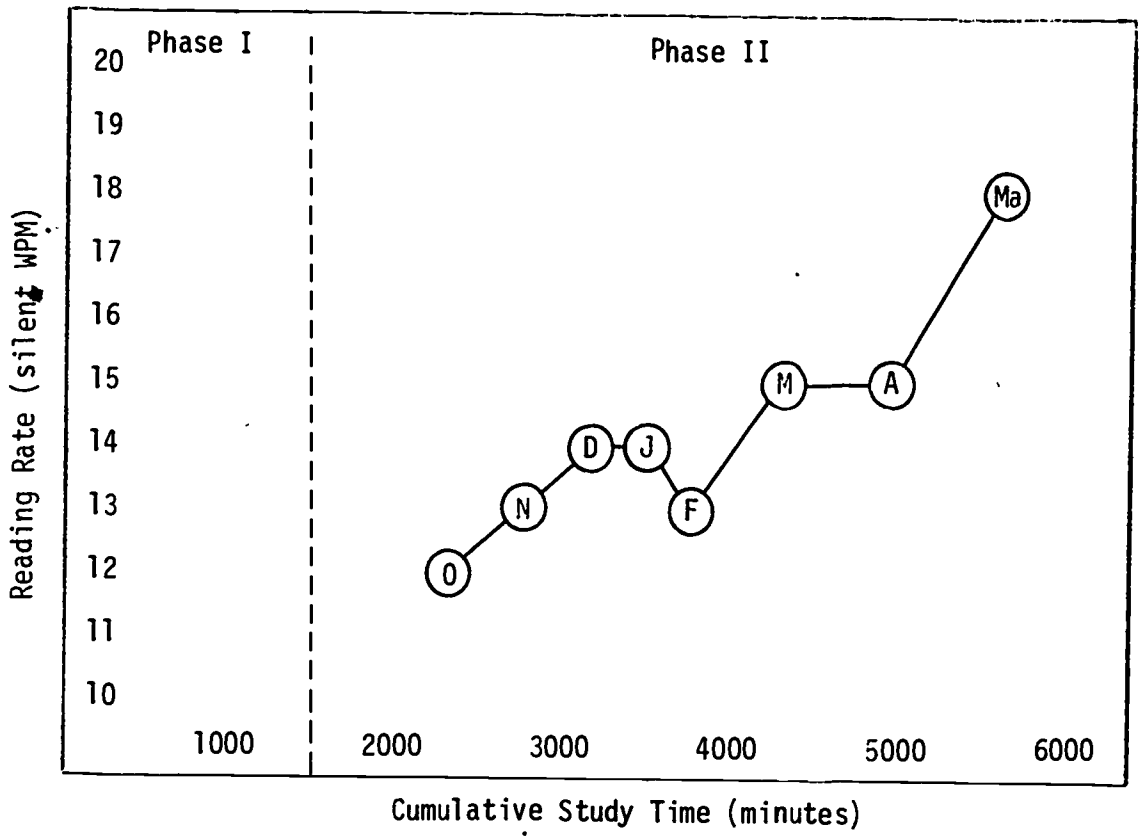
As will be seen in the next section, these ratings by AIR staff tended to be lower than similar ratings by the teachers of these same students.

Additional Indicators of Learner Progress

Monthly Progress in Lesson Materials: During Phase I, when the emphasis was placed on correctly learning how to use the Optacon and how to recognize letters, the students demonstrated their progress on exercises at the end of various instructional units. During Phase II they continued to demonstrate progress on exercises but did so on a monthly rather than unit-by-unit basis. They had already reached a level of independent study and now were attempting to reach self-set reading rate goals. Each monthly exercise generally consisted of two narrative paragraphs which the teacher timed and certified had been read with understanding. It should be understood that these were not tests as such but

rather a way of establishing progress so that appropriate instructional action could be taken at the local level.

Figure 3 shows the summaries of these monthly exercises as to the rates achieved and the increments in study time that were associated with those rates. The reader should note that 1) the typical rate of reading in these materials was somewhat higher than was found on the second Criterion Test given in March, 2) there is a growth from 12 to 18 WPM over the eight-month period, and 3) there was a lull in this progress in the middle of the academic year.



O = October J = January A = April
N = November F = February Ma = May
D = December M = March

Figure 3. Summaries of monthly progress in individualized study, Phase II.

The first finding is probably a reflection of students' reading ability when operating under non-threatening (non-test) situations. The second finding suggests that growth in reading rate would continue if instruction were to continue inasmuch as no leveling out has occurred. According to interviews, the most plausible reason for the mid-year lull rests in the large amount of illness that seemed to be present in the main study group during that period.

Teacher Ratings of Students' Skills: Tracking ability, tactile technique, word attack skills, and a reasonably high interest level are all important to continued progress in Optacon training. Teachers rated students on these dimensions monthly during Phase II. Table 6 shows that "poor" tracking ratings dropped from 14.3% in October to 0.0% in May; "poor" tactile technique dropped from 2.0% to 0.0%; "poor" word attack dropped from 18.4% to 6.7%; and "poor" interest level dropped from 12.5% to 0.0%. "Excellent ratings moved up slightly on all four categories during the same period. These figures are encouraging and indicate progress for many students. These data are clouded, however, by the fact that the N's also decreased during the same period. A number of poorer students were among these lost cases.

Predictors and Process Variables

The outcome data make it quite evident that not all students learn the Optacon with the same ease. A range of 2-37 WPM was previously noted, with a mean of 12.3 for passages read aloud and a standard deviation of 7.3 WPM. It is important that schools have a way of identifying students who can most benefit from Optacon training, since the prospects of supplying Optacons to all blind students is unlikely and probably unwarranted.

Predictor Variables: Table 7 shows the correlations between Optacon reading criterion performance and a number of potential predictors, characteristics that could be determined before involving the student in an Optacon course. The Tactile-Kinesthetic Form Discrimination test used in this study is a very useful predictor of speed, accuracy, and variety of

TABLE 6
SUMMARY OF TEACHER RATINGS OF STUDENT PROCESS SKILLS DURING PHASE II

	TRACKING TECHNIQUE				TACTILE TECHNIQUE			
Month	Poor	Average	Excellent	N	Poor	Average	Excellent	N
October	14.3%	55.1%	30.6%	49	2.0%	46.9%	51.0%	49
November	12.0	50.0	38.0	50	6.0	40.0	54.0	50
December	4.8	47.6	47.6	42	7.1	38.1	54.8	42
January	8.7	54.3	37.0	46	6.5	43.5	50.0	46
February	11.8	41.2	47.1	51	4.0	42.0	54.0	50
March	2.1	41.7	56.3	48	6.3	31.3	62.5	48
April	5.6	38.9	55.6	36	5.6	38.9	55.6	36
May	0.0	31.0	69.0	29	0.0	33.3	66.7	30
	WORD ATTACK				INTEREST LEVEL			
	Poor	Average	Excellent	N	Poor	Average	Excellent	N
October	18.4%	32.7%	49.0%	49	12.5%	50.0%	37.5%	48
November	11.8	35.3	52.9	51	11.8	45.1	43.1	51
December	9.5	38.1	52.4	42	11.9	54.8	33.3	42
January	6.5	47.8	45.7	46	6.5	69.6	23.9	46
February	5.9	45.1	49.0	51	7.8	62.7	29.4	51
March	6.3	35.4	58.3	48	8.3	50.0	41.7	48
April	11.1	27.8	61.1	36	8.3	58.3	33.3	36
May	6.7	43.3	50.0	30	0.0	60.0	40.0	30

TABLE 7

CORRELATIONS OF PREDICTORS WITH
OPTACON READING CRITERION PERFORMANCE AFTER
AN AVERAGE 58 HOURS OF TRAINING (SECOND SEMESTER)

Predictors	WPM (aloud)	WPM (silent)	Accuracy	Variety
Tactile Total	.50**	.47**	.49**	.43**
Tactile Short Form	.48**	.42**	.38**	.42**
Intelligence Total	.39**	.35**	.28*	.15
Information Subtest	.39**	.30*	.36**	.30*
Comprehension Subtest	.26*	.31*	.08	.07
Arithmetic Subtest	.53**	.48**	.44**	.33**
Similarities Subtest	.44**	.39**	.32**	.20
Vocabulary Subtest	.02	.01	-.02	.03
Digit Span Subtest	.18	.13	.03	-.14
Average WPM Braille	.21	.21	.27*	-.03
Sex (Female)	.27*	.28*	.22*	.28*
Age	-.25*	-.23*	.01	-.30**
Grade Equivalence	-.10	-.08	.15	-.20
Number of Years Sighted	-.05	-.04	-.14	.09
Had Prior Experience with Print	.17	.27*	.10	.04
Diagnostic Spelling (English)	.12	.09	.27*	.20
Self Concept	-.01	-.01	.11	-.12

* .05 significance level
** .01 significance level

N = 58

use. Inspection of the responses to items suggested that a short form of the Tactile test would serve quite adequately as a predictive tool, being correlated at the .01 level with all reading criterion outcomes. The ten items comprising the abbreviated Tactile measure are shown in Appendix E.*

Another effective predictor of Optacon reading success was intelligence as measured by the WISC and WAIS instruments. The most highly correlated aspect of intelligence was the arithmetic subtest, with correlations at the .01 level with all reading performance outcomes. The information subtest was also correlated with all reading performance outcomes. The similarities subtest was correlated with speed and accuracy, and the comprehension subtest with speed. The intelligence total was correlated with speed and accuracy but not with variety of use. It is especially interesting to note that vocabulary and digit span, for which an a priori rationale would seem plausible, did not show correlations of any meaningful nature.

Figure 4 shows histograms for both intelligence and tactile ability scores. As can be seen by examination of the intervals in both graphs, the consistency of the relationships to the reading rate criterion is marked.

With such high correlations with criterion performance, it is worth checking whether the intelligence and tactile tests are intercorrelated. An intercorrelation of .54 does exist. The multiple correlation of intelligence and tactile ability with reading rate (aloud) is not appreciably higher than the correlation of either tactile ability or intelligence with reading rate. Nevertheless, it should be borne in mind that greater ranges of tactile ability and intelligence might exist in the blind student population as a whole than are represented in this study. (It will be recalled that braille reading was a prerequisite, and that only a limited number of primary level students were included in this study.) Therefore, since both tactile and intellectual skills are involved in reading with the Optacon, both predictors might reasonably be used.

* Thermoform raised-shape copies of the Tactile measures are available from Dr. John M. Crandell, Jr., Associate Professor of Educational Psychology, Brigham Young University, 118 McKay Bldg., Provo, Utah 84601.

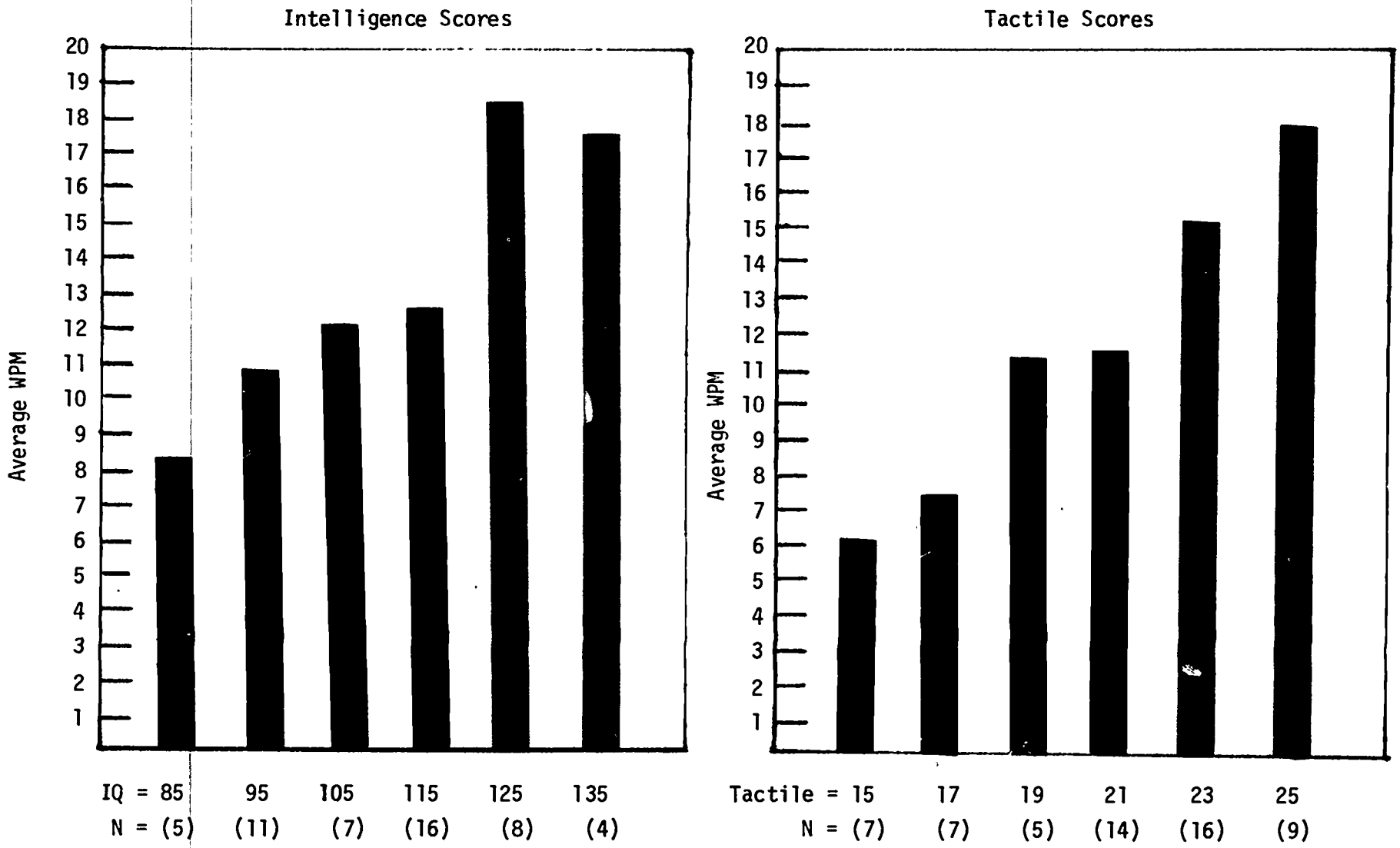


Figure 4. Frequency distribution of attained words per minute by IQ scores and by tactile scores.

A few other variables show a relationship to Optacon success on one or more of the performance measures. Braille does not appear to be a useful predictor, though it is correlated with Optacon reading accuracy.

Female students appear to be more successful at reading with the Optacon, according to the results shown in Table 7 . The top few readers in the study were girls. However, higher scores for females is not uncommon in many educational undertakings and should not be taken as a basis for excluding male students from the opportunity to learn the Optacon.

Table 7 shows age as being negatively correlated with speed and variety of use, but it is not correlated with accuracy. However, this result is very likely an artifact, or at least influenced by the greater study time that the younger elementary students devoted to the Optacon as compared to the older secondary students. (The relationship between study time and speed of reading has been illustrated in the previous section in connection with monthly progress in the lessons; its relationship as a process variable will be discussed shortly.)

The number of years sighted is not significantly correlated with any criterion performance indicators. It should be borne in mind that most of the students involved in this study were congenitally blind, so that these findings are based on relatively little variance.

As indicated in Table 7 , prior experience with print shows a significant correlation with silent reading speed, suggesting that knowledge of letter shapes may be useful. However, this finding is clouded by the absence of a significant correlation with WPM aloud or with accuracy.

Not surprisingly, there appears to be a significant correlation between accuracy and the correct spelling of words in English, as measured by the Diagnostic Spelling Test.

Self concept is not correlated with reading performance insofar as it was assessed in this study.

Table 8 is presented as a profile of low, middle and high Optacon readers in terms of reading rate. Educators who wish to channel students into Optacon training who appear most likely to benefit from it may find this table useful. In this table both the dependent variable of reading speed and the independent variables of intelligence and tactile ability (and their part scores) are displayed together with a standard Z score scale.

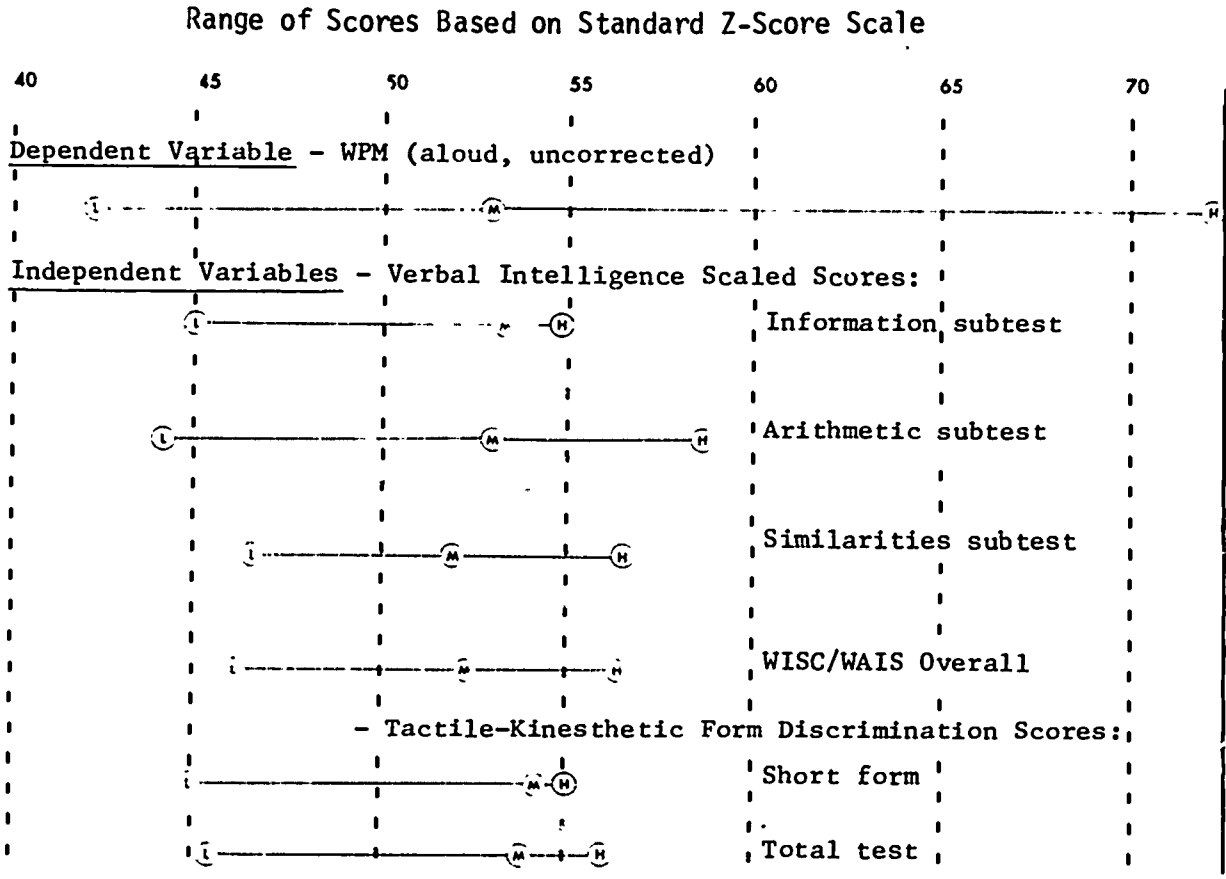
Within the constraints of interpretation imposed by the small N of the main study, and the fact that individual cases vary considerably, the school educator could anticipate that students who read in the range of 0-10 WPM after 58 hours of training would be those whose intelligence and tactile scores fall near the L symbols on the graph. Similarly, medium readers (10.1 to 20 WPM) would be likely to have intelligence and tactile scores near the M positions; high readers (20.1 +) would be near the H positions. For reference purposes, the mean scores and N's for low, medium and high groups on each variable are shown in the columns on the right.

Process Variables: Once the decision has been made to admit students to Optacon training, it is equally important to know what student behaviors will lead to maximum gain in reading performance. Table 9 shows the relationships between six process variables and Optacon reading success.

Tracking (with the hand that controls the camera), tactile technique (with the finger that "sees" the image), manipulation of controls (for clarity and intensity of the image), and the mental processes of word attack skills (deducing plausible words from available cues) are all significantly correlated with the performance criteria. In other words, teachers should expect that students who 1) can rapidly acquire the knack of traversing print smoothly and continuously with the camera, without losing the image or being disoriented during line changes, 2) can lay their finger on the vibrating array in a passive and flat manner, 3) can regulate the controls to optimize the apparent thickness and height of letters, and the vibration level of the array, and 4) can do this simultaneously with mental processing of the stimuli being delivered, are students with real potential to become competent and versatile Optacon users.

TABLE 8

PROFILE COMPARISON OF TACTILE-KINESTHETIC FORM DISCRIMINATION ABILITY AND SELECTED INTELLIGENCE CHARACTERISTICS WITH OPTACON READING RATES ATTAINED AFTER AN AVERAGE 58 HOURS OF TRAINING



	READING GROUPS(1)		
	Low N=25 Mean	Middle N=27 Mean	High N=6 Mean
Dependent Variable - WPM (aloud, uncorrected)	6.5	14.2	28.4
Independent Variables - Verbal Intelligence Scaled Scores:			
Information subtest	9.4	12.2	12.7
Arithmetic subtest	9.2	12.3	14.3
Similarities subtest	10.1	11.9	13.3
WISC/WAIS Overall	103.8	113.3	119.3
- Tactile-Kinesthetic Form Discrimination Scores:			
Short form	6.1	8.2	8.3
Total test	19.1	22.2	23.0

(1) Low = 0-10 WPM; middle = 10.1-20 WPM; high = 20.1 WPM and over.

TABLE 9

CORRELATIONS OF PROCESS VARIABLES TO
OPTACON READING PERFORMANCE AT THE CONCLUSION OF TRAINING[1]

Process Variables	WPM (aloud)	WPM (silent)	Accuracy	Variety
Observed Tracking Skill	.40**	.32**	.49**	.32**
Observed Tactile Skill	.31**	.38**	.19**	.26*
Observed Manipulation of Controls	.25*	.23*	.23*	.44**
Observed Word Attack	.37**	.43**	.36**	.23*
Observed Interest Level	.20	.13	.32**	.30*
Accumulated Study Time	.54**	.55**	.23*	.44**

[1]Based on observations of 58 main study students by AIR staff.

* .05 significance level
** .01 significance level

Table 9 shows that observed interest level is significantly correlated with accuracy and variety of use. While this may be so, the reader is cautioned that during the sessions in which these observations by AIR staff were recorded, evidence of pronounced interest, positive or negative, was not always present.

As indicated elsewhere in this report, there is a significant relationship between the study time invested and the speed, accuracy and variety of use skills that were developed. The importance of time as a con-

dition for Optacon success should not be underestimated. The reader will recall that both intelligence and tactile ability are highly correlated with Optacon success. Table 9 clearly shows that the correlation between overall study time and Optacon performance is not confounded by any of the predictors except age and grade equivalence.

Inspection of Table 9 shows that only age and grade equivalence (obviously highly interrelated) are negatively and significantly correlated with overall study time. Younger students accumulated more overall study time. This is almost certainly a consequence of the greater flexibility in arranging a schedule when the student is taught by one elementary teacher instead of four or five secondary teachers.

The question then becomes, if study time is held constant, does age or grade equivalence make a difference? The answer is no. As shown by the partial correlation with the criterion test reported in Table 10, it is evident that the higher performance of the elementary students is attributable to greater study time.

Situational Factors

Commitment to Study: A critical aspect of any instructional program, and no less the teaching of Optacon reading in the schools, is the regularity and commitment of the participants to adequate study time. Absenteeism among students was a cause of missing data and some attrition among main study participants. Conflicts in the school schedule cut deeply into available time. At the institutional level, this study was carried out with the cooperation of 15 schools and school districts, not all of which were able to devote as much time and personnel to the Optacon program as they might have liked. At the outset of the study, and again at the beginning of Phase II, the schools were encouraged to conduct instruction during school hours with sessions lasting at least 1/2 hour. When students were taught by itinerant teachers or had achieved a degree of independence in their instruction, schools were encouraged to let the students

TABLE 10

CORRELATIONS AND PARTIAL CORRELATIONS OF PREDICTORS WITH THE AMOUNT OF OVERALL STUDY TIME AS OF THE SECOND CRITERION TEST

Predictors	Correlation with overall study time	Partial correlation with criterion test, controlling for overall study time
Tactile Total	.09	
Tactile Short Form	.10	
Intelligence Total	.03	
Information Subtest	.08	
Comprehension Subtest	.03	
Arithmetic Subtest	.16	
Similarities Subtest	.06	
Vocabulary Subtest	-.03	
Digit Span Subtest	.11	
Average WPM Braille	-.05	
Sex (Female)	.17	
Age	-.40**	-.05
Grade Equivalence	-.34**	.10
Number of Years Sighted	-.12	
Had Prior Experience with Print	.07	
Diagnostic Spelling (English)	.01	
Self Concept	-.15	

** .01 significance level

practice Optacon reading outside of school hours and at home. Allowing for conflicts in scheduling, absence or vacations, 400 minutes of study per month under supervision or an aggregate of 600 minutes per month of study both in and out of school were deemed acceptable for purposes of this research.

After comparison of this standard to the study time reported in the schools for the months in Phase II preceding the second test, the sample was divided into groups that had and had not met the recommended guidelines for minutes of instruction. Table 11 shows the reading rates attained by students when the institutional commitment to instruction met the recommended guidelines. Group A shows a steady progression of growth in reading rate, moving from 8.6 WPM on the average after four months of instruction (May, 1973) to 15.3 WPM by March, 1974 and 17.9 WPM by May, 1974 when AIR staff observed the students in the schools. Group B and C show little or no growth.

Treatment Effects

Three treatment dimensions were studied in Phase I. (Appendix E described the population of Phase I, N=71). One dimension was the ratio between students and teachers. Two ratios were used--an individual tutorial in which the ratio was 1:1, and a small-group ratio in which one teacher worked with three students. A second dimension was the use of student teachers. In one condition student teachers were used, under the supervision of certificated teachers; and in the other condition no student teachers were involved. Thirdly, the subjects in the study were either elementary students (i.e., 4th through 8th graders), or secondary students, (9th to 12th graders). Although this variable could be dealt with as a population characteristic, it may usefully be treated as an additional treatment variable and its relative effects will thus be analyzed in conjunction with the other treatment dimensions.

Elementary and Secondary Treatment Groups: Elementary and secondary groups received similar treatments, except for minor differences in materials. As was described previously in the Methods section, the materials

TABLE 11

COMPARISON OF OPTACON STUDENTS WHO MET OR
DID NOT MEET RECOMMENDED GUIDELINES FOR INSTRUCTIONAL PACING

	MAY 1973 CRITERION TEST #1			MARCH 1974 CRITERION TEST #2			MAY 1974 AT TIME OF OBSERVATION		
	MEAN	STD.DEV.	N	MEAN	STD.DEV.	N	MEAN	STD.DEV.	N
GROUP A (1)									
WPM	8.6	6.0	28	15.3	8.2	29	17.9	9.5	28
ACCUM. HOURS	29.2	9.9		77.2	19.1		98.8	23.4	
GROUP B (2)									
WPM	6.2	3.5	18	10.2	4.9	20	8.3	6.3	17
ACCUM. HOURS	20.5	5.1		40.8	10.8		50.0	14.4	
GROUP C (3)									
WPM	6.7	2.9	9	7.6	3.0	9	5.2	2.0	9
ACCUM. HOURS	19.2	6.1		34.7	12.2		36.2(3)	13.9	

(1) Group A met or surpassed guidelines.

(2) Group B did not meet guidelines.

(3) Group C did not meet guidelines, observation took place in March.

for each group were slightly modified to provide enrichment exercises appropriate to grade level. The instructional strategies used throughout the materials, the content of units as well as their sequence, and the criterion exercises were essentially the same for both sets of materials.

Mean differences on all criterion measures for elementary and secondary groups, as well as for the other treatment factors, are presented in Table 12. The overall reading rate for both elementary and secondary groups was slightly over 6 WPM. The small advantage displayed by the secondary group, 6.6 WPM versus the 6.1 WPM of the elementary group represents neither a statistical nor a practically useful difference.

With respect to overall accuracy, there was a statistically significant difference between the groups at the .05 level. The mean accuracy of the elementary group was 82% and the mean of the secondary group was 90%. However, mean accuracy did not markedly differ between groups on any part of the Criterion Test except Part 1. Comparing the two groups in the Orion exercise, we find that both groups are reading at an accuracy level of better than 80%, and there is no significant difference between the two groups.

A consistent lack of significant differences between groups was found across the variety of use measures (mean scores 1.96 and 1.94). It is also clear from Table 12 that there were no significant differences between treatments on any of the five affective measures.

1:1 versus 3:1 Student/Teacher Ratios: With respect to reading rate there was no significant difference between student/teacher ratio treatments either in overall rate or rate on specific parts of the Criterion Test.

With respect to accuracy, a statistically significant advantage is found for the 3:1 ratio group. The 1:1 group had a mean accuracy of .81; while the 3:1 group displayed a mean accuracy of .91, a significant difference at the .01 level.

TABLE 12

COMPARISON OF TREATMENT GROUPS;
ELEMENTARY/SECONDARY COHORTS, 1:1-3:1 STUDENT/TEACHER RATIO,
AND USE OF STUDENT TEACHERS, AT END OF FIRST SEMESTER*

Criterion Measures	Treatments								
	Elem. Mean	Sec. Mean	Sig.	1:1 Mean	3:1 Mean	Sig.	Yes St.Tchr. Mean	No St.Tchr. Mean	Sig.
Optacon WPM	6.06	6.58	N.S.	5.83	6.81	N.S.	6.71	6.16	N.S.
Optacon Accuracy	.82	.90	.05	.81	.91	.01	.91	.84	.05
Optacon Variety	1.96	1.94	N.S.	1.84	2.06	N.S.	1.98	1.94	N.S.
Self-Concept	23.47	24.77	N.S.	25.22	22.97	N.S.	24.50	23.96	N.S.
Attitude toward Education	24.56	26.49	N.S.	25.83	25.17	N.S.	25.15	25.64	N.S.
Attitude toward Optacon	18.14	17.49	N.S.	19.31	16.29	N.S.	21.85	16.23	.01
Optacon Present Use	4.94	5.09	N.S.	4.94	5.09	N.S.	5.20	4.94	N.S.
Optacon Preference	3.17	2.86	N.S.	2.94	3.09	N.S.	3.75	2.72	N.S.

*Based on an N of 71 cases.

Both ratio groups performed similarly on the variety of use measures, with no significant differences between groups. Again, no significant differences on any of the affective measures were found.

A major reason for including the 3:1 ratio group in the study was to determine whether any detriment to learning would occur if students did not receive individual tutorial instruction on the Optacon. It appears that, within the constraints of the present study, the 3:1 ratio is fully as effective as the tutorial.

Student Teachers under Supervision versus Credentialed Teachers: This treatment was introduced to determine the effect of utilizing student teachers to carry a major load of the face-to-face instruction. However, in all cases, the student teachers used were supervised by a qualified professional. The results indicate that the only significant difference in reading performance found in comparing the students taught by student teachers with other students taught by qualified professionals is with regard to accuracy, and it is actually in favor of the former group. Of the affective measures, only Optacon attitude yielded significant differences between student teacher and credentialed teacher groups, and again, the student teacher group is higher.

Overview of Treatment Effects: At the end of Phase I, we seem to have established that none of the treatment factors made an important difference. Overall, the grade level, the student/teacher ratio used, and the use of student teachers do not appear to influence learning achievement. We might then infer that Optacon instruction is generalizable across grades, across individual and small-group modes of instruction, and across personnel, including the use of student teachers.

In any case, the 3:1 ratio typically becomes unnecessary once the students have demonstrated that they can read and prefer to become independent users. Such students do not need to be interconnected to each other's machines, to the tracking aid or the visual display. It is clear from observation that even where the 3:1 ratio was used at the beginning of training, the tendency is to break away from lock-step use. Certainly, all students need practice on their own and this should be encouraged.

Administrative Considerations

Students involved in this study were drawn from a variety of school situations in order to achieve the greatest possible generality to the many types of schools that might undertake Optacon training. While the sample of schools was not randomly drawn, it is nevertheless true that a range of schools were involved with respect to geographical distribution, school type (public vs residential), level of experience among the teaching staff, and case loads of the teachers (ratio of Optacon students per teacher).

It was apparent throughout the course of the study that active administrative support was a key ingredient. When administrators were actively involved in bringing Optacon instruction into the school and stayed involved and informed throughout the course of the project, it was apparent that teachers and students responded affirmatively. While this is not surprising, and is probably a characteristic found in most effective school programs, it is mentioned here for one very important reason. A new program such as Optacon training requires innovative thinking and flexibility in the solution of certain recurring problems. These are:

- Scheduling problems - There were a number of approaches attempted by administrators. At the elementary school level, the most effective arrangement was where Optacon training sessions were established cooperatively by the regular teacher and Optacon teacher. At the high school level there seemed to be a more difficult problem. One solution that seemed especially promising was the scheduling of Optacon training as though it were a language arts course, with credit being earned toward graduation.

- Access to equipment - Some schools were quite flexible in making the equipment available to students beyond the regularly scheduled class time; others were more conservative in this respect. Students appreciated the more flexible standards and a number of beneficial results were noted when students were allowed to "check out" the equipment and take it home; or, in the case of residential schools, to have access to it in the evenings.

- Classroom characteristics - Several schools attempted Optacon instruction in work spaces that were substandard in terms of either ambient noise level in the room, adequacy of table space, availability of electrical outlets at convenient locations for Optacon training stations, or security from theft or abuse by curious children. Although successful training for one or more students was achieved in these situations, it was evident from teacher fatigue and student comments that results might have been better if the setting(s) had been more conducive to learning.

- Instructional pace - It is difficult to determine how rapidly students should be expected to progress through the instructional materials. Principles of individualized learning obviously apply, and it is therefore important that administrators not set arbitrary goals about how many lessons or units of study are mastered in a semester. Students should enjoy Optacon training and not feel threatened by it. In participating schools where the greatest progress was shown, various motivational strategies were used. These ranged from candy M&M's for primary students to instructional games for upper grades and even a special field trip (deep sea fishing) for all Optacon participants at one of the schools.

During the course of this study, teacher absenteeism played an important role. This took three forms (in three sites) and had adverse influence on Optacon instruction in all of them. These problems were 1) use of student teachers who were not scheduled to teach for the entire school year, leaving students rather empty handed, 2) teacher strikes, which of course stopped instruction completely, and 3) extended teacher illness, which meant that Optacon instruction was carried out by a substitute who was not adequately prepared for the task. Administrators should be aware of these problems, even though they may be difficult to avoid.

Teacher and Student Comments

Comments of Teachers: Many valuable suggestions and constructive criticisms were offered by the teachers. AIR staff conducted open-ended interviews with 28 participating teachers at the close of the Optacon training, in May 1974. The following list summarizes the main points they made, according to AIR staff notes. The number of teachers commenting is shown in parentheses.

- Optacon training should be a part of the regular school schedule. Students do not want to give up extra-curricular activities. (10)
- More materials are needed at advanced levels emphasizing high interest content. (10)
- Training should start as early as possible, e.g., second or third grade. Students would then more completely integrate the Optacon into their educational plans. (8)
- It would be helpful to have a greater variety of materials, including alternate difficulty levels, so that the teacher could supplement the regular Optacon instruction. (7)
- Regularity of lessons and ample practice are essential. (5)
- Constant drill and the reading of selections below grade level lead to boredom and should be avoided. (4)
- A separate room, minimum distractions and adequate table space are essential. (1)
- Teacher training of 2-3 days is an essential prerequisite. (1)
- Half-hour training sessions are an optimum length. (1)

Teachers were also the source of many useful ideas for motivating students through the use of instructional techniques. During Phase II there

was considerable opportunity for inventiveness at the local instructional level. Some of the innovative instructional approaches were:

- playing table games in which the information is printed on cards.
- visiting local shops to check items on shelves.
- developing new hobbies, such as electronics, using popular magazines.
- participating in school journalism.
- examining college catalogues.
- teacher/student communication through typewriting.
- voting secretly on school ballots.
- "rereading" favorite stories that the student has heard before.

Comments of Students: Students were given an opportunity to express themselves about Optacon learning in general and about the Optacon equipment specifically.

Table 13 presents student evaluations of the ease of Optacon operation, as of March, 1974, the end of the second semester of training. Some 83% of the students apparently felt that learning to track was fairly easy; only 43% felt that reading different kinds of print was fairly easy; and about 71% felt that adjusting the Optacon controls for different kinds of print was fairly easy. These proportions of favorable responses are very similar to, though slightly lower than, the responses to the questionnaire at the end of the first semester.

When asked in what grade the Optacon should first be taught, the majority of students (53%) felt the 4th through 6th grades were most appropriate. Other frequently mentioned grades were the 1st to 3rd (21%). As compared to the first semester, there was a tendency toward centralization of opinion in favor of the 4th through 6th grade starting time.

TABLE 13

STUDENT EVALUATIONS OF EASE OF OPTACON OPERATION
AS INDICATED ON OPTACON QUESTIONNAIRE ITEMS
AT END OF SECOND SEMESTER

Evaluation of Optacon Ease of Operation	Percent and N of Favorable Responses
Learning to track	83% (48)
Reading different kinds of print	43% (25)
Adjusting for different kinds of print	71% (41)
Grade level children should learn to read with the Optacon:	
1 to 3	21% (12)
4 to 6	53% (31)
7 to 8	14% (8)
9 to 12	9% (5)
College	2% (1)
Never	2% (1)

AIR staff conducted open-ended interviews with 75 students during the last site visit. The following list summarizes the main points they made. The number of students commenting is shown in parentheses.

Students' comments about the advantages of Optacon learning centered on four factors:

1) new flexibility about what one can read (in ink-print), (27)

2) the autonomy of selecting what one wants to read without depending on its prior "translation" by someone else, (17)

3) the thrill of discovery about the "world of print" and the use of print previously unknown to them, (6)

and

4) the privacy afforded by a personal machine which (under normal use) is "read" only through the user's finger, enabling the reading of correspondence and other personal documents. (3)

Students' comments about the limitations of Optacon learning focus on these factors:

1) doubts of their own ability to "break the code" and achieve a really functional reading rate, (23)

2) doubts that the machine really meets their needs (e.g., reading of handwriting, colored copy, etc.), (19) and

3) doubts that the extent of exposure to ink-print as provided in the instructional materials was sufficient to achieve really independent use outside the classroom. (16)

Students' comments about the Optacon and its associated equipment of a positive nature centered on:

1) its ease of use, (2) and

2) its ease of adjustment. (2)

Students' comments about the Optacon and its associated equipment of a negative nature centered on:

1) the complexity of mechanical adjustments necessary to achieve "optimal" images, (19)

2) the difficulties encountered in tracking freehand over diverse kinds of print copy, (14)

3) the troublesomeness of setting up and putting away the camera and other peripheral equipment, (9)

4) the occasions when the Optacon or other equipment would malfunction, or seem to malfunction, (5)

5) the cost of the machine, which was known to most of the students and felt by some to be "out of reach," (4) and

6) the noise generated by the Optacon vibrators, which inhibited some of the students who were competent to use the device in classes or the library but chose not to. (3)

Results for "New" Students (October 1973-May 1974)

It was explained earlier that for various reasons including graduation, transfer, and personal reasons, some Phase I students did not continue training in the fall, the second semester. It was decided that new students should be admitted to the study, provided that their access to the equipment in the schools did not conflict with the scheduling of Optacon training sessions for Phase I continuers. This not only meant that additional students might be benefitted but that all Optacon equipment could be fully utilized, and the study would gain information about an additional population, albeit a small one consisting of 15 students.

Appendix D describes the demographic characteristrics for this "new" class of Optacon students. Table 14 summarizes the attained reading rates for the "new" students. It can be seen that the median accumulated study time by March was about 30 hours. Only one person with less time than 30 hours study time was believed able to take the criterion test in March (according to teacher judgment) and that person read very slowly, less than 1 WPM. Five persons with greater amounts of study time took the criterion test and their scores ranged from 2.1 WPM to 10.2 WPM.

Several months later, when the students had completed the academic year, AIR staff observed the students reading paragraphs of information about major U.S. cities (none of which were cities in which the students went to school). As shown in Table 14, all the students were reading, and the range of speeds was 2 WPM to 16 WPM...figures that were generally in accord with the main study group at the time it had finished the equivalent of an academic year.

In view of the limited numbers of "new" students who were given the Criterion Test 2, data for accuracy and variety of use were not sufficient to warrant analysis.

TABLE 14

SUMMARY OF ATTAINED READING RATES FOR STUDENTS ENTERING THE STUDY IN PHASE II

ID	WPM Criterion Test 2 in March	Accumulated Hours to Criterion Test 2	WPM Observation in May	Accumulated Hours to Observation
201	----	29.4	2	53.3
202	0.7	23.5	---(1)	----
203	----	22.7	16	31.6
204	----	18.5	5	28.7
205	----	18.5	5	28.7
206	8.0	70.0	11	92.0
207	4.1	31.8	9	38.6
208	----(2)	29.7	6	50.1
209	10.2	56.4	15	93.7
210	2.1	49.7	5	87.5
211	----(2)	18.6	10	31.8
212	6.9	49.6	4	70.1
213	----	16.2	2	26.3
Median	5.5	29.4	5.5	51.5

(1) This student became disinterested in school work in general and only infrequently attended school; he declined to be observed.

(2) These primary level students were reading in special lesson materials which utilized limited vocabulary. Student 208 achieved 6.3 WPM; student 211 achieved 4 WPM.

Note: Two additional students (214 and 215) began instruction in the second semester but dropped out before the Criterion Test and Observation.

RESULTS FOR SPECIAL CASES

During Phase I of this research ten special cases were studied and complete case descriptions were included in the Interim Technical Report. During Phase II only five individuals were considered to be special cases and data were collected on that basis. Table 15 shows the cases, special characteristics, training period, and disposition of each case. Brief summaries will then be given for the Phase I special cases and more extensive descriptions for the special cases studied in Phase II. This will be followed by an overview of the special cases as a whole.

It should be noted that several students were reclassified following Phase I and were then included in the main study for Phase II. The reason for this reclassification was that their exceptionality was based on instructional differences rather than personal characteristics. Phase I findings indicated that instructional variations could be tolerated quite well in Optacon programs.

Phase I Case Studies

Ten persons were treated as special cases in Phase I. Three (Percy, Keith and Kent) will be described under Phase II case studies since their data spans the entire study. The special cases discussed here consist of one adult, one student with an additional handicap, one student who was taught by a blind instructor, one student instructed on an experimental basis by AIR staff, one student who was cross-age tutored, and two students with prior experience with the Optacon. Brief synopses of these case studies follow. They are described in detail in the Interim Technical Report.

Case: Mike

This student was in the 4th grade and was transported daily from his regular school district into the school district where Optacon instruction was taking place. He was tutored in the use of the Optacon by an 8th grade blind girl who had previous Optacon experience. Mike's intelligence score was 128 and he was 100% accurate on his tactile test. He was also extremely accu-

TABLE 15

SPECIAL CASES DESCRIBED IN PHASE I AND PHASE II

Cases	Special Characteristics (reasons for exception)	Training Period Reported	Disposition of the Case
Mike	Cross age tutored by blind student	Phase I	Reclassified into main study
Cindy	Taught with draft instructional materials	Phase I	Dropped out
Alicia	Prior exposure to Optacon	Phase I	Reclassified into main study
Della	Prior exposure to Optacon; Served as tutor	Phase I	Reclassified into main study
Dottie	Taught by blind teacher	Phase I	Reclassified into main study
Heinrich	Multiply handicapped with severe hearing loss	Phase I	Graduated
Pete	Adult, teacher in participating school	Phase I	Dropped out
Beatrice	First grader, used "whole word" materials	Phase II	Will continue
Percy	First/second grader, used "whole word" materials	Phase I & II*	Will continue
Dylan	Second grader, used "whole word" materials	Phase II	Will continue
Keith	Second/third grader, used regular materials	Phase I & II*	May drop out
Kent	Multiply handicapped, hydrocephalic with paralysis	Phase I & II*	May continue

*Discussed under Phase II Case Studies.

rate during the course of instruction and reportedly caught up to his tutor in terms of his ability to recognize words. It was noted that he consistently tracked on a slant across the words, a characteristic that was also true for his blind tutor. At the end of the first semester Mike had an average reading speed of 17.4 WPM. He was 98 to 100 percent accurate and he was correct on 5 of the 7 variety of use items.

Case: Cindy

This student was in the 6th grade and was considered a special case because she was involved in the pilot testing of the draft instructional materials. Her intelligence score was 134 and she was 96% accurate on her tactile test. She was transported several days a week to AIR where she received her training. She exhibited a deliberate, careful approach in learning to read with the Optacon. By the end of the first semester, Cindy had reached a point where she needed only a minimum of help. She averaged 9.4 WPM and was 93 to 98 percent accurate. She attempted 7 variety of use items and succeeded with 5.

Case: Alicia

This student was in the 7th grade and had prior experience with print and some prior exposure to Optacon training, therefore she rarely used the Optacon manual. Her intelligence score was 116 and she was 96% accurate on her tactile test. For most of the semester Alicia read materials of her own choice under general supervision of a resource teacher. Her tactile technique was good as well as her word attack skills and her tracking ability. She attempted reading her French and Spanish textbcok with the Optacon and seemed to enjoy it. She also took the Optacon into those classes and demonstrated it.* At the end of the first semester her average reading speed was 18 WPM and she was 98 to 100 percent accurate. On the variety of use she attempted 7 items and succeeded on 4 of them.

* Appendix G summarizes the class reaction to the Optacon and their estimation of its noise level.

Case: Della

This student was in the 8th grade, had prior experience with the Optacon and served as the tutor for the 4th grade boy previously described. Her intelligence score was 94 and her tactile test score was 76% correct. Her approach to instruction and to learning was deliberate and consistent. To develop her own skills she spent a considerable amount of time reading paperback books. She also demonstrated the Optacon in her Spanish class. At the end of the first semester her average reading speed was 26.1 WPM. Her accuracy ranged from 69 to 86 percent. She attempted 7 variety of use items and succeeded on 4 of them.

Case: Dottie

This student was in the 11th grade and was 20 years old. She was being instructed by a blind teacher who had minimum personal experience with the Optacon but used a braille version as he followed her progress. Her intelligence score was 116 and her tactile test was 96% correct. During instruction Dottie had considerable trouble in remembering not to "scrub" with the finger receiving the stimulus. Dottie also seemed to have poor tracking and word attack skills. Frequently she would guess at the letters within words in such a way that it showed little understanding of contextual cues. At the end of the first semester she was reading at an average speed of 7 WPM. She was 75 to 92 percent accurate and succeeded in only 2 of the 7 variety of use items she attempted.

Case: Heinrich

This student was in the 12th grade and was multiply handicapped, having a hearing impairment that was very severe in some frequencies, limiting inward communication by the teacher. His intelligence score was 140 and he was 100% accurate on his tactile test. Because of his familiarity with German and the Optacon teacher's ability to speak it, this was sometimes resorted to as a way of clarifying instructions. He preferred to read through a complete phrase or line before receiving corrections and help from the teacher. He would complain about the Optacon vibration on his finger and frequently had to rest. At the end of the first semester his average reading speed was 5.3 WPM and he was 86 to 97 percent accurate. He attempted 6 variety of use items and succeeded on 1.

Case: Pete

This student was a 40 year old adult blind teacher. No intelligence test scores were available. He was 92% correct on his tactile test. Pete received his instruction from another teacher at the school. He had a great deal of difficulty in recognizing letter shapes and did not seem to be able to make the necessary tactual discriminations. He was very dependent on contextual clues in his reading and progressed very slowly. At the end of the first semester his reading speed was 1.5 WPM but he was 100% accurate. He did not attempt the variety of use items.

Special Case Studies in Phase II

The five students described as special cases consist of four children who were either first or second graders at the time they entered the study plus one child who was multiply handicapped.

Case: Beatrice

This female student was six years old and in the first grade in a residential school. She began Optacon study in October, 1973. Her level of social maturity was 111, as tested with the Maxfield-Bucholz test for preschoolers. Cause of blindness was listed as microthalmus. She was just starting to learn braille. Her tactile test score was 60% correct. Her behavior in class was characterized as hyperactive, and her attention was constantly shifting away from the topic under study. It was decided to try her on the Optacon with the understanding that she would have lots of short breaks at first, and, through the use of M&M incentives she would be encouraged to work longer periods with the machine. This technique worked fairly well, and as the year went on the Optacon period (something she looked forward to) contributed a little toward settling her down.

She used the Primary Level Whole Word Approach materials provided by AIR. Beatrice said she "liked to learn new words more than reading ones she already knew" but nevertheless exhibited great pride in demonstrating her well learned vocabulary. She did demonstrate her ability to read words that were not in the vocabulary but which were nevertheless familiar

to her. For example, she read a story about a field trip to the zoo. It had been written by her class and she was familiar with the terms used, even though some were very long and complicated. Sometimes her teacher would play word games with her, and she suggested that rhyming words, sentence completion and other techniques be added to the basic whole word stories.

Beatrice had very poor tracking skills and was unable to use the camera independent from the tracking aid. She was too immature, according to her teacher, to learn how to set the Optacon adjustments to get "good" images or to put the camera away. Her finger was generally not flat on the array of vibrators.

Beatrice spent approximately 30 hours in Optacon study over the span of the year. By March she was reading at 4 WPM in her own materials. Slow speeds were partly caused by her tendency to go back over words even when she had already read them. By May, when she was observed by AIR staff, she had reached 10 WPM, though only for very short reading passages...her real interest was to have interaction with the observer.

Case: Percy

This male student was in the second grade at a public school. His blindness was caused by retinoblastoma. He began Optacon study in February, 1973, when he was in the first grade and six years old. His intelligence was 144 using the WISC test. He was 96% correct on the tactile test and was learning braille concurrently with his Optacon instruction. He took the diagnostic spelling test (which was not designed to be at his grade level) and was correct on 33% of the words.

Percy is a very energetic, quick and endearing child. His memory is good, as evidenced by his ability to remind visitors of their promises made many weeks before. His approach to Optacon instruction was one of confidence and eagerness, and during the early stages of Optacon instruction said he was "going to save his own money to buy one." By the end of the second year he had accumulated $260.

He used the AIR Primary Level Whole Word Approach materials, and enjoyed the stories. Draft versions of these stories were prepared by his teacher. The vocabulary and story characters were paralleled in his Harper and Row reading series, which were presented in braille. His teacher used various techniques to inspire him, including a chart on which he "read" his progress. A favorite story book that he "graduated" to was Curious George, which seemed to hold his interest for quite a long time.

He had good tracking technique with and without the tracking aid. He held his finger passively and flat on the array of vibrators, and he was able to adjust the controls to get correct letter size and thickness, though he said it was "hard to adjust the threshold." His use of contextual cues was excellent.

At the end of the Spring 1973 semester, on three trials of reading, his scores were 14 WPM, 13 WPM and 12 WPM (aloud). He studied 42 additional hours during the 1973-74 school year. By March, he felt ready to take the criterion test the "big kids" were taking. He scored considerably slower, with an average of 5.7 WPM aloud and 6 WPM silent. In his own materials at about the same time he was averaging around 11 WPM. In May, when visited by an AIR staff member, he again read about 6.5 WPM on the 4th grade level material. However, he read 10.5 on 4th grade level paragraphs supplied with the monthly AIR materials, and was aiming for 16 WPM in his own reading materials, Pooh Hears a Buzzing Noise.

Case: Dylan

This male student was in the second grade in a public school. He began Optacon instruction in October 1973 when he was seven years old. His blindness was caused by retinal degeneration. His intelligence was 115 on the WISC test. He scored 80% correct on the tactile test. He was 73% correct on the diagnostic spelling test.

Dylan was felt to be precocious in school and was well liked by his teachers. He was eager to study the Optacon and fascinated by its parts when he was first introduced to it. Throughout the year Dylan was frequently sick and absent.

He used the AIR Primary Level Whole Word Approach materials (after starting on a letter-by-letter method) and much preferred them. His "ambition" was to read a catalogue.

His tactile technique, word attack and interest level were excellent. However, his tracking during line changing was extremely poor and he would frequently lose his place altogether. His manipulation of the controls was also poor and he had a persistent habit of cutting off the tops of letters...either through faulty adjustment or, more frequently, through faulty tracking.

Over the 1973-74 school year he accumulated some 36 hours of study time with the Optacon. By March, he was reading his own materials at 6.3 WPM (based on five reading samples) with 91% accuracy. In May, when he was observed by AIR staff, he read at 6 WPM on 4th grade level materials.

Case: Keith

This male student was in the third grade in a public school. He began Optacon training in February, 1973, when he was in the second grade and eight years old. His blindness was caused by congenital cataract, though he had some residual vision. His intelligence was 126 on the WISC test. His tactile ability test was 80% correct. His score on the diagnostic spelling test was 40% correct. He also took the self concept test, attitude toward education,and attitude toward the Optacon tests. Respectively, he felt his initial self concept was low, attitude toward education middle to low, and attitude toward the Optacon was high. When tested again his self concept went sharply up, attitude toward education was about the same, but attitude toward the Optacon was down. By May, 1974, he told the AIR staff observer, "I hate the Optacon but I do what the school tells me to do."

Keith had good rapport with his teacher, who was a student teacher at first, replaced by the regular resource teacher. She characterized his tactile technique, word attack, and interest as excellent, and his tracking as average. He tended to guess a lot at words, though by mid-semester he seemed to do better at recognizing words. He took the 4th grade level Criterion Test in May, 1973, and scored 3.4 WPM, 4.8 WPM, and 6.4 WPM with accuracy in the 88-97% range.

During the 1973-74 school year Keith studied the Optacon for an indeterminate amount of time, though at a lesser amount than in the previous spring semester. His regular teacher was ill for an extended period and adequate time records were not kept by the substitute teacher. In March, 1974, he took the Criterion Test again. This time he scored 5.2 WPM aloud on common words; 6.2 WPM on vocabulary used in the lesson materials; and 8 WPM on a 4th grade level CTBS reading passage. His accuracy ranged from 77 to 88%.

Case: Kent

This male student was in the 7th grade in a public school. He began Optacon study in the 1972-73 school year when he was 11 years old and in the sixth grade. He was a multiply handicapped child, being hydrocephalic and paralyzed from the waist down. His fingers were small and his hands were frail. His blindness was caused by cranial pressure and optic atrophy. His intelligence was 114 on the WISC test; he read braille at roughly 6-7 WPM; his tactile test score was 52% correct; his diagnostic spelling was 90% correct and he was low in self concept, attitude toward education and attitude toward the Optacon.

He was taught in the regular elementary level instructional materials prepared by AIR. It was necessary to take frequent rests during instruction because of drainage problems and because he complained that the Optacon bothered his finger. He tended to become frustrated at the task of tracking and preferred to have it done for him. His spatial orientation ("up", "down," "right", "left") was poor at first and he had difficulty learning the layout of the page.

In reading, he was painfully deliberate, not wanting to read faster than letter-by-letter and expressing his discontent by criticizing the "dumb" characters in the stories he was reading. Interestingly, Kent is rather verbal and has earned a reputation, including the winning of prizes, for his poetry. The most unusual thing he read was the paper in a fortune cookie.

By May, 1973, when he took the Criterion Test, he was reading at 2.8 - 3.0 WPM, with an accuracy range of 71-96%.

He studied the Optacon for about 37 additional hours during the 1973-74 school year. He took the Criterion Test again in March, 1974, and this time scored 8.6 WPM on common words, 6.0 WPM on vocabulary words in the materials, 8.4 WPM on the 4th grade level CTBS reading passage, and 8.6 WPM on the 8th grade level CTBS reading passage. His accuracy was in the 90-95% range.

When observed by AIR staff in May, 1974, he had learned proper tactile technique but was still very poor and erratic in tracking. His reading rate was basically unchanged.

Overview of the Special Cases

As reported in the Interim Technical Report, the Phase I special cases (excepting the primary level child and adult) were compared with the Phase I main study students on the basis of criterion performance. There were no significant differences. This, taken together with the Phase I findings that variations in the instructional method could be tolerated in Optacon instruction, caused several special cases to be reclassified at the onset of Phase II and treated as main study students.

It is especially interesting that all four of the special cases at the primary grade level learned to read with the Optacon. Those first and second graders who learned with the "Whole Word" materials seemed more satisfied and likely to continue Optacon study. The smallness of their index fingers did not present an insurmountable problem. Their attention span was short and correspondingly short instructional sessions had to be scheduled.

It would appear that Optacon instruction was not very practical for either of the two multiply handicapped students; the one having severe hearing loss and the other being orthopedically handicapped. In the first instance, it was evident that the deafness sharply hampered inward communication and thereby prevented the teacher from giving the kind of immediate feedback that is so necessary at the outset of Optacon instruction. For the orthopedically handicapped child, the main problems were deficiencies in tactile sensitivity and tracking consistency that were brought about by his physical condition.

DISCUSSION AND CONCLUSIONS

A number of provocative and interesting findings were described in the foregoing Results sections. Many of these have practical significance for educators who are considering the introduction of Optacon training in the schools. An attempt will be made here to review the more important findings and offer interpretations.

Attainment of Reading Performance Skills

The data from both Criterion Tests 1 and 2 are consistent and indicate a steady but moderate growth in Optacon performance skills. Reading rates are generally slower to develop than what most students anticipate, though a wide range of speed (2 to 37 WPM) after 58 hours of training was noted.

Accuracy in reading is quickly attained and is quite sufficient for most reading applications. It is worthy of note that accuracy is high for the vast majority of students in the study and can even be achieved by students who are decoding words on a slow letter-by-letter basis. Indeed, the strong emphasis on being accurate causes many of the students to retrace words in order "to be sure," resulting in a net loss in reading speed.

The variety of use to which the Optacon can be put by the students is very limited by the end of 24 hours of training, but after 58 hours shows an encouraging trend with most items being read acceptably by most students. Viewed in perspective, it is rather unlikely that students at this point in their training need to read such a diversity of print materials as was presented for test purposes. On the other hand, many students are curious about the range of possibilities opened up with the Optacon and often try a number of unusual things, including attempting to "read" the appearance of clothing, upholstery and wall surfaces. The attempts made to establish variety of use, then, were more exploratory in nature than a final estimation of the ability that could be developed given personal interest and motivation.

The importance of regular study sessions, preferably daily for one-half hour or more, was evidenced. The high performing students had devoted proportionally more time to Optacon study. The accumulation of this study time was in part a reflection of individual effort, but it was also influenced by commitment at the institutional level, including necessary administrative support to the program. Teachers and students both agreed that adequate study time is essential.

Both teachers and AIR staff rated the students in terms of how well they had developed the process skills of a) tracking the camera, b) tactile technique with the finger, c) adjusting the controls to produce clear letter shapes, and d) utilizing proper word attack techniques. By the end of the study, at the close of Phase II, the great majority of students had demonstrated these process skills at acceptable levels. This would suggest that the motor, perceptual and cognitive process skills of the students were not deterrents, and that continued growth in performance (reading rate, accuracy and variety of use) would be heavily dependent on the amount of study time devoted.

Apparently there are no attitudinal benefits derived from Optacon instruction during the first few semesters of training. However, until reading speeds become sufficient to really influence the daily behavior and study patterns of Optacon students, it is reasonable that this be so. Similarly, initial self concept did not appear to be a factor in developing improved Optacon performance.

"New" students, i.e., students entering Optacon study one semester after training had begun, followed generally similar patterns of growth in skill development to the main study group.

Students identified as "special" cases, i.e. not conforming to the learner characteristics of the main study group in some way, made good progress in skill development. Most notably, the primary level students (beneath the age/grade cutoff) made good progress in reading using special "whole word" instructional materials, although restricted to a limited vocabulary. Multiply handicapped students, however, did not appear to do as well with Optacon instruction and may benefit less.

Selection of Optacon Trainees

It was evident in this study that the most useful predictors of Optacon reading ability were intelligence (particularly the arithmetic, similarities and information subtests of the WISC or WAIS test) and tactile ability (using the Tactile-Kinesthetic Form Discrimination Test in either its long or short form). The presence of high intelligence and tactile ability are not guarantees of success but should enter into decisions about which of several students might benefit most from Optacon training.

Students at all grade levels were able to develop Optacon reading abilities, but the weight of opinion among teachers and students favors starting blind students at the early elementary grades rather than deliberately waiting until they are in secondary school.

Process Skills

Sustained interest, adequate study time, and attention to Optacon process skills are all important to eventual success.

Without sustained interest students can become bored and eventually drop out of Optacon study altogether. Without adequate study time they will not advance appreciably in reading rate. Without attention to the process skills of tracking (with the camera), tactile technique (with the index finger), manipulative technique (with Optacon controls), and word attack skills (context cueing), functional reading levels are not likely to be attained.

Instructional Content

It was determined that the basic instructional materials prepared by AIR were satisfactory, being favorably rated by teachers and students, but that additional intrinsically interesting materials were needed for students at advanced levels, i.e. who had completed the manual.

Management of Optacon Training Programs

It was found that Optacon training could be carried out effectively in public itinerant, public resource room, and residential schools. Instructional ratios of 1:1 (tutorial) and 3:1 (small group) both seemed to work satisfactorily. In the case of the 3:1 ratio, where students are initially taught together through master/slave equipment configurations, individual differences among students indicates the need for a competent, flexible teacher. In any case, students who begin in small group training should work on an independent basis once they have learned to track properly and to recognize words without prompting from the teacher.

Training was carried out by credentialed teachers and student teachers and both proved satisfactory. Experiments with two blind instructors (one a teacher, the other an eighth grade tutor) were successful, given the availability of braille versions of the instructional materials.

Instruction was made more difficult when adequate facilities were not made available. Specifically needed are a) sufficient table space for the Optacon, tracking aid, visual display, instructional manuals and raised thermoform letter pages, b) sufficient privacy so that the student will not be distracted and the conversation between teacher and student is not restricted, and c) electrical power outlets in close proximity for Optacon recharging and operation of the visual display.

Probably the most critical single administrative consideration is that adequate Optacon study time be scheduled during the school day. Regular classes, lasting one-half hour or more, were preferred to after school sessions, and the offering of course credit was deemed feasible in several schools.

Finally, some Optacon instructional programs in this study were given continued commitment and support by administrators... others less so. The effect upon the "tone" of instruction was perceptible. It is definitely advisable that administrators give close attention to the needs of Optacon teachers and students.

RECOMMENDATIONS

For purposes of clarity, the recommendations are presented in list form according to the major classes of concerned parties...educators concerned with carrying out Optacon instruction on an operational basis and agencies concerned with the advancement of research and development in the area of ink print reading by the blind.

Recommendations for Educators

Based on the findings and training experiences in this study, the following recommendations are directed toward administrators and teachers.

- Functionally blind children can benefit from regular classes of instruction in ink print reading. The Optacon would appear to be one enabling device that has merit for some students, though clearly not all of them. (In the future, other devices which convert ink print to a different sensory modality may prove useful for other students and presumably could be included in such a regular ink print reading program.)
- Classes should be conducted within regular school hours, be at least one-half hour long (possibly for credit), and be carried out in a suitable instructional setting.
- Instruction can be by credentialed teachers or student teachers under supervision of credentialed teachers, but all teachers should have at least two or three days of prior orientation to the Optacon and to the instructional materials, and should have access to a local "knowledgeable" person who has had experience in Optacon instruction. Cross-age tutoring by blind children who are Optacon users also seems feasible. Instruction can either be tutorial or in small groups, i.e., 1:1 and 3:1 ratios.

- Students ranging from the first to twelfth grades can learn to use the Optacon. However, the scope of this study precluded a full investigation of the possibilities for Optacon learning by kindergarten and primary students; further study would be highly desirable.

- There are pronounced individual differences in the reading performance levels attained, indicating that some blind students should not be channeled into Optacon instruction. Intelligence scores with the WISC or WAIS tests (especially the arithmetic, similarities and information subtests) can be used to help predict Optacon reading proficiency. Similarly, tactile scores obtained with the Tactile-Kinesthetic Form Discrimination Test (or its short form) can be used to help predict Optacon reading proficiency.

- Since the acquisition of Optacon reading proficiency is gradual rather than sudden, educators would be well advised to counsel students about reasonable expectations. Extravagant claims about Optacon success and frequent reference to outstanding readers may lead to a discouraging letdown. Useful parallels can be drawn to the time it takes to become proficient with braille or other complex skills.

- Once the Optacon skills are learned, students may still be reluctant to use the device in other classes if they or their classmates are bothered by the noise of the vibrators. Until such time as the noise can be engineered to low levels, it is important for educators to help the concerned parties (the user and those around him) to overcome this sensitivity.

- Special attention should be given during instruction to a) maintaining a high level of student interest, b) developing a good tactile technique...flat, passive index finger properly aligned on the vibrating array, c) developing good tracking techniques with the camera...steady forward progress across whole words without frequent retracing or horizontal drift, and d) developing good word attack techniques...

utilizing contextual cues and knowledge of word construction. The use of incentives and contingency rewards is one promising avenue for achieving these objectives.

- Instructional materials should be appropriate for the grade levels of students involved. The instructional manuals developed by AIR for the primary, elementary and secondary levels appear to be quite satisfactory in meeting the needs of teachers and students for beginning instruction, i.e., 30 to 50 contact hours depending on the individual. Advanced level, high interest materials are not currently available and should be compiled locally until such time as manuals become available nationally.

- A basic complement of equipment for training purposes involves an Optacon, Tracking Aid and Visual Display. However, schools would be well advised to anticipate some "down time" since equipment malfunctions do occur. In order to avoid cessation of instruction it is advisable to have a back up Optacon available to use while the repairs take place. Although not used in this study, districts with adequate resources might give consideration to the Automatic Page Scanner (an accessory which automatically tracks at prescribed rates) as a means for building students' reading speeds to functional levels.

- When students have learned how to use the Optacon, or any other ink print reading device, arrangements should be made to provide them with one of their own. This arrangement should be known to the student and worked out far enough in advance so that the training is not seen as a "dead end" but has a purpose.

Recommendations for Agencies

Research, development and operational needs in the area of ink print reading by the blind are as follows.

- Further research and development needs to be undertaken at the early childhood level. Little could be established in this

study about the feasibility of kindergarten instruction using the Optacon for orientation to letter shapes and pre-reading activities. Additionally, much more needs to be learned about the optimum ways of conducting Optacon instruction in the first, second and third grades.

- Provision should be made for providing Optacon inservice teacher training such as regional workshops for teachers. Federal, state or local support to non-profit service organizations is one way of achieving this; colleges and universities represent another avenue. Summer sessions are an ideal time for such workshops.

- Federal, state and local agencies, as well as private foundations and philanthropic organizations, should give attention to the economics of Optacon instruction and ownership. Because of the price, schools will be hard pressed to include the purchase of Optacons and related training equipment in any significant amounts within their regular school budgets Similarly, they cannot be expected to give away equipment to students who learn to use the equipment. Nevertheless, individuals who become trained need their own Optacons. A coordinated system of financial aid should be devised through which qualified schools and individuals can routinely obtain funds for the equipment without the necessity of canvassing, benefit sales or other personal appeals. Estimates of cost should take into account maintenance and insurance costs, as well as initial costs.

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APPENDIX A

EXCERPTS FROM OPTACON INSTRUCTIONAL MATERIALS

(Elementary and Secondary)

APPENDIX A-1

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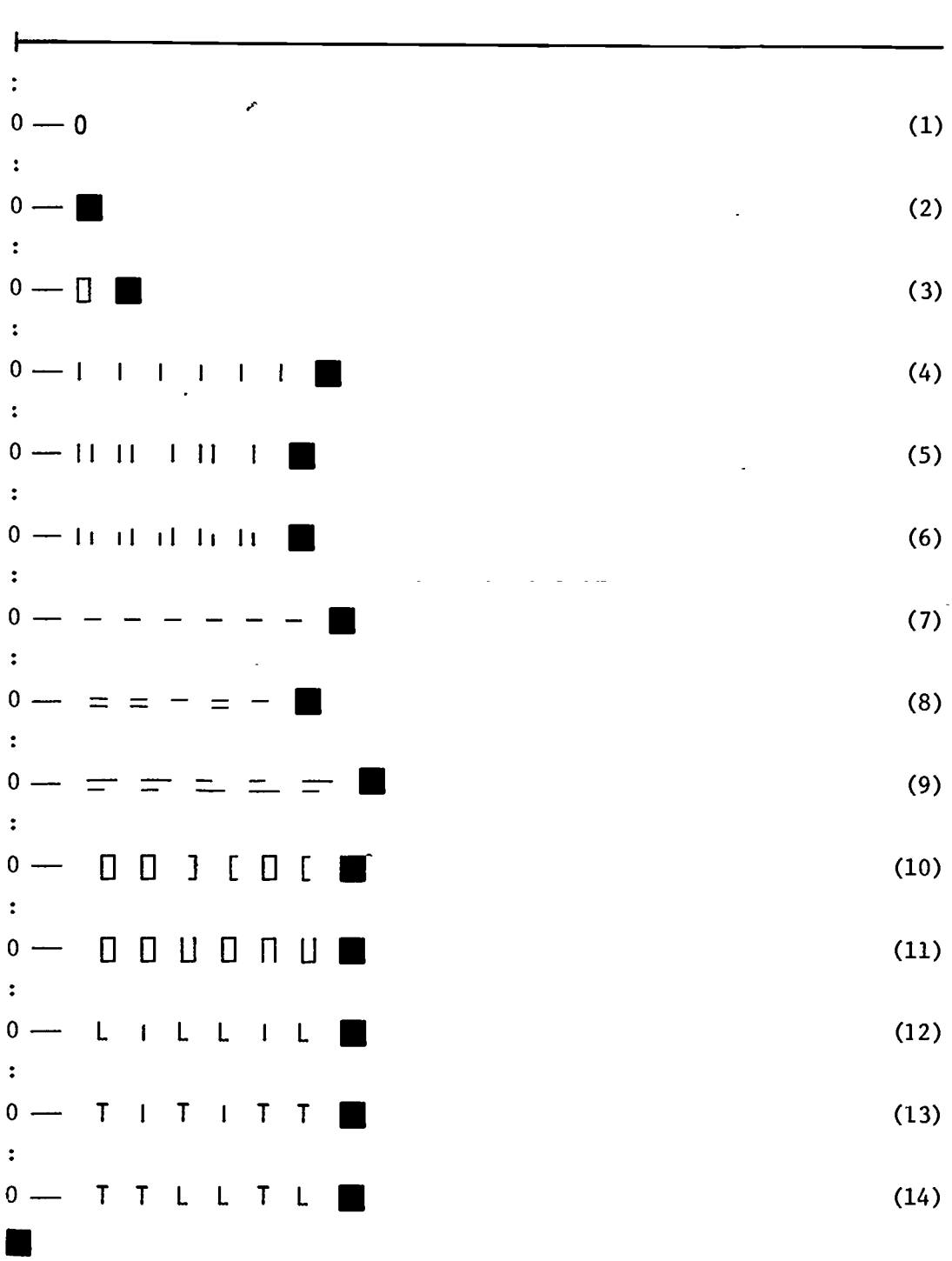


UNIT 1 - INTRODUCTION TO THE OPTACON — Elementary Level
Lesson 1: Equipment Orientation (first line only)
Lesson 2: Field Practice (begin with second line)

:

1 — 7 7 7 6 7 7 7 ... 8 8 8 8 7 8 8 ■

:

2 — 9 8 9 9 9 9 9 ■

:

3 — 0 1 2 3 4 5 6 7 8 9 ... 8 0 4 6 2 7 3 1 5 9 ■

:

4 — 767 - 2676 ... (348) 555 - 1212 ■

:

5 — 9 - 2 = 7 ... 6 + 3 = 9 ... 7 + 1 = 8 ■

:

6 — 8 + 9 = 17 ... 8 - 7 = 1 ... 9 + 1 = 10 ■

:

7 — 3 62 18 93 21 46 ■

:

8 — 1495 1963 1776 1802 ■

■

:

1 — J J J / J J / J / J ■

:

2 — X X X J X J X X J X ■

:

3 — Z Z Z X Z J X Z J Z ■

:

4 — X J Z C E J O X D S Z F I M J A R Z H X ■

:

5 — OX JOB JAM FOX ZOO MIX JUG ■

:

6 — JAR TAX ZERO JACK FIZZ EXTRA ■

:

7 — JUST ZOOM LAZY JUICE EXPECT ■

: . . . . . .

8 — SIX BEES BUZZED AROUND THE JAR OF JAM. ■

:

9 — I EXPECT TO GET A ZERO ON THE NEXT QUIZ. ■

:

10 — REX TOLD A CRAZY JOKE ABOUT A ZEBRA. ■

:

11 — JANE FIXED A CAKE MIX FROM A BOX. ■

:

12 — IN MEXICO, LIZARDS LIVE IN THE JUNGLE. ■

■

:
1 — j j j / j j / j j / ■
:
2 — x x x j x j j x x x ■
:
3 — z z z j z x z x j z ■
:
4 — x h z r a j m i f z s d x o j e c z j x ■
:
5 — jab six fix joy box zip jerk ■
:
6 — joke jump fuzz next crazy ■
:
7 — excited dozen jacket frozen ■
: . . . . . .
8 — when I have no job to do ■
:
9 — you can find me at the zoo, ■
:
10 — just eating popcorn from a box ■
:
11 — and talking with my friend the ox. ■
■

1 — Z x j X J z x Z j X Z z J x X J

2 — jelly axe Zero Japan fox jazz

3 — X-ray zoo jet doze just Expert

. . . . . .

4 — Life can be a puzzle, and hardly ever what you expect.

5 — My brother Joe found that out. Last June he won a free

6 -- pizza as a prize on a quiz show. He was so excited that he

7 — called a friend, and they went right down to the pizza parlor.

8 — Joe's "prize" was a six-inch pizza, plain, with no junk

9 — on it. His friend wanted the jumbo-size with everything,

10 — plus something fizzy to drink. So Joe's "free" pizza

11 — cost him $4.75, plus tax.

:

1 — X Z X J J Z X Z J Z X J ■

:

2 — j x z x j z z x j x z j ■

:

3 — Zoom six jumbo zero Jim ■

:

4 — extra Judge puzzle junk box ■

■

:

5 — J X J Z X Z J X J Z X Z ■

:

6 — x z x j z x j x z j z j ■

:

7 — ooze jury X-ray fox Zone ■

:

8 — Joe zebra expert jail Joy ■

■

Below is the table of contents from a magazine called Talking Book Topics. This magazine is sent free by the Library of Congress to those who are visually handicapped. Can you find the page number for children's nonfiction?

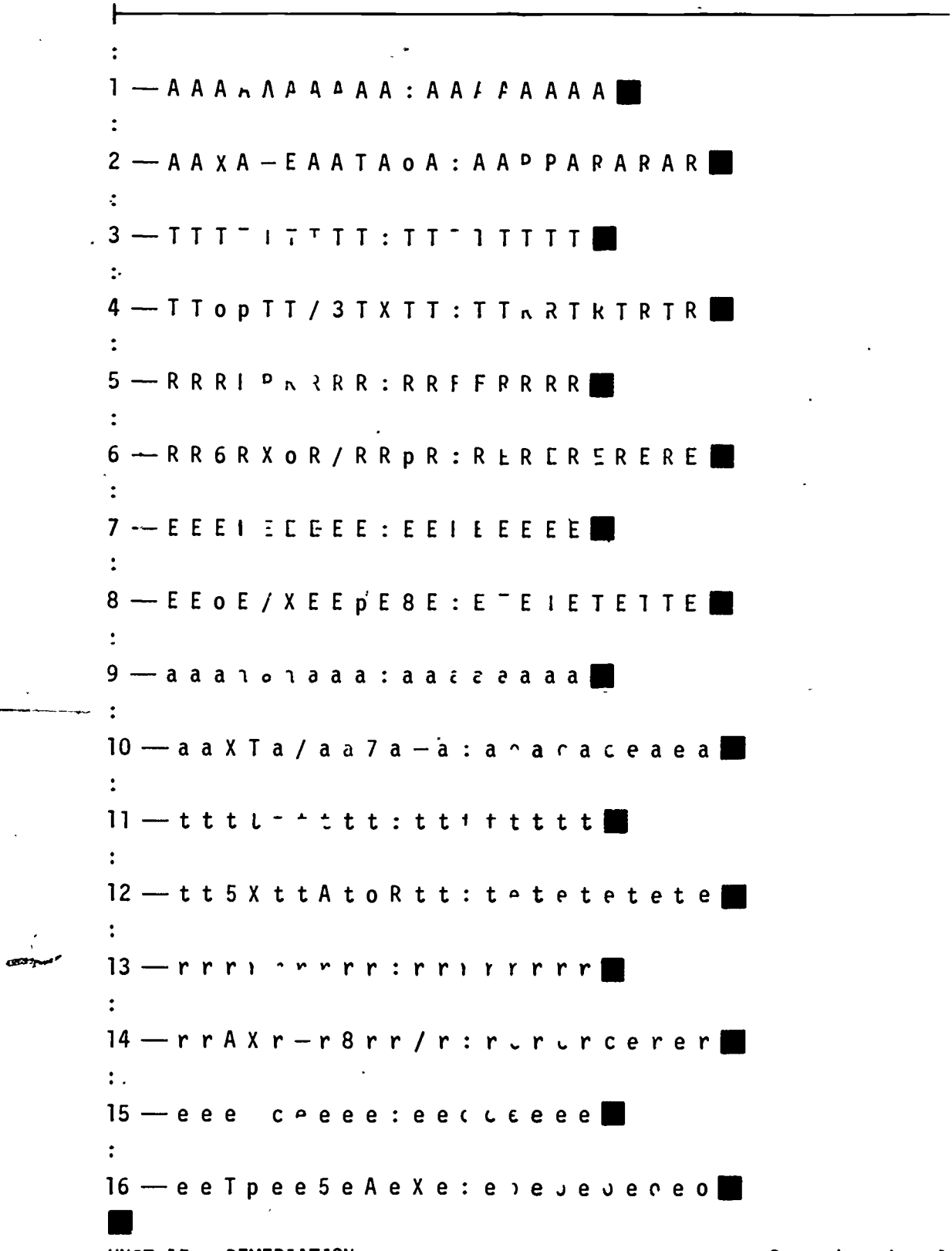
Contents

Volume 38 Number 5
September-October 1972

- -

Here is a short poem in free verse form.

I have a friend
    who's always there
and who knows
      all my secrets.
My friend
        is
         me.



UNIT 15 - REMEDIATION
Lesson 2: Alphabet (A,T,R,E)

Secondary Level

1 —Here are some paragraphs to check your reading speed. They

2 —come from different kinds of reading material. Try to read

3 —each selection in five minutes. How fast can you read?

25 words from a newspaper horoscope:

Keep at whatever you are doing since you seem to be close to what you want to achieve. This is a day for fast action. STOP.

- -

50 words from a history textbook:

The earliest homes in New England were simple cottages with wooden sides. The roof was made of leaves and branches. There was a dirt floor. Holes were cut in the boards for windows and doors. The window spaces were covered with oiled paper. The furniture was made from split logs. STOP.

- -

100 words from Aesop's Fables:

A farmer was once driving a heavy load along a very muddy way. At last he came to a part of the road where the wheels sank halfway into the mud, and the more the horses pulled, the deeper the wheels sank. So the farmer threw down his whip, and knelt down and prayed to Hercules the Strong. "Oh Hercules, help me in my hour of need," the farmer said. But Hercules appeared to him, and said: "Tut, my good man, don't sprawl there. Get up and put your shoulder to the wheel. The gods help them that help themselves." STOP.

- -

Not everything you read will be printed in the same type as the one you have been learning. This lesson will give you practice in the type of letters usually found in textbooks. First you will read numbers, then all the letters of the new alphabet in capitals and small letters. Next, you will read some common words. Last of all, there are some sentences written by famous people. See how well you can read these sentences. If you have trouble, the type of letters you first learned about are printed near the bottom of the page so you can compare them with the new letters.

0 0 0 1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8 9 9 9

A A A B B B C C C D D D E E E F F F G G G H H H I I I

J J J K K K L L L M M M N N N O O O P P P Q Q Q R R R

S S S T T T U U U V V V W W W X X X Y Y Y Z Z Z

a a a b b b c c c d d d e e e f f f g g g h h h i i i

j j j k k k l l l m m m n n n o o o p p p q q q r r r

s s s t t t u u u v v v w w w x x x y y y z z z

At is to On if Up by be as he or We my go are
His the You for Can put Ask but and Say box jar here
sits Loud from Come much knew with have Only zero quiet

Some books are to be tasted, others to be swallowed, and some few to be chewed and digested. (Francis Bacon, Of Studies)

Reading is to the mind what exercise is to the body. (Joseph Addison, The Tatler)

How many a man has dated a new era in his life from the reading of a book. (Henry Thoreau, Walden)

What I like in a good author is not what he says, but what he whispers. (Logan Pearsall Smith, Afterthoughts)

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
a b c d e f g h i j k l m n o p q r s t u v w x y z

On this page is a poem written by an Optacon student. Read the poem, and then read the instructions that come after it.

The Telephone

Although it makes my mother groan
I like to use the telephone.
I called the operator one lonely day,
And said, "Get me the President right away."

"Hello Lyndon, where is John?"
"I'll get him in a minute, please hold on."
I sat and waited for over an hour,
Then discovered he was lunching with Eisenhower.

When my father saw the bill that week,
He gave a large and horrible shriek.
He yanked the cord out of the wall
And said, "You'll never make another call."

So Alexander Bell I'll always adore,
Though I can't use the telephone any more.

- -

What did you think of the poem? Make up a poem of your own. Dictate the poem and your teacher will see that it is typed so that you can read it. Or, if you know how to type, you might want to type your own poem.

This lesson will help you learn how to find a book in the library. Every library has a card catalog with separate cards for every book that the library owns. There are usually three sections in the card catalog. In one, books are listed by the last name of the author, in alphabetical order. In another section, books are listed by their titles, also in alphabetical order. In the third section, books are listed by their subject matter, in alphabetical order again. For example, if you want a book about the Civil War, you might find it in the subject catalog under "Civil War" or "U. S. History."

There is one catalog card printed at the bottom of this page. The author's name is at the top of this card. The book title is on the next line. The numbers telling where to find the books are printed in the upper left hand corner of the card. If you want help in finding a book tell the librarian the number and the letter just below the number.

Now, try to read the author's name and book title with your Optacon. Then ask your teacher for your next assignment.

370.15
R

Rogers, Carl Ransom, 1902-

Freedom to learn; a view of what education might become [by, Carl R. Rogers. Columbus, Ohio, C. E. Merrill Pub. Co. [1969]

x, 358 p. 24 cm. (Studies of the person)

Includes bibliographies.

1. Learning, Psychology of. 1. Title.

LB1051.R636 370.15 72-75629
SBN 675-09519-0 MARC

Library of Congress 69 [5]

APPENDIX A-3

DESIGN OF THE AIR/OPTACON INSTRUCTIONAL MATERIALS

Goals and Objectives

The broad goal of the American Institutes for Research/Optacon instructional materials package is to provide an interesting, efficient, and educationally sound framework at the elementary and secondary levels by which blind students can learn to read standard print via the Optacon, an optical-to-tactile converter manufactured by Telesensory Systems, Inc.*

By using these materials the teacher will be able to:

- allow each student to progress at his own rate;
- integrate drill and practice of numerals and letters with the reading of meaningful material in sentence form;
- diagnose particular learning difficulties and prescribe appropriate learning activities within the materials;
- give the student a role in deciding when he wants to assume independence in tracking and other equipment operation skills;
- provide a variety of reading experiences for the student, including alternative typefaces, formats and subject matter;
- monitor the progress of the student on a unit-by-unit basis as well as at the end of the course.

*Telesensory Systems, Inc., 1889 Page Mill Road, Palo Alto, California 94304.

Following each of the basic Units 2 through 9 (numbers and letters of the alphabet) is a page of Criterion Exercises. When the learner and the teacher believe he is ready, the student can "challenge" the first criterion exercise at the top of the page. For most students this will probably occur after both drill and enrichment materials have been studied. Some students who want to move through the materials more rapidly might prefer to challenge the first criterion exercise as soon as they have finished the drill portion of the three lessons in the unit.

Note that two criterion exercises are provided for each unit. Both exercises follow the same format. In the criterion exercises for Unit 2, the first two lines contain all the numerals in scrambled order. The third line has a series of two-digit numbers. The fourth line has five simple arithmetic problems with the answers left blank. The student should read the problems silently, and respond with the correct answer.

In the criterion exercises for Units 3 through 9, the first line of each exercise contains the upper case letters learned in the unit, and the second line contains the lower case letters. The third and fourth lines contain ten words using the newly learned letters. Some of these words are capitalized.

The student should be asked to read the lines in sequence. If the student can complete the first exercise to the criterion level recommended for the unit, he should go on to the next unit without attempting the second criterion exercise. If he falls short of an acceptable criterion level on the first exercise, and if it appears that he would benefit from more drill and practice, then the student should go back for more work in the unit before attempting the second criterion exercise. However, he should not repeat the entire lesson or unit. Instead, he should practice only on the lines within the unit containing the characters with which he has a problem. When he is ready to try again, he should use the second criterion exercise, again attempting to reach an acceptable criterion level.

as he stands up, then lower it to his body. Advise him that the Optacon should hang towards the center of his body rather than to the side so that it will be less likely to bump into things.

Lesson 2: Field Practice

The purpose of Lesson 2 is to orient the student to the tactile field of the Optacon by presenting him with the different shapes to be found in letters. Page 33 includes vertical and horizontal lines, and page 34 emphasizes circles and diagonals. In this lesson you should track over the lines for the student, after reading aloud or paraphrasing the instructions. The following numbered statements correspond to line numbers on pages 33 and 34. As necessary, use the thermoform sheets of raised letters to teach the student the concepts of "vertical," "horizontal," "circle," and "diagonal."

During this lesson, be alert that the student seats his hand and finger properly in the Optacon. It is particularly important that the left index finger be flat and fairly stable on the tactile array. Watch also that the student's left thumb does not inadvertently move the threshold knob on the front of the Optacon.

Before beginning the lesson, set the intensity low, and adjust the magnification on the camera so that the box on line 2 is just within the display field on the Visual Display.

Say:

Line 2. Put your left hand in the opening of the Optacon, with your index finger lying flat in the groove. The shape you are feeling now is like a filled-in box. As you learn to use the Optacon, you will feel this box at the end of each line. It will mean to "stop" and go back to the next line of instruction.

Line 3. Here is the shape of an empty box. Try to get the top near the tip of your finger. Remember to keep your finger down flat. Can

Teacher Instructions

A major option is open to the teacher at this point. The intent of this unit is to introduce the nine numerals and then give reinforcement in their use in later units, where lines are numbered. However, Unit 2, which teaches numerals, can be deferred until a later point in training if the teacher and student prefer to gain exposure to the numerals through the context of line numbering. As an additional option, the enrichment material (below the dotted lines) may be bypassed until a later time.

If the decision is made to teach numerals now, then at a minimum the drill and practice portion of all three lessons within the unit should be covered as well as the criterion exercise which follows.

> [Note: Beginning with this unit, and continuing through Unit 9, each line of instruction begins with a number, followed by a short horizontal line. These numbers and lines are tracking cues for the student. On each new page, he should learn to pull the camera down from the top of the page and then left along the guide line. He should pull the camera down slowly, past the two dots, until he finds the line number. Then he should follow the horizontal line to the right to find the new letter or word.]

Lesson 1: 0, 1, 2, 3

The numerals 0, 1, 2, and 3 are taught in this lesson.

On line 1, there is a series of zeros, with one X used as a distractor. Ask the student to identify the characters by saying whether each is a zero or not. He does not have to name the different symbol.

In the middle of line 1, there are three widely spaced dots. This is the mark used to separate one learning task from another. The second half of line 1 teaches the numeral 1. Here again, a series of ones is presented,

Teacher Instructions

By this unit most students will have advanced to a point where they are tracking for themselves with the help of the tracking aid. If not, then the teacher may want to concentrate on tracking practice before going on to the new letters I, H, O, S.

The same options for bypassing within the lessons exist in Unit 4 as they did in Unit 3.

Note: Beginning with this lesson the student will be introduced gradually to punctuation marks. No special instructions have been written to teach punctuation, since students easily learn punctuation marks in the context of the sentence or paragraph.

Lesson 1: Upper Case IHOS

The letters I, H, O, S are taught in this unit.

On lines 1 through 4, the student should identify the letters being taught in each set.

Line 5 presents a series of scrambled letters, including those learned in the previous lesson. The student should read each letter.

Lines 6 through 9 contain words ranging from two to five letters in length. The student should read each word. Discourage him from reading each letter out loud.

Enrichment begins at line 10. Lines 10, 11 and 12 are short sentences for the student to read. Note that the period is used for the first time in these sentences.

1. The first exercise is for practice with a list that is printed in columns. There are three vertical columns of numbers with a word after each number. Read number 1 and the word that follows it. Then move the camera back to number 1 and down to the next line to find number 2. Continue in this way until you come to the end of the column (that is, there are no more numbered lines in the column). To find the next column in the series, again move the camera back up to number 1. Then move the camera across the page until you find the next number, in this case it would be number 5. Continue reading this column, and then find and read the third column.

2. The second exercise gives some practice in reading a table. The table is a puzzle, with three horizontal rows of numbers and three vertical columns of numbers. There is one number missing. Read the instructions, then try to solve the puzzle.

3. The third exercise is a table of contents. You need not read every word, but read the instructions and see if you can answer the question. Note that the capital W in "Writing" is shaped like two V's.

4. The last exercise in this lesson is a short poem in free verse form in which the lines are not even. Read the poem. It begins with "I" and ends with "me."

Criterion Exercise, Unit 12

The first criterion exercise for this unit is designed to test the student's ability to track, as well as to recognize words and numerals. The second exercise tests the ability to locate typing errors for those students who do their own typing and who proofread with the Optacon.

Teacher Instructions

This unit is designed to give the student some familiarity with the kinds of materials he will encounter in his reading outside of the classroom. In selecting these materials the major criterion has been their utility for the independent reader. No concessions have been made for the handicapped student through editing or rewriting, since this unit is intended to be a slice of the real world. Some of the lessons will be more difficult than others, and you should offer assistance when needed. To avoid discouragement, the exercises can be interspersed with reading from a book or magazine that the student has chosen himself. Be sure this student-selected material is printed in clear, readable type with good spacing between letters and lines.

Lesson 1: Reading New Materials

In Lesson 1 some guidelines or principles about printing formats have been given to prepare the student for the following lessons. In the other lessons he is given instructions.

Lesson 2: Tape Recorder Guarantee

This lesson includes words the student may need help with, such as "defective," "guarantee," or "negligence," and he may not realize that Channel Master is the company name. The decoration around the print will also be a new experience for him which may require explanation.

Lesson 3: Using a Card Catalog

If the cataloging system in your school library or the public library is different than the example, this should be explained to the student. If possible, a trip to the library so that the student can examine the card file might be worthwhile.

APPENDIX A-4

Student's Monthly Goal Planning Sheet

Month of _____ Student's Name _____

School _____ Teacher's Name _____

Reading of Connected Text (See Definition):	Exceeded or Surpassed	Achieved	Not Yet Achieved
Goal 1. (Rate) Be able to read at _____ words per minute.	○	○	○
Goal 2. (Amount) Read _____ pages of text or book material this month.	○	○	○
Goal 3. (Type) Read parts of this printed material this month:			
Title: _____ _____	○	○	○
Title: _____ _____	○	○	○
Title: _____ _____	○	○	○

Reading of Special Material (See Definition):			
Goal 1. _____ _____	○	○	○
Goal 2. _____ _____	○	○	○
Goal 3. _____ _____	○	○	○

Definitions:

Connected text is any material which flows in straightforward sentence or paragraph form and does not present special problems of format, type clarity or type size. Included would be books or novels, textbooks, magazines, typewritten letters, memos, etc., regardless of the type style.

Special material is anything printed which is not primarily in narrative or paragraph form. This would include lists (telephone book, dictionary, tables, TV schedules, etc.); unusual layouts (newspaper, brochures, catalogs, menus, etc.); and unique applications (labels, bulletin boards, handprint, diagrams, computer printout, etc.)

INSTRUCTIONAL MATERIAL

Criterion Exercises*

1. Did you ever have to write about how you spent your summer vacation? One year everyone in my class had a special trip to tell about. I didn't go anyplace, but I did have fun exploring my own backyard. It was hard to make it sound exciting, but it was.

Time: ____ Min. ____ Sec.

Meaning Understood: _____

2. What are you going to do this summer? My secret wish is to travel with the circus. I like the noise and excitement, and the sawdust under my feet. I'd like to push through the crowds, selling popcorn or hot dogs. But I will probably just sit home and dream.

Time: ____ Min. ____ Sec.

Meaning Understood: _____

*After the student reads each selection, ask him or her to tell what it was about or what happened. If the student gives a meaningful answer, perhaps citing events, persons or key story points, indicate "yes" and initial in the blank.

APPENDIX B

EXCERPTS FROM PRIMARY WHOLE WORD INSTRUCTIONAL MATERIALS

APPENDIX B-1

TABLE OF CONTENTS

:

1—— here here here here ■ (Can you read the letters in the first word? The word is "here.")

:

2—— Here here here Here ■ (Can you tell which words begin with capital letters?)

:

3—— Come here. ■ (Let's read these sentences.)

:

4—— Here comes Janet. ■ (In this sentence we will add the letter "s" to a word we already know.)

:

5—— jump jump jump ■

:

6—— jump jump Jump Jump jump■ (Tell me which words begin with a capital letter.)

:

7—— Jump, Janet. ■ (Read these sentences.)

:

8—— Jump, Mark. ■

:

9—— See Mark jump. ■

:

10— See Socks jump. ■

■

(Adapted from Janet and Mark by Mabel O'Donnell. Copyright c 1966 by Harper and Row, Publishers, Inc., Evanston, Illinois.)

The puppy was asleep in his box. Ann could hear her (asleep)
mother and daddy talking, but she could not hear
what they said. Then she could hear her daddy at her door.
"Are you asleep, Ann?" said Daddy.
"No, I am not asleep. Oh, Daddy, look at my puppy.
He is very good. See. He is asleep.
Can he stay with us? Can I have him as my very own?" (us)
Daddy looked at Ann and then he looked at the puppy.
He said, "If it will make you happy, the puppy can stay.
But I want to ask you something." "What is it?" said Ann.
Daddy said, "Let's not have any new surprises.
I think one puppy is enough in this house."
Ann laughed and went to sleep. (sleep)

Introduction to Beginning Reading Materials

a.

Learning to read with the Optacon can be an exciting and rewarding experience for the beginning reader. This will be particularly true if the teacher is patient and supportive of the child, readily providing verbal reinforcement and help in tracking.

At the outset, it is necessary that the teacher take the time to acquaint the student with the device itself, how the symbols and words will feel, and how to discriminate shapes. It is equally important that each student develop good study habits and good word attack skills.

Separate teacher instructions for five preliminary steps are on lettered pages a to v. Student materials begin on page 1.

The pages numberes 12 through 81 contain stories that are coordinated with the Harper & Row Basic Reading Program. These pages can be divided into five sections, each of which goes along with one of the five books in the Harper & Row Series. The use of these materials is by no means restricted to schools where the Harper & Row texts are in use.

You will note that the instructions to the teacher are on the same page as the material for the student's reading practice. This should present no problem if the student who is doing his own tracking is reminded that he should go down to the next line when he encounters the black "stop" square. The instructions given on pages 12-81 are briefer than those given with the preliminary steps. These materials do continue building the student's reading skills using the whole-word approach. When introducing a new word, the teacher should follow this sequence:

- Say the word out loud several times while you or the student track over the whole word.
- Help the student feel each letter of the word, reminding him of similar words, familiar letters or letter combinations.
- Track across the whole word again saying the whole word out loud.

Teacher Instructions

Pre-reading Lesson: Whole Word Pattern Recognition

Instructional Materials Page 9

SAY:

Line 1 - Here is the word "a." Feel that there is only one letter in this word. (Use the raised thermoform sheet.) Here is what the letter "a" is shaped like. Now, let's feel the whole word again on the Optacon. (When "an" is reached) Did that feel like the word "a"? It was the word "an." It is a little longer because it has an "a" and an "n" (thermoform). Here's what the "n" feels like. Now, let's feel some words with the Optacon and you tell me which ones are "a" and which ones are "an."

2 - Here is a new word -- "and." How does it feel? Why does it feel different than "an"? (Use the raised thermoform letters to show the student the "d.")

3 - Now, you have learned these words, "a," "an," "and." Let's read these three words on this line. Tell me each time you find "and" with a "d" sticking up.

4 - Here is the word "it." (Thermoform). Feel the letters "i" and "t." Which word on this line is not the word "it"? The word is "is." (Use the thermoform sheet to show him the height difference between "t" and "s" and that both words begin with an "i" line.)

5 - (Have the student go over the line and tell you each word.)

6 - On this line you have the word "is" and another word. The new word starts with "i" but the second letter is not an "s." Can you find it? It is the word "in." (Use the thermoform letters to help the student feel the difference between the "s" and "n".) Can you find the word "in" again?

7 - Now, you have learned in, is, it. Can you read each word on this line?

:

1 — a a an an an a an a ■ (Introduce "a", "an")

:

2 — and and an an and an ■ (Introduce "and")

:

3 — an a and a an and ■

:

4 — it it it is it ■ (Introduce "it", "is")

:

5 — is it it is is ■

:

6 — is is in is in ■ (Introduce "in")

:

7 — is it it is in is ■

:

8 — he he he the he ■ (Introduce "he", "the")

:

9 — the he he the he ■

:

10 — the they the the they ■ (Introduce "they")

:

11 — the the they they the ■

:

12 — he the they they he the ■

■

:

1 — ride ride ride ride ■ (Can you read these letters? The word is "ride.")

:

2 — Ride Ride ride ride Ride ■ (Tell me if each word begins with a capital or small letter.)

:

3 — Ride, Janet. ■ (Note to teacher: From this point on, new words are introduced without repetition.)

:

4 — Ride, Mark. ■

:

5 — See Mark ride. ■

:

6 — See Janet ride. ■

:

7 — I can ride. ■ (Introduce "can.")

:

8 — Socks can ride. ■

:

9 — Janet can ride. ■

:

10 — Mark can ride. ■

:

11 — Ride, ride, Mark! ■ (Explain the exclamation point at the end of the sentence.)

■

APPENDIX C

ADMINISTRATION GUIDELINES AND SPECIMENS OF
MEASURES OTHER THAN STANDARD INTELLIGENCE TESTS

APPENDIX C-1

Test Package for Teachers in the Optacon Project

This package contains all the test materials, directions for administration, records, and forms that you need. The test package contains two folders:

1. A teacher folder containing the directions for administration of each test and the activity logs.

2. A student folder containing the test forms to be filled in by each student and the activity log forms for each student. You have a separate student packet for each of your students taking part in the Optacon project. The tests in the student's packet are to be completed according to the schedule provided. Each form should be removed from the student folder when completed and given to your local project coordinator to mail to AIR.

At the end of the project, each student's packet will be empty. All the materials in the student folder will have been removed, completed, and sent to us. Your own folder will remain intact.

We have packaged these materials as conveniently for you as possible. To use them most effectively and with the least effort, we recommend the following steps:

1. Read the test schedule and identify when each record or test is to be given. Note particularly that the Activity Log is to be completed at the end of each unit of instruction for each student.

2. Read the general directions for administering tests.

3. To administer or complete any particular test or record, take the directions for that test from your folder and the blank form from the student folder. When it is completed, send the completed student form to the project coordinator and return the teacher directions to your own folder.

Note that teacher directions and student forms for each test are correspondingly coded by title.

General Directions for Administering Tests

Preparation of Students for Testing

Preceding each test students should be apprised of the test in such a way as to increase their interest. They can be told that they are to be tested on their Braille skills to see how that relates to the new skills they will acquire with the Optacon, or that they are to be tested on skills or attitudes which are related to their new skills, or that they are to be tested on how well they have learned their new Optacon skills as the case may be. The tests are designed to assist them, you the teacher in helping them, and eventually other blind children who will be learning to use the Optacon. You should guard against arousing anxiety in the students.

Special Considerations for Effective Testing Sessions

Each testing session should be planned so that each student has the greatest possibility of performing to his maximum ability. Give careful attention to the following:

- When several tests are scheduled to occur during the same month, space them over several different days (avoid giving them all in one day).
- Schedule the testing so that there is sufficient time to finish before the student is scheduled to change classes.
- Administer the tests, if possible, on Tuesday, Wednesday or Thursday and avoid days just prior to or after vacations or important school functions.
- Avoid periods after strenuous physical exercise.
- Eliminate, if possible, distractions such as bells or telephones ringing (do not schedule when a fire drill is planned if you know about it in advance).
- Become thoroughly familiar with the tests themselves and the directions for administering them before testing the child.

- Set up an atmosphere in the classroom for the most effective testing, free of tension and concern.
- Follow directions precisely, reading verbatim those sections preceded by "SAY."
- Make sure students know what they are to do and allow time for questions before beginning the testing.
- When timing is required, observe time limits exactly with a stop watch or timepiece with a second hand.
- Limit any assistance you give to students to the mechanical aspects of marking answers, clarifying directions, and finding the place to start (guard against indicating a correct answer or pointing out the rationale of an item.)
- When giving group tests monitor all students to ascertain that each student is marking his answers as directed and is marking only one response for each item.

Instrument: Optacon Questionnaire
and Attitude Toward Learning and Self-Concept

Mode of Administration: Teacher tests all children in a group session.

Materials Required:

1. Brailled Optacon Questionnaire for each child
2. Brailled Attitude Toward Learning and Self-Concept for each child
3. Pencil for each child

Directions:

1. Read general directions for administering tests.
2. Write student name, date and school on each test sheet.
3. Distribute test sheets and pencils to the students.
4. Begin testing.
5. When completed, give materials to the local project coordinator to mail to AIR.

OPTACON QUESTIONNAIRE

Teacher Copy
(Student receives braille version)

The following questions are about your opinions of the Optacon. Express your own feelings. There are no right or wrong answers.

Below you will find some statements about the Optacon. Under each statement are some boxes. Mark the box that tells how you feel about the statement. Remember, there are no right or wrong answers. Just describe how you feel. Raise your hand if you have any questions.

1. I enjoy reading with the Optacon.

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

2. I use the Optacon to read my school work.

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

3. I would use the Optacon next year to read my school work.

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

4. I use the Optacon to read for pleasure.

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

5. I would use the Optacon next year to read for pleasure.

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

6. I would use the Optacon after I graduate from school.

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

7. I use the Optacon outside of school for other things, such as finding phone numbers and reading labels.

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

8. I would use the Optacon next year outside of school for other things, such as finding phone numbers and reading labels.

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

9. Learning to track with the Optacon is:

[] Very hard [] Hard [] Easy [] Very easy

10. Learning to read different kinds of print with the Optacon is:

[] Very hard [] Hard [] Easy [] Very easy

11. Adjusting the Optacon for different kinds of print is:

[] Very hard [] Hard [] Easy [] Very easy

12. At what grade level should children learn to read with the Optacon?

[] Grade 1 to 3 [] 4 to 6 [] 7 to 8 [] 9 to 12 [] College [] Never

The following questions are about the reading lessons you have been using:

13. Were the lessons interesting?

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

14. The length of each lesson was:

[] Too long [] About right [] Too short

15. Were the raised letters useful?

[] Very useful [] Some use [] Not much use [] No use

16. Did you enjoy the stories and games in the lessons?

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

Suppose that you had some new lessons to learn at school and you could learn them by any of these ways: Braille, tape, Optacon, readers, talking books.

17. Which way would be your first choice?

[] Braille [] Tape [] Optacon [] Readers [] Talking Book

18. Which way would be your second choice?

[] Braille [] Tape [] Optacon [] Readers [] Talking Book

19. Which way would be your third choice?

[] Braille [] Tape [] Optacon [] Readers [] Talking Book

20. Which way would be your fourth choice?

[] Braille [] Tape [] Optacon [] Readers [] Talking Book

Would You?

OMB 51-S73001

ATTITUDE TOWARD LEARNING AND SELF CONCEPT

Teacher Copy
(Student receives braille version)

Directions: See how well you can describe yourself.
Mark the box that tells how you feel about yourself.
Here is a sample:

How often do you have a dollar in your pocket?

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost Always

If you think you have a dollar in your pocket about half the time, put a mark in the [] before "about half the time."

Remember, none of the questions have right or wrong answers. They are just ways to describe yourself. Raise your hand if you have any questions.

---

1. How often do you feel free to say what you really think?

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

2. How often do you try to make things turn out the way you want?

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

3. How often are you a leader when friends are around?

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

4. How often do you feel left out of things because of your blindness?

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

5. How often do you think that good grades are important to you?

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

6. How often do you think the teacher likes to teach you?

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

7. How often do you feel smart enough to solve hard problems?

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

Would You?

8. How often do you learn from your mistakes and try not to do them again?

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

9. How often, when you are home, do you and your parents talk about your school work?

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

10. How often do you read books or magazines, other than for school work?

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

11. How often do you feel like coming to school in the morning?

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

12. How often do you make up your own mind instead of listening to other kids?

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

13. How often do you stick to a hard job until you finish it?

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

14. How often do you feel happy to be who you are?

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

15. How often do you work hard even if the reward or payoff isn't soon?

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

16. How often do you like to decide things for yourself?

[] Almost never [] Not very often [] About half the time [] Most of the time [] Almost always

APPENDIX C-3

Instrument: Tactile-Kinesthetic Form Discrimination Test (Long Form)

Mode of Administration: Teacher tests each child individually. There is a set of the raised forms to be used for this test at your school. See your Optacon coordinator to obtain them. Sorry, but we could not complete enough of these 3-dimensional forms for each folder.

Materials Required:

1. Five thermoform sheets with five rows of geometric figures on each sheet.
2. Sheet containing directions and place to record student's name and responses.
3. Pencil for the teacher.

Directions:

1. Read general directions for administering tests.
2. Write student name, date and school on the test sheet.
3. Provide the student with the first thermoform sheet and begin administration.
4. Child is to touch forms with left hand only, using the index finger, for this test.
5. Try to put the child at ease. Do not give any negative comment. Do not tell the child he is wrong.
6. Do not give prompts or helps.
7. Record each response as right (C) or wrong (X). Count first choice only. However, child may go back and forth over a row before making a choice.
8. When completed, give materials to local project coordinator to mail to AIR.

TACTILE-KINESTHETIC FORM DISCRIMINATION TEST

Name _____

Date _____

School _____

The following sheets, marked 1-5, contain facsimiles of the test figures. The actual figures for administration to blind students are embossed on 3-dimensional plastic sheets.

Instructions for Administration

Sheets 1 & 2

Give the child embossed sheet number one.

Say: There are some forms. Put your fingers on the top row. (Assist the child to locate row if necessary.)

Find the form that is different from the others. Show me the different one.

Then repeat instructions for each row on sheets 1 and 2 and for the top two rows of sheet 3.

Sheets 3, 4, & 5

Beginning on row 3 of sheet 3,

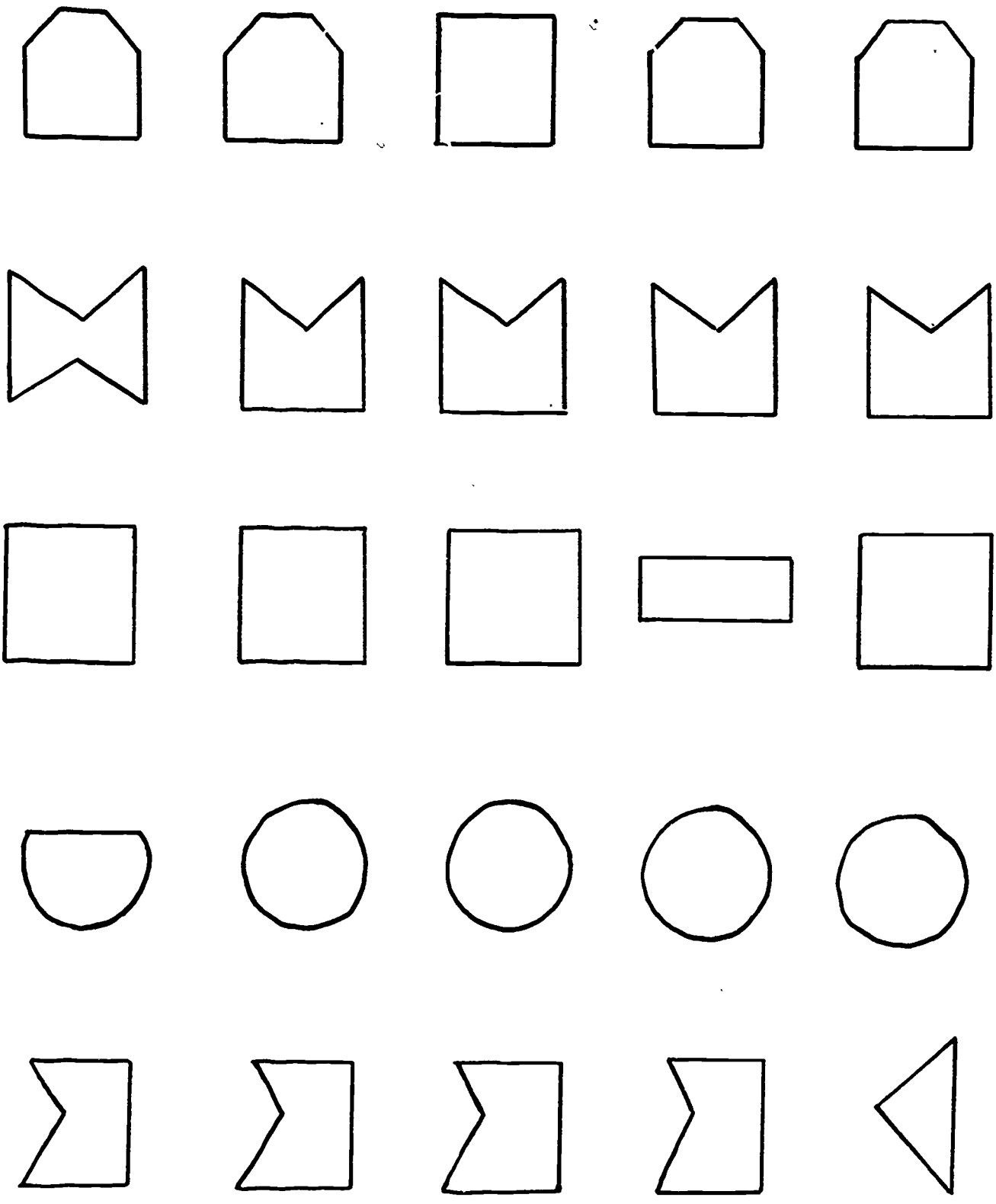
Say: Here are some more forms. This time find the two that are the same in each row.

Put your fingers on the top row (assist if necessary). Now find the two forms that are the same. Show them to me.

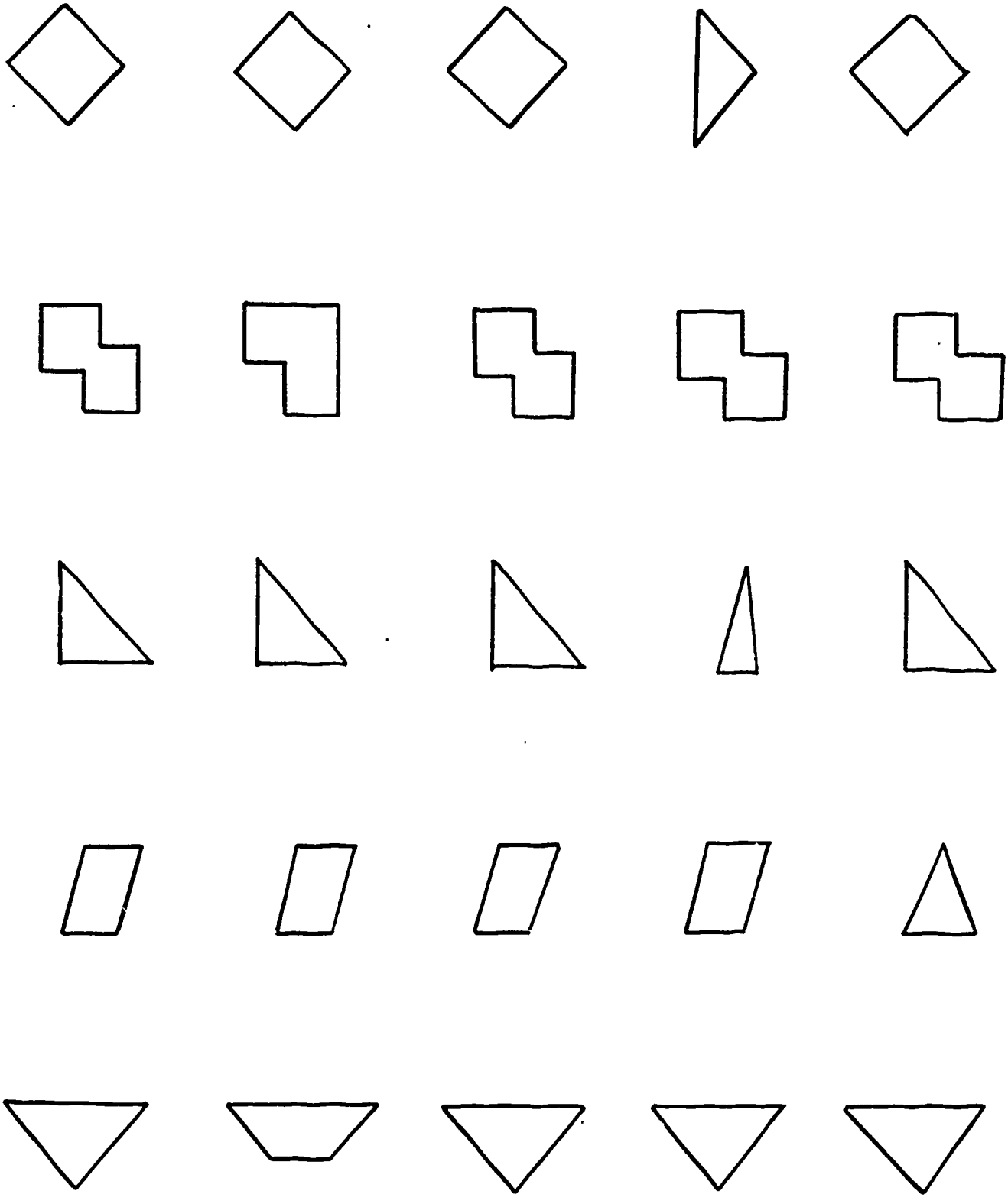
Mark a "C" if correct and an "X" if the student's answer is wrong:

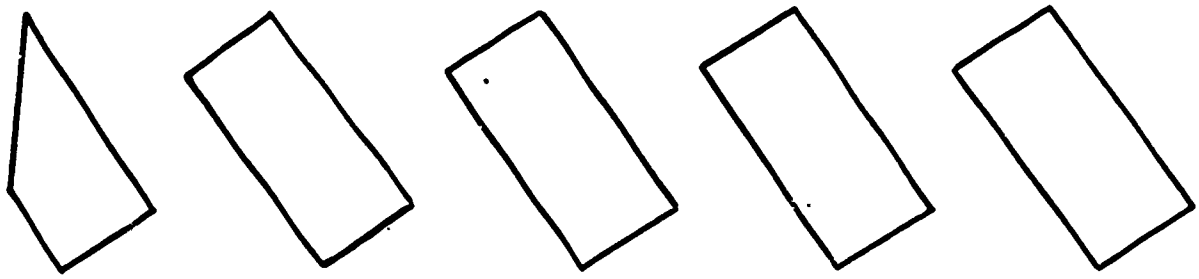
	Sheet 1	Sheet 2	Sheet 3	Sheet 4	Sheet 5
Row 1	[]	[]	[]	[]	[]
Row 2	[]	[]	[]	[]	[]
Row 3	[]	[]	[]	[]	[]
Row 4	[]	[]	[]	[]	[]
Row 5	[]	[]	[]	[]	[]

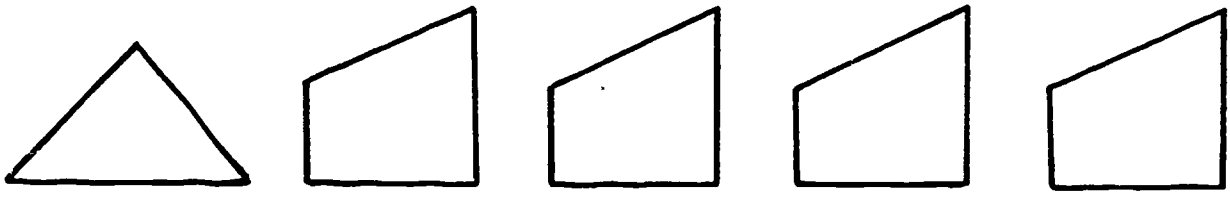
FACSIMILE SET (Use raised version for testing)

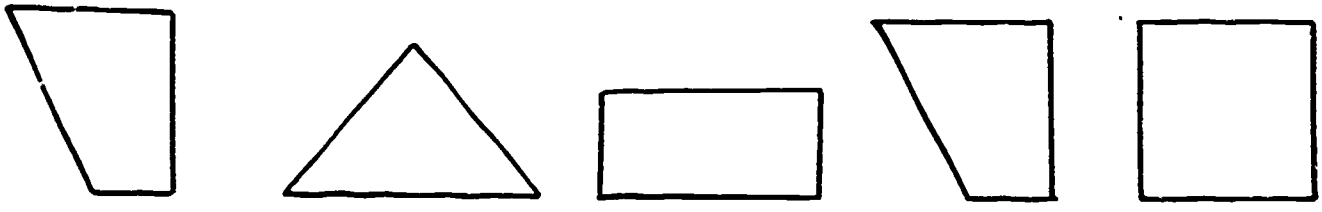


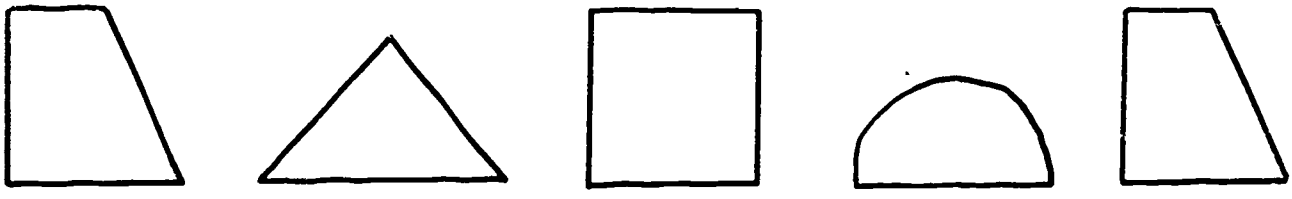
(2)

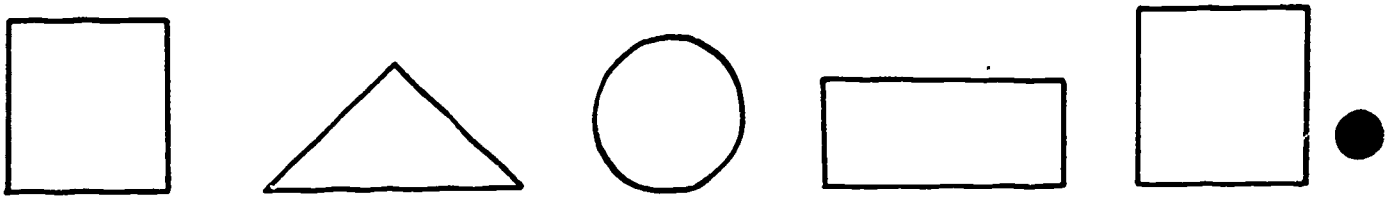


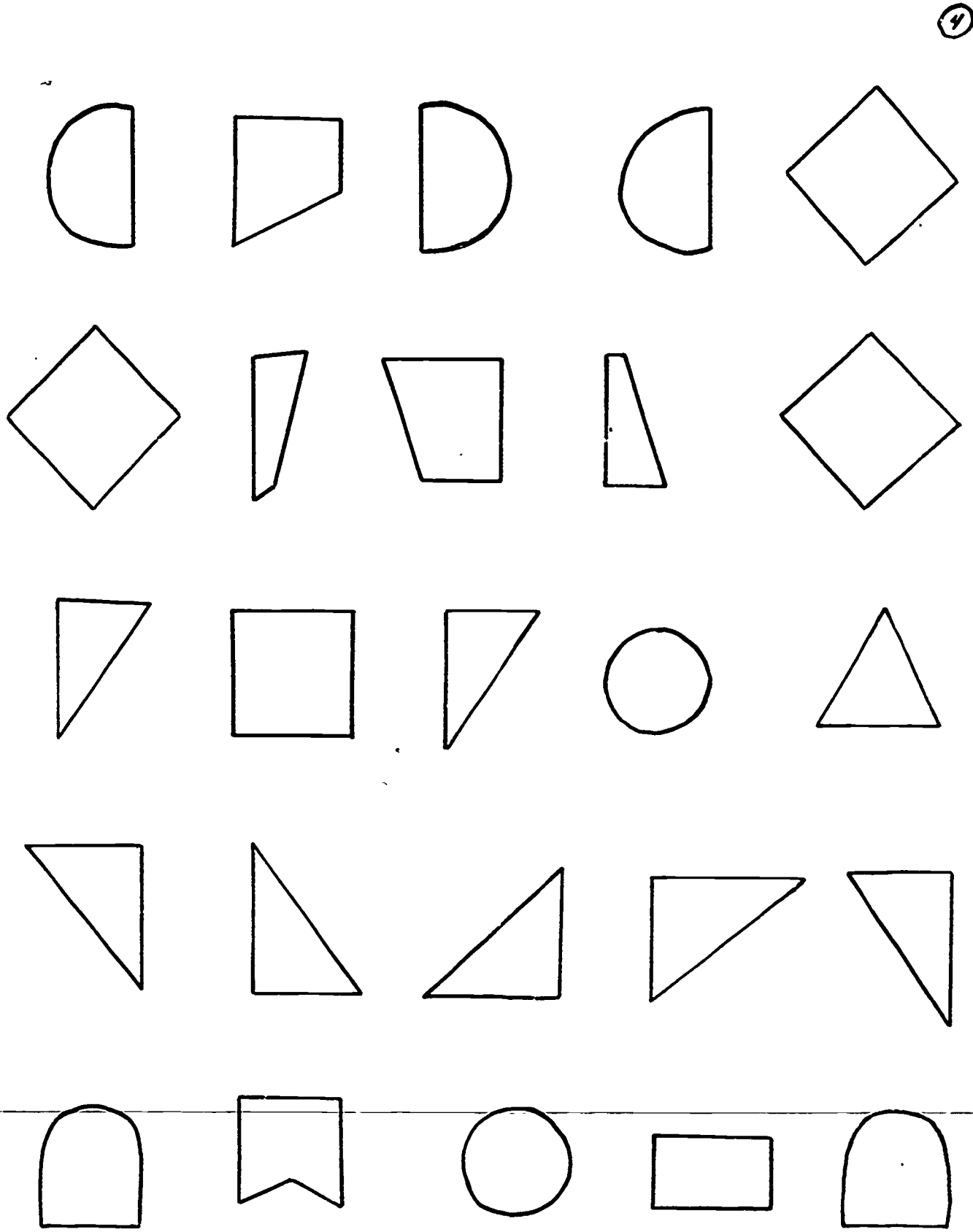


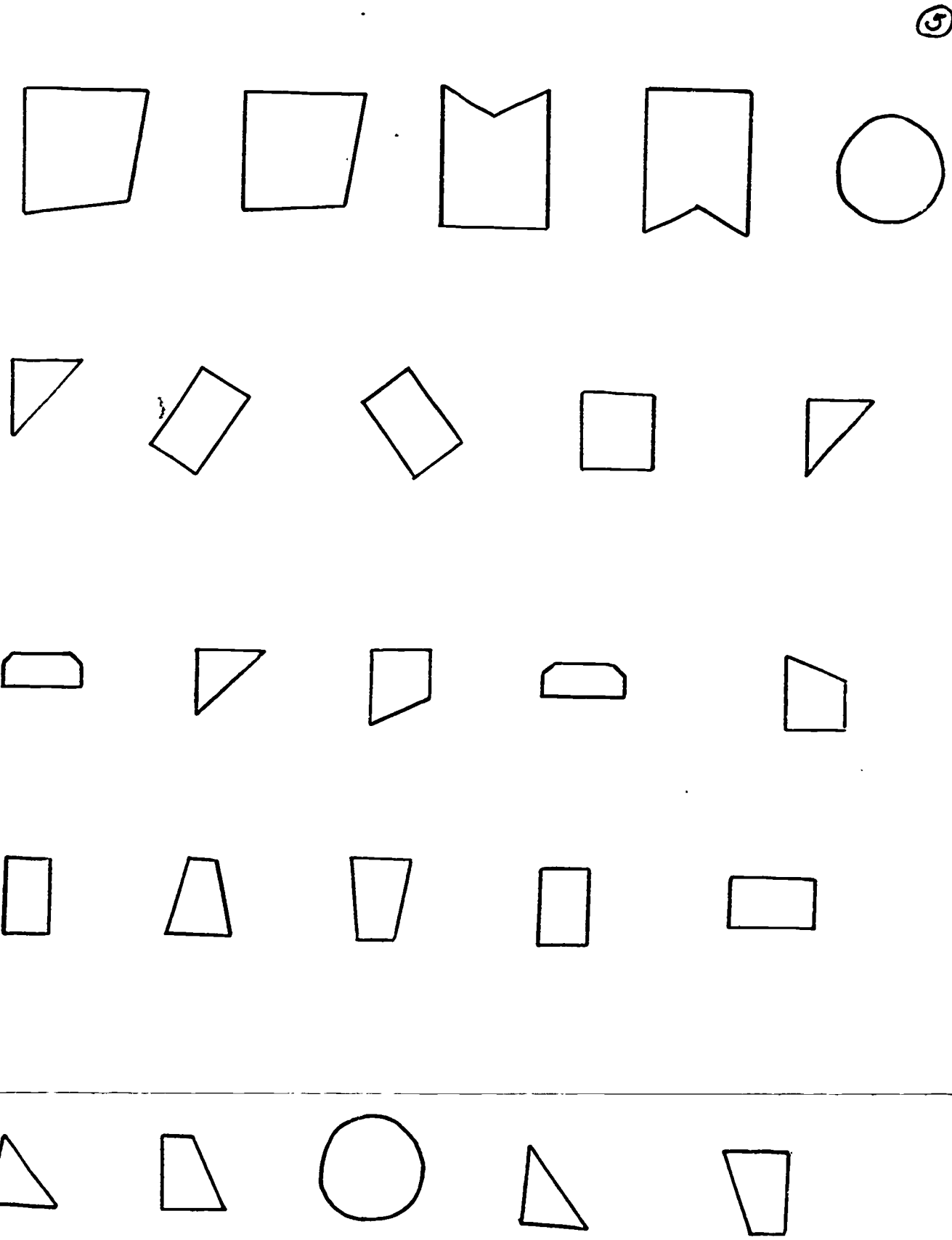












APPENDIX C-4

BRAILLE READING COMPREHENSION

TEACHER INSTRUCTIONS

Each student should receive the Reading Comprehension Test appropriate for his or her grade level. The student's name and other identifying information should be filled in by the teacher. Make sure that each student has a sharpened pencil.

Say: This test will show how well you understand what you read.

Say: You are to read the story and do the items following it. Be sure you choose the best answer for each item. Make a mark in the space next to the letter of the answer you choose. Are there any questions?

Say: Now do the Sample Item.

After students have had time to complete the Sample Item, check to be sure that all students know how they are to mark their answers.

Say: When I say "BEGIN," start reading. At the end of two minutes I will say "MARK." You are to circle the last word you have read and then continue reading and answer the items.

Say: Do you have any questions?

Say: All right, BEGIN.

Note the time and after two minutes say: MARK. Circle the last word you have read. Then continue. When you have completed Question #8, stop and wait for further directions.

When everyone has completed Part 1, go on to Part 2.

Say: This is the second part of the test. When I say "BEGIN," start reading. At the end of two minutes I will say "MARK." You are to circle the last word you have read and then continue reading and answer the items.

Say: Are there any questions?

Say: All right, BEGIN.

Note the time and after two minutes say: MARK. Circle the last word you have read. Then continue.

When everyone has completed Part 2, collect the tests.

BRAILLE READING COMPREHENSION

Elementary Level

Grades 4, 5, 6, 7, 8

Teacher Copy
(Student folder contains braille version)

Student _____

Date _____

School _____

SAMPLE ITEM: Read the sample item below and mark the answer.

Be sure you mark

( ) A all the answers
( ) B a good answer
( ) C many answers
( ) D the best answer

Part 1

A king had a daughter named Shining Moon. She was so tall and strong that she was almost a giant. She could wrestle with any young man in the kingdom and win. Her father wanted her to marry. But she said she would only marry a man who could wrestle better than she. Her father then gave her a written promise that she could marry of her own free will. This was proclaimed all over the kingdom. Men came from everywhere. The first man who could defeat her could have her as his wife. Any who lost must forfeit to her a hundred horses. Before long she had more than ten thousand horses.

At last, as in all such legends, there came a young and handsome prince, son of a powerful king. He brought with him a thousand beautiful horses. The king very much wanted this rich youth as his son-in-law. He privately asked his daughter to let herself be beaten this time. She said she would not do so for anything in the world.

In the great hall the audience gathered, the king and the queen sitting above them. In the rules of the contest it was decided that because the young prince was of such high rank, he should forfeit all his horses if he were beaten. Everyone in the hall wanted the prince to win. But Shining Moon won again!

1. From the story, we can decide that Shining Moon

( ) A did not marry the prince
( ) B wrestled the prince again
( ) C married another man later
( ) D never wrestled again

2. In most of her wrestling matches, the man Shining Moon defeated had to give her

( ) A 10 horses
( ) B 100 horses
( ) C 500 horses
( ) D 1,000 horses

3. Shining Moon defeated

( ) A fewer than 10 men
( ) B no more than 50 men
( ) C as many as 100 men
( ) D no less than 150 men

4. How many horses did Shining Moon win from the prince?

( ) A 10
( ) B 100
( ) C 1,000
( ) D None

(continued on next page)

5. The best title for this story would be

( ) A The Land of Strong Women
( ) B Shining Moon
( ) C Strange Ways of Courting
( ) D Wrestling

6. The prince can be described as

( ) A popular
( ) B merry
( ) C old-fashioned
( ) D poor

7. Shining Moon can be described as

( ) A ugly
( ) B humble
( ) C practical
( ) D powerful

8. A conclusion about the end of the story would be that it

( ) A has a happy ending
( ) B ends the way we expect
( ) C has a surprise ending
( ) D suggests the prince wins

STOP

Part 2

Our first consideration has been safety. The Orion is made only in a 2-door sedan. You don't have to worry about setting automatic back door locks that come on 4-door cars--your children can't fall out of an Orion!

Both front and back seats are furnished with shoulder-type safety straps at no extra cost. The dashboard is deeply padded with foam rubber and all the instruments on the front panel are recessed. The steering wheel gives six inches under a moderate impact. There is even a safety light which flashes when you reach 60 miles an hour, and a gentle bell rings when you pass 72.

Our second consideration has been to provide you with an economical but not a cheap car. The interior finishes are durable and washable. There is a minimum of extra trim and all of it is either aluminum or stainless steel. These are easier to maintain than chrome. All cars come with the same 160 horsepower, straight 6 motor. This gives adequate pick-up for safe passing and is cheaper to maintain than a V-8.

Optional extras? Most of them are standard. But you can purchase a radio or automatic transmission (only slightly less economical on gas than manual) if you wish.

9. An optional extra would be

( ) A turn signals
( ) B windshield wipers
( ) C automatic transmission
( ) D manual transmission

10. From the things claimed for this car, we can say that it is

( ) A a sturdy car for thrifty buyers
( ) B a cheap car which will not stand up
( ) C a costly car, since it includes so many extras
( ) D about the cheapest car in America

11. The manufacturer claims that the upkeep is less expensive on a car with

( ) A front-wheel drive
( ) B turbo-jet engine
( ) C a V-8 motor
( ) D a straight 6 engine

12. The car comes equipped with

( ) A chrome
( ) B a radio
( ) C recessed instruments
( ) D a large V-8 engine

13. This ad implies that the seat covers on the Orion are

( ) A washable
( ) B beautiful
( ) C temporary
( ) D removable

14. The expression "adequate pick-up" means sufficient

( ) A weight of the car
( ) B load capacity
( ) C color and appearance
( ) D increase in speed

15. Although many claims are made for the Orion, the only evidence given is about

( ) A comfort
( ) B safety features
( ) C exact price
( ) D performance

16. A good title for this ad would be

( ) A Orion--America's 4-Door Car!
( ) B Information About Fastbacks!
( ) C Orion--The Car for the Young Family
( ) D The Supersonic Speedster!

STOP

Instrument: Braille Reading Comprehension, Secondary Level (Grades 9, 10, 11, 12)

When Used: January

Mode of Administration: Teacher tests all children in grades 9 through 12 in a group session.

Materials Required:

1. Braille Reading Comprehension Booklet, Secondary Level, for each child.
2. Pencil for each child.
3. Teacher instructions for Braille Reading Comprehension Test.
4. Stop watch or watch with sweep second hand.

Directions:

1. Read general directions for administering tests.
2. Write student name, date and school on each booklet.
3. Distribute booklets and pencils to students.
4. Begin testing.
5. When completed, give materials to local project coordinator to mail to AIR. Do not score.

BRAILLE READING COMPREHENSION

Secondary Level

Grades 9, 10, 11, 12

Teacher Copy
(Student folder contains braille version)

Student _____

Date _____

School _____

Braille Reading Comprehension

SAMPLE ITEM: Read the sample item below and mark the answer.

Be sure you mark

( ) A all the answers
( ) B a good answer
( ) C many answers
( ) D the best answer

Part 1

Our first consideration has been safety. The Orion is made only in a 2-door sedan. You don't have to worry about setting automatic back door locks that come on 4-door cars--your children can't fall out of an Orion!

Both front and back seats are furnished with shoulder-type safety straps at no extra cost. The dashboard is deeply padded with foam rubber and all the instruments on the front panel are recessed. The steering wheel gives six inches under a moderate impact. There is even a safety light which flashes when you reach 60 miles an hour, and a gentle bell rings when you pass 72.

Our second consideration has been to provide you with an economical but not a cheap car. The interior finishes are durable and washable. There is a minimum of extra trim and all of it is either aluminum or stainless steel. These are easier to maintain than chrome. All cars come with the same 160 horsepower, straight 6 motor. This gives adequate pick-up for safe passing and is cheaper to maintain than a V-8.

Optional extras? Most of them are standard. But you can purchase a radio or automatic transmission (only slightly less economical on gas than manual) if you wish.

1. An optional extra would be

( ) A turn signals
( ) B windshield wipers
( ) C automatic transmission
( ) D manual transmission

2. From the things claimed for this car, we can say that it is

( ) A a sturdy car for thrifty buyers
( ) B a cheap car which will not stand up
( ) C a costly car, since it includes so many extras
( ) D about the cheapest car in America

3. The manufacturer claims that the upkeep is less expensive on a car with

( ) A front-wheel drive
( ) B turbo-jet engine
( ) C a V-8 motor
( ) D a straight 6 engine

4. The car comes equipped with

( ) A chrome
( ) B a radio
( ) C recessed instruments
( ) D a large V-8 engine

5. This ad implies that the seat covers on the Orion are

( ) A washable
( ) B beautiful
( ) C temporary
( ) D removable

6. The expression "adequate pick-up" means sufficient

( ) A weight of the car
( ) B load capacity
( ) C color and appearance
( ) D increase in speed

7. Although many claims are made for the Orion, the only evidence given is about

( ) A comfort
( ) B safety features
( ) C exact price
( ) D performance

8. A good title for this ad would be

( ) A Orion--America's 4-Door Car!
( ) B Information About Fastbacks!
( ) C Orion--The Car for the Young Family
( ) D The Supersonic Speedster!

STOP

Part 2

America's favorite heroes go far toward vindicating the whole democratic theory of careers open to talents. We believe that character is more important than brains. Hard work, tenacity, enterprise, and firmness in the face of odds are the qualities that Americans most admire, rather than originality or eloquence of tongue and pen.

The hero must be a man of good will and also a good neighbor, preferably something of a joiner. The public likes to think of its idol as simple in greatness. Manliness, straightforward manners, and salty speech are approved. Love of the soil, of dogs and horses and manual hobbies and fishing is better understood than absorption in art, literature, and music. (The public distrusts Presidents who are photographed fishing in their store clothes.) The hero must not lose touch with his birthplace and origins, however humble; the atmosphere of small towns and front-porch campaigns, cultivated by so many candidates for President, pays tribute to this demand. "I really believe there are more attempts at flattering the farmers than any other class," Lincoln, as candidate for President, remarked at the Wisconsin State Fair; "The reason for which I cannot perceive, unless it be that they cast more votes than any other."

Also, the touch of versatility and homely skills is applauded in a hero. Jefferson is most remembered as an inventor of gadgets from which he plainly got a great deal of fun. "Tinkering" is American. Famous Europeans have testified to the fascination that Franklin held for them. A hero's achievements (unlike those of the artist, philosopher, and pure scientist) must lie open to everyman's comprehension.

9. The American hero described in this passage must love things that are

( ) A beautiful
( ) B complicated
( ) C expensive
( ) D ordinary

10. The author believes that Americans are likely to respect a man more for

( ) A originality than courage
( ) B patience than initiative
( ) C hard work than a smooth tongue
( ) D a large vocabulary than plain speech

11. In the second paragraph, the author quotes Lincoln's

( ) A explanation of the flattery of farmers by politicians
( ) B explanation of his popularity
( ) C opinion of farmers
( ) D opinion of politicians who constantly flatter farmers

12. In the first paragraph, the qualities Americans most admire are listed in

( ) A a footnote
( ) B an example
( ) C an illustration
( ) D a series

(continued on next page)

13. According to this article, Americans believe that a hero must

( ) A be friendly with his neighbors
( ) B retreat occasionally into solitude
( ) C be generous to his neighbors
( ) D respect his neighbor's privacy

14. The expression "simple in greatness" means

( ) A slow but sure to get there
( ) B complex in minor ways
( ) C unassuming though famous
( ) D friendly to everybody

15. "Manual hobbies" are hobbies that are

( ) A liked by boys
( ) B done with the hands
( ) C enjoyed outdoors
( ) D used to build muscles

16. According to the article, which of the following is best suited to become an American hero?

( ) A a philosopher born on a farm
( ) B a writer born in a mansion
( ) C a research scientist born in Europe
( ) D a tinkerer born in a small town

STOP

APPENDIX C-5

DIAGNOSTIC SPELLING TEST

Name _____

Date _____

School _____

Teacher Instructions:

Say: Here are some words to spell. I will say the word and you spell it correctly, without using any contractions. Ready?

(Say each word twice, slowly. The teacher marks the appropriate box for each answer.)

	Braille spelling (uses braille code)	Correct spelling (uses English code)	Other (makes mistake)
1. after	[]	[]	[]
2. city	[]	[]	[]
3. should	[]	[]	[]
4. some	[]	[]	[]
5. friend	[]	[]	[]
6. father	[]	[]	[]
7. children	[]	[]	[]
8. many	[]	[]	[]
9. sing	[]	[]	[]
10. their	[]	[]	[]
11. had	[]	[]	[]
12. this	[]	[]	[]
13. much	[]	[]	[]
14. mean	[]	[]	[]

Diagnostic Spelling Test
(cont.)

	Braille spelling (uses braille code)	Correct spelling (uses English code)	Other (makes mistake)
15. your	[]	[]	[]
16. work	[]	[]	[]
17. across	[]	[]	[]
18. and	[]	[]	[]
19. word	[]	[]	[]
20. mission	[]	[]	[]
21. together	[]	[]	[]
22. those	[]	[]	[]
23. the	[]	[]	[]
24. found	[]	[]	[]
25. name	[]	[]	[]
26. really	[]	[]	[]
27. every	[]	[]	[]
28. question	[]	[]	[]
29. along	[]	[]	[]
30. still	[]	[]	[]

APPENDIX C-6

Instrument: Activity Log

When Used: With each lesson and at end of each unit

Mode of Administration: Teacher completes form for each child Individually

Materials Required:

1. Activity Log sheet
2. Pencil for self
3. Stop watch or watch with sweep second hand

Directions:

1. At beginning of unit, fill in student name, teacher name, and unit number.
2. At the end of the first lesson, circle the elapsed time to the nearest 10 minutes. For example, if pupil takes 28 minutes to do the lesson, circle 30. If pupil takes 35 minutes, circle next highest number, i.e., 40.
3. At the end of the second lesson, add on the amount of time from the first lesson. For example, if 30 minutes were used to do Lesson 1 and 23 minutes were used to do Lesson 2, circle 50. Similarly, cumulate for each subsequent lesson.
4. If more than 150 minutes of study are used in the unit, show the total time in the blank provided to the right of 150.
5. At the end of the unit or when criterion exercises have been completed, fill in remainder of the form. (See Definitions of Student Performance and Materials Adequacy Variables.)
6. When completed, give to local project coordinator to mail to AIR.

ACTIVITY LOG

Unit #: _____ Student name: _____

Lesson subsections used: _____ Teacher name: _____

Elapsed time: 10 20 30 40 50
60 70 80 90 100
110 120 130 140 150

Criterion exercise: _____ # Correct _____ Date _____
Correct _____ Date _____
Correct _____ Date _____

TEACHER EVALUATION OF:

Student Performance

	Excellent	Average	Poor
Tracking technique	○	○	○
Tactile technique	○	○	○
Letter recognition	○	○	○
Word attack	○	○	○
Interest level	○	○	○
Attention span	○	○	○

Materials Adequacy

	Very appropriate	Usable	Inappropriate
Drill & practice materials	○	○	○
Enrichment materials	○	○	○
Criterion exercise	○	○	○
Difficulty level	○	○	○
Inherent interest	○	○	○

Other use of Optacon (time and description): _____

Remarks, observations, suggestions about the lesson (turn over for more space):

EQUIPMENT:

	Optacon	Optacon	Visual Display	Tracking Device	Cable
Equipment # :	_____	_____	_____	_____	_____
Minutes used:	_____	_____	_____	_____	_____

Equipment problem (if any): _____

Corrective action taken: _____

Remarks, observations, suggestions about the equipment (turn over for more space):

Definitions of Student Performance and Materials Adequacy Variables

Student Performance

Tracking Technique:

Excellent: Moves camera smoothly and in good alignment; finds new lines without help.

Average: Moves camera and locates new lines with occasional help.

Poor: Moves camera in a jerky manner or retraces camera frequently; finds new lines with difficulty and often requires help.

Tactile Technique:

Excellent: Maintains index finger in proper placement on tactile vibrators.

Average: At times moves finger on image but most of the time is steady.

Poor: Rolls finger or rotates finger to feel image outline.

Letter Recognition:

Excellent: Recalls letter forms after initial introduction of letter shape with very few mistakes.

Average: Recalls most letters after introduction but has trouble with some.

Poor: Needs continuous help and prompting on letter recognition.

Word Attack:

Excellent: Remembers the sequence of letters until the word is completed; quickly recognizes letter patterns.

Average: Remembers sequences if words are short; recognizes a few letter patterns.

Poor: Has difficulty with short term recall of letters read; has frequent retracing of words; does not recognize letter patterns.

Interest Level:

Excellent: Looks forward to the lesson; expresses enthusiasm; shows desire to continue.

Average: Does not express either strong enthusiasm or strong criticism.

Poor: Seems reluctant to initiate and complete the lessons; needs frequent encouragement to continue.

Attention Span:

Excellent: Sustains attention throughout a full lesson period (approximately 30 minutes).

Average: Sustains attention only for shorter time periods (approximately 15 minutes).

Poor: Sustains attention only briefly (approximately 5 minutes or less).

Materials Adequacy

Drill and Practice Materials are

Very Appropriate: Just right for this child.

Usable: Mostly right for this child.

Inappropriate: This child has frequent trouble with drill and practice materials.

Enrichment Materials are

Very Appropriate: Just right for this child.

Usable: Mostly right for this child.

Inappropriate: This child has frequent trouble with the enrichment materials.

Criterion Exercise is

Very Appropriate: Just right for this child.

Usable: Mostly right for this child.

Inappropriate: This child has frequent trouble with the criterion exercise.

Difficulty Level:

Very Appropriate: The overall unit is at the right difficulty level for this child.

Usable: The overall unit is mostly at the right difficulty level for this child.

Inappropriate: The overall unit does not seem to be at the right difficulty level for this child.

Inherent Interest:

Very Appropriate: The overall unit has inherent interest for this child.

Usable: The overall unit is mostly interesting to this child.

Inappropriate: The overall unit does not seem to interest this child.

Guidelines for Completion of the Activity Logs

Each time a student begins a new instructional unit the teacher should identify herself and the student on a fresh Activity Log sheet. As the student progresses through the material a tally of cumulative time should be kept at the top of the sheet. If the time exceeds the amount shown (150), write the number of excess minutes in the adjacent blank.

When the student finishes each instructional unit the Activity Log should be completed and forwarded to AIR through the local Optacon Project Coordinator. Most of the items call for check marks or other short answers. Information about the equipment should be filled out as well. Completion of the form will typically take from 3-5 minutes depending on the amount of teacher comments added.

Note carefully the definitions of terms that are used on the form and try to adhere closely to these definitions. Some additional explanations are:

1. In judging tracking technique be conscious of the fact that beginning students will often retrace letters or words before attempting to name them. This is a natural action at first, but should decrease as the student progresses. Perhaps more important as a sign of poor tracking is the retracing of words because of poor alignment of the camera. That is, if the student is unable to track with a consistent orientation of the line within the field he will find it necessary to retrace in order to align the type properly.

2. Duration of attention span is meant to refer to the student's attention to the lesson, not simply to the amount of time he has his finger on the Optacon vibrators. For example, he may still be giving his attention if he is discussing the lesson, feeling the raised letters, or touching the tracking equipment. It is quite possible, too, that the teacher may deliberately want to provide relief during the lesson with rest periods of a minute or so. This is still reasonable use of time within the meaning of "attention span."

3. Keep in mind that the evaluations on the Activity Log should be as complete and as "objective" as possible. The focus of the attention here is the student, the materials, and the equipment. In no way is it a reflection of the teacher's performance or ability to have the student learn.

Instrument: Optacon Reading Criterion Test, Elementary Level (Grades 4, 5, 6, 7, 8)

Mode of Administration: Teacher tests each child individually

Materials Required:

1. Optacon Reading Criterion Test, Elementary Level, Teacher's copy.
2. Optacon Reading Criterion Test, Elementary Level, Student's copy.
3. Pencil for self.
4. Stop watch or watch with sweep second hand.

Directions:

1. Read general directions for administering tests.
2. Write student name, date and school on teacher's copy.
3. Give student's copy to the student.
4. Begin testing. Have the child read aloud on Parts 1-4 and read silently on Parts 5-8.
5. In Parts 1-4, you may prompt the child on any word not read in a reasonable time (about 15 seconds), but mark the word the same way as any word not read correctly.
6. Record times and answers on teacher's copy.
7. Part 9 is not timed.
8. When completed, give materials to the local project coordinator to mail to AIR.

OPTACON READING CRITERION TEST
ELEMENTARY LEVEL

Grades 4, 5, 6, 7, 8

Teacher's Copy
(Complete One Copy Per Student)

Name _____

Date _____

School _____

Part 1

Say: Here is a story to read. When I say "START," you are to read the story aloud. It is a very short story. If you come to a word you have trouble reading, guess at it and keep going. Don't get hung-up on one word. Remember, when I say "START," read the story aloud. When I say "STOP," you should stop reading. Do you have any questions?

START

(A 5-minute limit; start timing. As the child reads aloud, draw a line through each word he has not read correctly, using your copy of the story. If the pupil inserts a word not in the sentence, write in the word he says. If the student completes the passage in 5 minutes or less, record the exact time he took to read the entire passage. If he does not finish within the 5 minute period, say "STOP" and circle the last word he read.)

Often people are different. Some children like to work together but others do not. No one can live in just his own world. If we think other people are never right, it is time to find out more about their life. We can study them and the things they do. STOP

Time Elapsed _____
Minutes & Seconds

Part 2

Say: Here is a story to read. When I say "START," you are to read the story aloud. It is a very short story. If you come to a word you have trouble reading, guess at it and keep going. Don't get hung-up on one word. Remember, when I say "START," read the story aloud. When I say "STOP," you should stop reading. Do you have any questions?

START

(A 5-minute limit; start timing. As the child reads aloud, draw a line through each word he has not read correctly, using your copy of the story. If the pupil inserts a word not in the sentence, write in the word he says. If the student completes the passage in 5 minutes or less, record the exact time he took to read the entire passage. If he does not finish within the 5 minute period, say "STOP" and circle the last word he read.)

Ned has a letter from Utah. He is excited because it is from Jane, who is coming to visit. They both like horses and going to the zoo. Jane is fun. She always knows quite a few jokes. She also likes to yell and to keep busy with loud games. STOP

Time Elapsed _____
Minutes & Seconds

Part 3

Say: Here is a story to read. When I say "START," you are to read the story aloud. It is a very short story. If you come to a word you have trouble reading, guess at it and keep going. Don't get hung-up on one word. Remember, when I say "START," read the story aloud. When I say "STOP," you should stop reading. Do you have any questions?

START

(A 5-minute limit; start timing. As the child reads aloud, draw a line through each word he has not read correctly, using your copy of the story. If the pupil inserts a word not in the sentence, write in the word he says. If the student completes the passage in 5 minutes or less, record the exact time he took to read the entire passage. If he does not finish within the 5 minute period, say "STOP" and circle the last word he read.)

A king had a daughter named Shining Moon. She was so tall and strong that she was almost a giant. She could wrestle with any young man in the kingdom and win. Her father wanted her to marry. But she said she would only marry a man who could wrestle better than she. STOP

Time Elapsed _____
Minutes & Seconds

Part 4

Say: Here is a story to read. When I say "START," you are to read the story aloud. It is a very short story. If you come to a word you have trouble reading, guess at it and keep going. Don't get hung-up on one word. Remember, when I say "START," read the story aloud. When I say "STOP," you should stop reading. Do you have any questions?

START

(A 5-minute limit; start timing. As the child reads aloud, draw a line through each word he has not read correctly, using your copy of the story. If the pupil inserts a word not in the sentence, write in the word he says. If the student completes the passage in 5 minutes or less, record the exact time he took to read the entire passage. If he does not finish within the 5 minute period, say "STOP" and circle the last word he read.)

Our first consideration has been safety. The Orion is made only in a 2-door sedan. You don't have to worry about setting automatic back door locks that come on 4-door cars--your children can't fall out of an Orion! Both front and back seats are furnished with shoulder-type safety straps at no extra cost. STOP

Time Elapsed _____
Minutes & Seconds

Part 5

Say: Here is a story to read. When I say "START," you are to read the story silently. It is a very short story. If you come to a word you have trouble reading, guess at it and keep going. Don't get hung-up on one word. Remember, when I say "START," read the story silently. Tell me when you are through reading the story. When I say "STOP," you should stop reading. Do you have any questions?

START

(A 5-minute limit; start timing. If the student completes the passage in 5 minutes or less, record the exact time he took to read the entire passage. If he does not finish within the 5 minute period, say "STOP" and circle the last word he read. Then ask the student to tell you what the story was about. If the student is able to recount most of the concepts and happenings in the passage, mark meaning understood. If the student was able to read only part of the passage, judge his comprehension on that part only.

Father read parts of the page. Mother heard several hard words in the sentence. They could see something to change which would make my answer better. I need to study their example to see if the whole story should be said again. Many of my words were good but long. STOP

Meaning Understood: Yes ___ No ___

Time Elapsed _____
Minutes & Seconds

Part 6

Say: Here is a story to read. When I say "START," you are to read the story silently. It is a very short story. If you come to a word you have trouble reading, guess at it and keep going. Don't get hung-up on one word. Remember, when I say "START," read the story silently. Tell me when you are through reading the story. When I say "STOP," you should stop reading. Do you have any questions?

START

(A 5-minute limit; start timing. If the student completes the passage in 5 minutes or less, record the exact time he took to read the entire passage. If he does not finish within the 5 minute period, say "STOP" and circle the last word he read. Then ask the student to tell you what the story was about. If the student is able to recount most of the concepts and happenings in the passage, mark meaning understood. If the student was able to read only part of the passage, judge his comprehension on that part only.

Yesterday a letter came from Jack, who has been in Mexico for a year now. He says it is very hot there. However, he has fun in the busy stores and the loud streets. He is excited about going to the jungle, where he expects to pick up a lizard. STOP

Meaning Understood: Yes ___ No ___ Time Elapsed _____ Minutes & Seconds

Part 7

Say: Here is a story to read. When I say "START," you are to read the story silently. It is a very short story. If you come to a word you have trouble reading, guess at it and keep going. Don't get hung-up on one word. Remember, when I say "START," read the story silently. Tell me when you are through reading the story. When I say "STOP," you should stop reading. Do you have any questions?

START

(A 5-minute limit; start timing. If the student completes the passage in 5 minutes or less, record the exact time he took to read the entire passage. If he does not finish within the 5 minute period, say "STOP" and circle the last word he read. Then ask the student to tell you what the story was about. If the student is able to recount most of the concepts and happenings in the passage, mark meaning understood. If the student was able to read only part of the passage, judge his comprehension on that part only.

Her father gave her a written promise that she could marry of her own free will. This was proclaimed all over the kingdom. Men came from everywhere. The first man who could defeat her could have her as his wife. Any who lost must forfeit to her a hundred horses. STOP

Meaning Understood: Yes ___ No ___ Time Elapsed _____ Minutes & Seconds

Part 8

Say: Here is a story to read. When I say "START," you are to read the story silently. It is a very short story. If you come to a word you have trouble reading, guess at it and keep going. Don't get hung-up on one word. Remember, when I say "START," read the story silently. Tell me when you are through reading the story. When I say "STOP," you should stop reading. Do you have any questions?

START

(A 5-minute limit; start timing. If the student completes the passage in 5 minutes or less, record the exact time he took to read the entire passage. If he does not finish within the 5 minute period, say "STOP" and circle the last word he read. Then ask the student to tell you what

the story was about. If the student is able to recount most of the concepts and happenings in the passage, mark meaning understood. If the student was able to read only part of the passage, judge his comprehension on that part only.

On a safe car, the dashboard is deeply padded with foam rubber and all the instruments on the front panel are recessed. The steering wheel gives six inches under a moderate impact. There is a safety light which flashes when you reach 60 miles an hour, and a gentle bell rings when you pass 72. STOP

Meaning Understood: Yes ___ No ___

Time Elapsed _____ Minutes & Seconds

Part 9

Give the child Part 9 of the test.

Say: Here are some different reading selections. I will tell you what to do for each selection. There are thick lines between each selection so you can tell when you are at the end of a selection.

1. Now start with number one at the top of the page. (Locate number one.) Here are several sentences in different kinds of type style. Now read each sentence aloud to me. (If the pupil reads any word wrong, draw a line through that word.) There is a thin line between the different type styles and a thick line at the end.

My dog is big and barks at everything. Once he jumped on an old lady. Now he goes to school to learn how to behave.

Jane asked me if I would loan her a dollar. I said yes, but I never got it back. Jane is no longer my friend.

2. Now go to number 2. Here are some names and phone numbers. Find Mr. Paul Harmon's phone number--read it aloud to me.

Hansen Vance 1060 Day rd.....842-7088
Hanson Earl 8695 Morey av 842-6553
Hardcastle Ira 8282 Murray av.....842-4944
Harker Robert D 240 2nd.....842-5274
Harmon Paul 8080 Swanston Ln.....842-3539
Harms Dwayne 8313 Kelton dr.....842-7850
Haro Antonia 7361 Forest. 842-5807

Record Actual Response: _____

3. Now go to number 3. Here is a newspaper headline. Read it aloud. (If the pupil inserts a word not in the sentence, write in the word he says.)

Eating High Priced Foods

Record Actual Response: _____

4. Now go to number 4. Here is part of a catalogue. How much does the tape recorder cost?

Wollensak 4000 cordless cassette
The lowest-priced Wollensak ever!
Weight 3 lbs.
Price (less betteries) $42.50

Record Actual Response: _____

5. Now go to number 5. Here is part of an index in a book. Tell me the page to which you would turn to read about Miss Johnson.

Jingle jangles, 530
Johnson, Burges, 498
Johnson, James Weldon, 238
Johnson, Miss, 462
Joplin reading plan, 205
Just-so stories, 287

Record Actual Response: _____

6. Now go to number 6. Here are four labels from bottles or tubes in a medicine cabinet. There is a thin line between each label. Tell me which of these things are dangerous.

ASPIRIN

WARNING: Keep this and all medicines out of children's reach. In case of accidental overdose, contact a physician immediately.

First Aid
& Burn Cream

CAUTION: As with all medicines keep out of reach of children.

DANGER  POISON
KEEP OUT OF REACH OF CHILDREN
NOT TO BE
TAKEN BY MOUTH

Record Actual Responses:

Label #1: _____

Label #2: _____

Label #3: _____

Label #4: _____

OPTACON READING CRITERION TEST
SECONDARY LEVEL

Grades 9, 10, 11, 12

Teacher's Copy

(Complete One Copy Per Student)

Name _____

Date _____

School _____

Part 1

Say: Here is a story to read. When I say "START," you are to read the story aloud. It is a very short story. If you come to a word you have trouble reading, guess at it and keep going. Don't get hung-up on one word. Remember, when I say "START," read the story aloud. When I say "STOP," you should stop reading. Do you have any questions?

START

(A 5-minute limit; start timing. As the child reads aloud, draw a line through each word he has not read correctly, using your copy of the story. If the pupil inserts a word not in the sentence, write in the word he says. If the student completes the passage in 5 minutes or less, record the exact time he took to read the entire passage. If he does not finish within the 5 minute period, say "STOP" and circle the last word he read.)

Often people are different. Some children like to work together but others do not. No one can live in just his own world. If we think other people are never right, it is time to find out more about their life. We can study them and the things they do. STOP

Time Elapsed _____
Minutes & Seconds

Part 2

Say: Here is a story to read. When I say "START," you are to read the story aloud. It is a very short story. If you come to a word you have trouble reading, guess at it and keep going. Don't get hung-up on one word. Remember, when I say "START," read the story aloud. When I say "STOP," you should stop reading. Do you have any questions?

START

(A 5-minute limit; start timing. As the child reads aloud, draw a line through each word he has not read correctly, using your copy of the story. If the pupil inserts a word not in the sentence, write in the word he says. If the student completes the passage in 5 minutes or less, record the exact time he took to read the entire passage. If he does not finish within the 5 minute period, say "STOP" and circle the last word he read.)

Ned has a letter from Utah. He is excited because it is from Jane, who is coming to visit. They both like horses and going to the zoo. Jane is fun. She always knows quite a few jokes. She also likes to yell and to keep busy with loud games. STOP

Time Elapsed _____
Minutes & Seconds

Part 3

Say: Here is a story to read. When I say "START," you are to read the story aloud. It is a very short story. If you come to a word you have trouble reading, guess at it and keep going. Don't get hung-up on one word. Remember, when I say "START," read the story aloud. When I say "STOP," you should stop reading. Do you have any questions?

START

(A 5-minute limit; start timing. As the child reads aloud, draw a line through each word he has not read correctly, using your copy of the story. If the pupil inserts a word not in the sentence, write in the word he says. If the student completes the passage in 5 minutes or less, record the exact time he took to read the entire passage. If he does not finish within the 5 minute period, say "STOP" and circle the last word he read.)

Our first consideration has been safety. The Orion is made only in a 2-door sedan. You don't have to worry about setting automatic back door locks that come on 4-door cars--your children can't fall out of an Orion! Both front and back seats are furnished with shoulder-type safety straps at no extra cost. STOP

Time Elapsed _____
Minutes & Seconds

Part 4

Say: Here is a story to read. When I say "START," you are to read the story aloud. It is a very short story. If you come to a word you have trouble reading, guess at it and keep going. Don't get hung-up on one word. Remember, when I say "START," read the story aloud. When I say "STOP," you should stop reading. Do you have any questions?

START

(A 5-minute limit; start timing. As the child reads aloud, draw a line through each word he has not read correctly, using your copy of the story. If the pupil inserts a word not in the sentence, write in the word he says. If the student completes the passage in 5 minutes or less, record the exact time he took to read the entire passage. If he does not finish within the 5 minute period, say "STOP" and circle the last word he read.)

America's favorite heroes go far toward vindicating the whole democratic theory of careers open to talents. We believe that character is more important than brains. Hard work, tenacity, enterprise, and firmness in the face of odds are the qualities that Americans most admire, rather than originality or eloquence of tongue and pen.

Time Elapsed _____
Minutes & Seconds

Part 5

Say: Here is a story to read. When I say "START," you are to read the story silently. It is a very short story. If you come to a word you have trouble reading, guess at it and keep going. Don't get hung-up on one word. Remember, when I say "START," read the word silently. Tell me when you are through reading the story. When I say "STOP," you should stop reading. Do you have any questions?

START

(A 5-minute limit; start timing. If the student completes the passage in 5 minutes or less, record the exact time he took to read the entire passage. If he does not finish within the 5 minute period, say "STOP" and circle the last word he read. Then ask the student to tell you what the story was about. If the student is able to recount most of the concepts and happenings in the passage, mark meaning understood. If the student was able to read only part of the passage, judge his comprehension on that part only.

Father read parts of the page. Mother heard several hard words in the sentence. They could see something to change which would make my answer better. I need to study their example to see if the whole story should be said again. Many of my words were good but long. STOP

Meaning Understood: Yes ___ No ___

Time Elapsed _____
Minutes & Seconds

Part 6

Say: Here is a story to read. When I say "START," you are to read the story silently. It is a very short story. If you come to a word you have trouble reading, guess at it and keep going. Don't get hung-up on one word. Remember, when I say "START," read the story silently. Tell me when you are through reading the story. When I say "STOP," you should stop reading. Do you have any questions?

START

(A 5-minute limit; start timing. If the student completes the passage in 5 minutes or less, record the exact time he took to read the entire passage. If he does not finish within the 5 minute period, say "STOP" and circle the last word he read. Then ask the student to tell you what the story was about. If the student is able to recount most of the concepts and happenings in the passage, mark meaning understood. If the student was able to read only part of the passage, judge his comprehension on that part only.

Yesterday a letter came from Jack, who has been in Mexico for a year now. He says it is very hot there. However, he has fun in the busy stores and the loud streets. He is excited about going to the jungle, where he expects to pick up a lizard. STOP

Meaning Understood: Yes ___ No ___

Time Elapsed _____ Minutes & Seconds

Part 7

Say: Here is a story to read. When I say "START," you are to read the story silently. It is a very short story. If you come to a word you have trouble reading, guess at it and keep going. Don't get hung-up on one word. Remember, when I say "START," read the story silently. Tell me when you are through reading the story. When I say "STOP," you should stop reading. Do you have any questions?

START

(A 5-minute limit; start timing. If the student completes the passage in 5 minutes or less, record the exact time he took to read the entire passage. If he does not finish within the 5 minute period, say "STOP" and circle the last word he read. Then ask the student to tell you what the story was about. If the student is able to recount most of the concepts and happenings in the passage, mark meaning understood. If the student was able to read only part of the passage, judge his comprehension on that part only.

On a safe car, the dashboard is deeply padded with foam rubber and all the instruments on the front panel are recessed. The steering wheel gives six inches under a moderate impact. There is a safety light which flashes when you reach 60 miles an hour, and a gentle bell rings when you pass 72. STOP

Meaning Understood: Yes___ No ___

Time Elapsed _____ Minutes & Seconds

Part 8

Say: Here is a story to read. When I say "START," you are to read the story silently. It is a very short story. If you come to a word you have trouble reading, guess at it and keep going. Don't get hung-up on one word. Remember, when I say "START," read the story silently. Tell me when you are through reading the story. When I say "STOP," you should stop reading. Do you have any questions?

START

(A 5-minute limit; start timing. If the student completes the passage in 5 minutes or less, record the exact time he took to read the entire passage. If he does not finish within the 5 minute period, say "STOP" and circle the last word he read. Then ask the student to tell you what

the story is about. If the student is able to recount most of the concepts and happenings in the passage, mark meaning understood. If the student was able to read only part of the passage, judge his comprehension on that part only.

The hero must be a man of good will and also a good neighbor, preferably something of a joiner. The public likes to think of its idol as simple in greatness. Manliness, straightforward manners, and salty speech are approved. The hero must not lose touch with his birthplace and origins, however humble. STOP

Meaning Understood: Yes ___ No ___

Time Elapsed _____ Minutes & Seconds

Part 9

Give the child Part 9 of the test.

Say: Here are some different reading selections. I will tell you what to do for each selection. There are thick lines between each selection so you can tell when you are at the end of a selection.

1. Now start with number one at the top of the page. (Locate number one.) Here are several sentences in different kinds of type style. Now read each sentence aloud to me. (If the pupil reads any word wrong, draw a line through that word.) There is a thin line between the different type styles and a thick line at the end.

My dog is big and barks at everything. Once he jumped on an old lady. Now he goes to school to learn how to behave.

Jane asked me if I would loan her a dollar. I said yes, but I never got it back. Jane is no longer my friend.

2. Now go to number 2. Here are some names and phone numbers. Find Mr. Paul Harmon's phone number--read it aloud to me.

Hansen Vance 1060 Day rd..... .. 842-7088
Hanson Earl 8695 Morey av 842-6553
Hardcastle Ira 8282 Murray av.....842-4944
Harker Robert D 240 2nd.....842-5274
Harmon Paul 8080 Swanston Ln.....842-3539
Harms Dwayne 8313 Kelton dr.. 842-7850
Haro Antonia 7361 Forest.....842-5807

Record Actual Response: _____

3. Now go to number Here is a newspaper headline. Read it aloud. (If the pupil inserts a word not in the sentence, write in the word he says.)

Eating High Priced Foods

Record Actual Response: _____

4. Now go to number 4. Here is part of a catalogue. How much does the tape recorder cost?

Wollensak 4000 cordless cassette
The lowest-priced Wollensak ever!
Weight 3 lbs.
Price (less batteries) $42.50

Record Actual Response: _____

5. Now go to number 5. Here is part of an index in a book. Tell me the page to which you would turn to read about Miss Johnson.

Jingle jangles, 530
Johnson, Burges, 498
Johnson, James Weldon, 238
Johnson, Miss, 462
Joplin reading plan, 205
Just-so stories, 287

Record Actual Response: _____

6. Now go to number 6. Here are four labels from bottles or tubes in a medicine cabinet. There is a thin line between each label. Tell me which of these things are dangerous.

ASPIRIN

WARNING: Keep this and all medicines out of children's reach. In case of accidental overdose, contact a physician immediately.

First Aid
& Burn Cream

CAUTION: As with all medicines keep out of reach of children.

DANGER  POISON
KEEP OUT OF REACH OF CHILDREN
NOT TO BE
TAKEN BY MOUTH

Record Actual Responses:

Label #1: _____

Label #2: _____

Label #3: _____

Label #4: _____

APPENDIX D

Scaling of the Measures

Prior to the analysis of the data embodies in these instruments, scales were developed for various subsections as appropriate.

- Part I and Part II of the Braille Reading Comprehension Test (CTBS adaption) each yielded two scales, one of words per minute when reading silently for two minutes, and the other of overall comprehension, based on the number of questions correctly answered out of eight.
- The Diagnostic Spelling Test was collapsed into one scale, based on the total number spelled correctly in English, wish braille contractions being considered as wrong for the purposes of reading standard print.
- The Tactile Ability Test was reduced to one scale by combining the number of correct choices in the part dealing with recognizing similar shapes and number of correct choices in the part dealing with identifying shapes that are different.
- In Phase I, the Would You? measure items 1, 2, 3, 4 (reversed), 7, 8, 12 and 16 were added to form a self-concept scale; while the items 5, 6, 9, 11, 13, 14, and 15 were added to form an attitude toward education scale. When reanalysis occurred in Phase II all items were added to form a single self concept scale.
- Items 2, 4 and 7 on the Optacon Attitude Inventory were added to form an index of current usage. Items 1, 3, 5, 6, 8 and a composite of items 17 through 20 (reversed and treated as a single item) were used to form a scale indicating projected use of the Optacon. In Phase II the items 1 through 8 and 17 through 20 were combined to form a single scale of attitude toward the Optacon. Items 17 through 20 were also used to create an independent scale of performance for the Optacon in

relation to other alternatives for acquiring presented information. Items 9 through 12 were not made into a composite scale for analysis purposes, but were reported in terms of the percent of positive responses regarding ease of use of the Optacon. Similarly, items 13 through 16 were not compositely scaled for analysis purposes, but were reported as percent of positive responses that students expressed about the materials. These items were intended primarily as input to future revision of the training manual.

APPENDIX E

POPULATION OF THE STUDY

APPENDIX E-1

NUMBER OF OPTACON PARTICIPANTS PHASE I

Regular cases (main study)	71	
Special cases (case studies)	10	
Total cases reported		81
Regular cases, late participation and insufficient study time	8	
Dropouts, extended absence*	9	
Cases not included		17
Initial N		98

*Initial data were obtained on two students who entered the study late in the semester as replacements for two of those who dropped out.

NUMBER OF OPTACON PARTICIPANTS PHASE II

Regular cases (main study)	58	
New students (semesters 2 & 3)	15	
Special cases	5	
Total cases reported		78
Dropouts because of:		
Graduation, moving away	14	
Illness, injury, extended absences from school	4	
Conflict with other school work	8	
Personal disinterest with Optacon program	4	
Cases not included		34
Total N		112

APPENDIX E-2

BACKGROUND INFORMATION ON PHASE I STUDENTS

Grade Equivalent:		4	5	6	7	8	9	10	11	12
	N	5	7	6	9	9	7	12	14	2
	%	7.0	9.9	8.5	12.7	12.7	9.9	16.9	19.7	2.8

Age:		9	10	11	12	13	14	15	16	17	18	19
	N	2	7	4	3	7	9	9	7	14	7	2
	%	2.8	9.9	5.6	4.2	9.9	12.7	12.7	9.9	19.7	9.9	2.8

Sex:	Male		Female
N	37	N	34
%	52.1	%	47.9

Number of Years Sighted:		0	1	2	3	4	5	6	7	8	9	10	11	12
	N	57	2	0	1	1	0	1	2	1	1	3	1	1
	%	80.3	2.8	0	1.4	1.4	0	1.4	2.8	1.4	1.4	4.2	1.4	1.4

Prior Experience with Print:		Yes		No
	N	26	N	44
	%	37.1	%	62.9

Typing Experience:		Yes		No
	N	58	N	11
	%	84.1	%	15.9

Additional Handicap:	No handicap		Handicap Would Not Affect Performance		Handicap Might Affect Performance*	
	N	63	N	4	N	1
	%	92.6	%	5.9	%	1.5

*Cerebral palsy determined subsequently not to be a problem affecting performance.

	ATTAINED SCORES					
	N	Minimum	Maximum	Median	Mean	Std.Dev.
IQ Score	62	85.0	158.0	109.5	109.7	15.0
Diagnostic Spelling (English)	71	0.0	30.0	27.2	25.1	6.0
Tactile Test	71	10.0	25.0	21.7	20.9	3.7
Braille Reading WPM	69	10.0	118.0	77.0	70.1	30.3

BACKGROUND INFORMATION ON PHASE II STUDENTS

Grade Equivalent:

	4	5	6	7	8	9	10	11
N	4	7	3	7	9	5	11	12
%	6.9	12.1	5.2	12.1	15.5	8.6	19.0	20.7

Age:

	9	10	11	12	13	14	15	16	17	18	19	20
N	1	6	4	2	0	6	9	3	12	0	1	1
%	1.7	10.3	6.9	3.4	0.0	10.3	15.5	5.2	20.7	0.0	1.7	1.7

Sex:

	Male		Female
N	29	N	29
%	50.0	%	50.0

Number of Years Sighted:

	0	1	2	3	4	5	6	7	8	9	10	11	12	13
N	44	2	0	1	1	1	1	2	0	1	3	0	1	1
%	76	3.4	0.0	1.7	1.7	1.7	1.7	3.4	0.0	1.7	5.2	0.0	1.7	1.7

Prior Experience With Print:

	Yes		No
N	21	N	37
%	36.2	%	63.8

Typing Experience:

	Yes		No
N	49	N	9
%	84.5	%	15.5

Additional Handicap:

	No handicap	Handicap would not affect performance	Handicap might affect performance*
N	51	3	1
%	92.7	5.5	1.8

*Cerebral palsy determined subsequently not to be a problem affecting performance.

	ATTAINED SCORED				
	N	Minimum	Maximum	Median	Mean	Std.Dev.
IQ Score	51	82	139	112.5	110.3	14.9
Diagnostic Spelling (English)	57	16	30	27.9	26.5	4.0
Tactile Test	58	10	25	21.9	21.0	3.6
Braille Reading WPM	58	16	138	80.5	75.8	29.6

BACKGROUND INFORMATION FOR "NEW STUDENTS"

Grade Equivalent:

	3	4	5	6	7	8	9	10	11	12
N	1	4	3	0	1	0	0	0	3	1
%	7.7	30.7	23.1	0.0	7.7	0.0	0.0	0.0	23.1	7.7

Age:

	9	10	11	12	13	14	15	16	17	18	19
N	1	6	0	2	0	0	0	0	0	2	2
%	7.7	46.1	0	15.4	0.0	0.0	0.0	0.0	0.0	15.4	15.4

Sex:

	Male		Female
N	8	N	5
%	61.5	%	38.5

Number of Years Sighted:

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
N	6	1	1	0	0	0	1	0	1	2	0	0	0	0	0	0	1
%	46.1	7.7	7.7	0.0	0.0	0.0	7.7	0.0	7.7	15.4	0.0	0.0	0.0	0.0	0.0	0.0	7.7

Prior Experience With Print:

	Yes		No
N	8	N	5
%	61.5	%	38.5

Additional Handicap:

	No handicap
N	13
%	100

	ATTAINED SCORES					
	N	Minimum	Maximum	Median	Mean	Std.Dev.
IQ Score	13	82	133	104	107.1	13.3
Diagnostic Spelling (English)	12	3	30	28	24.2	8.1
Tactile Test	12	16	25	22	22	2.3
Braille Reading WPM	8	5	111	100	75.4	41.7

APPENDIX F

TACTILE-KINESTHETIC FORM DISCRIMINATION TEST
(Recommended Short Form)

Name_____

Date_____

School_____

The following sheets, marked 1-3, contain facsimilies of the test figures. The actual figures for administration to blind students are embossed on 3-dimensional plastic sheets.

Instructions for Administration

Sheets 1, 2, & 3

Give the child embossed sheet number one.

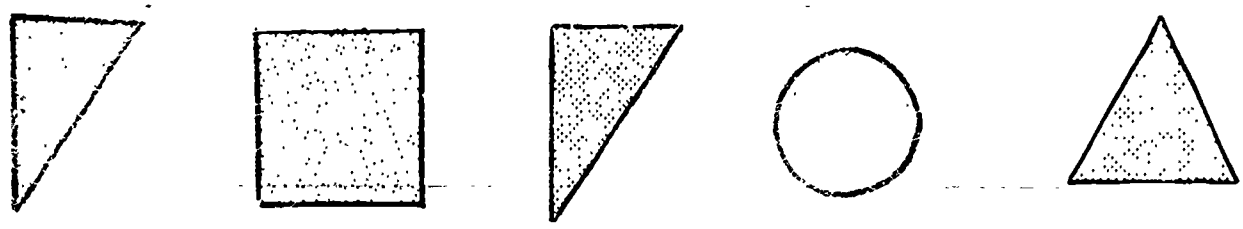
Say: "There are some forms. Put your fingers on the top row. This is a practice row." (Assist the child to locate row, if necessary.) "Find the form that is the same as the first one. Show me the one that is the same."

Beginning on row 2 of sheet 1,

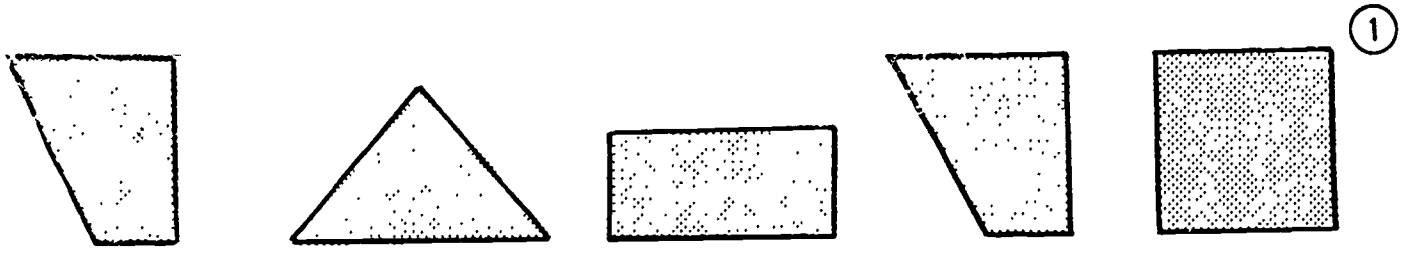
Say: "Here are some more forms. Find the two that are the same in each row."

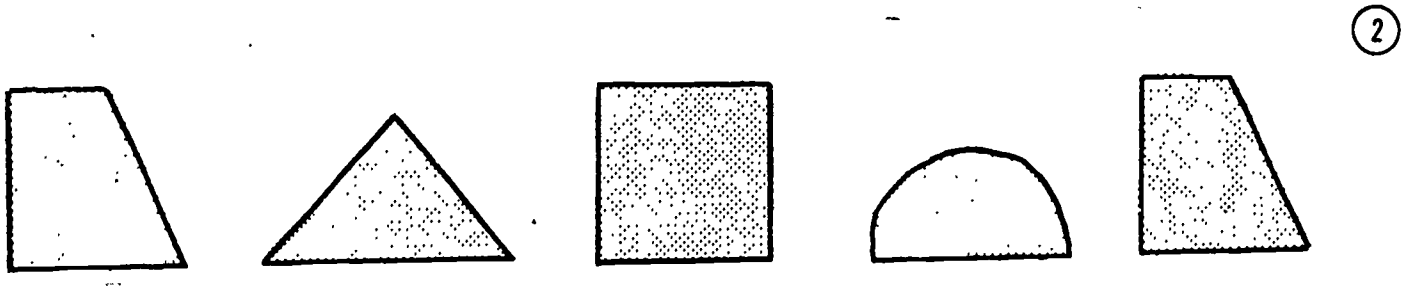
Then repeat instructions for each row on all of the sheets. Mark a "C" if correct and an "X" if the student's answer is wrong:

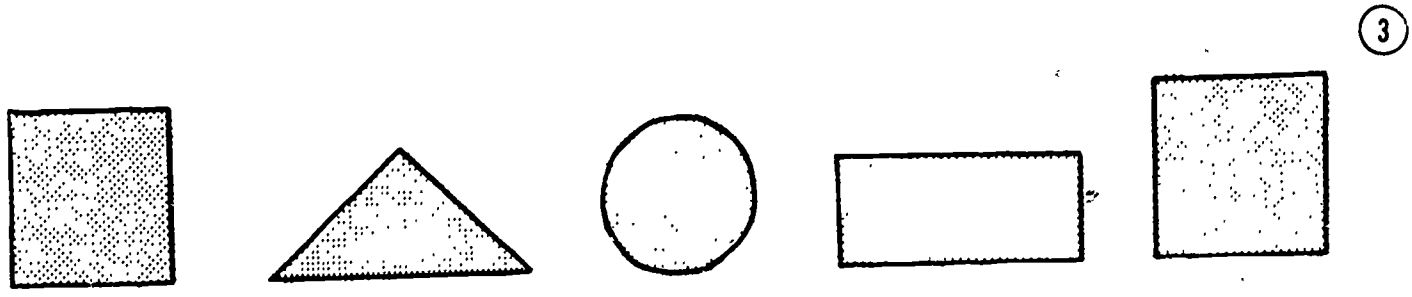
	Sheet 1	Sheet 2	Sheet 3
Row 1	[ ]	[ ]	[ ]
Row 2	[ ]	[ ]	[ ]
Row 3	[ ]	[ ]	[ ]
Row 4			[ ]

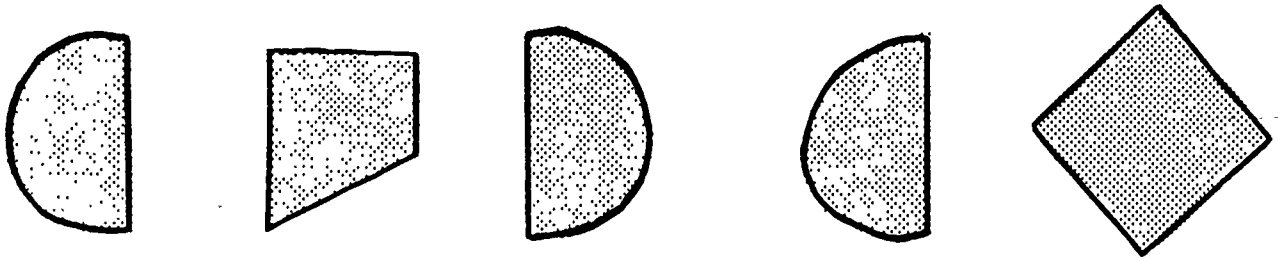


SAMPLE ITEM





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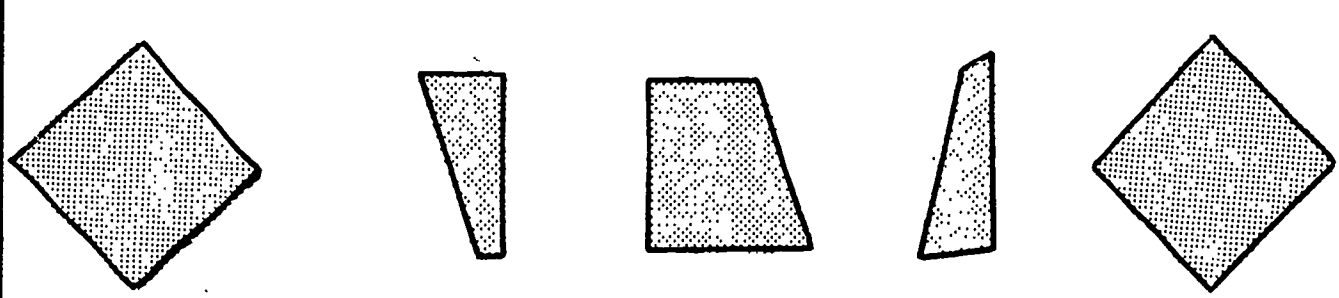
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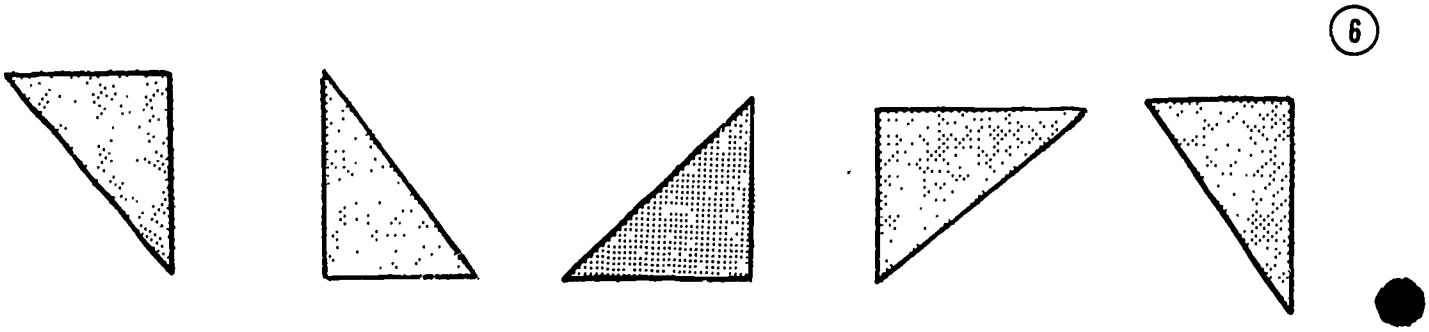
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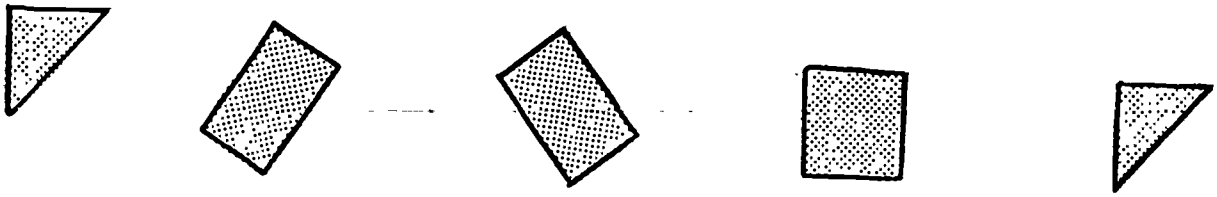

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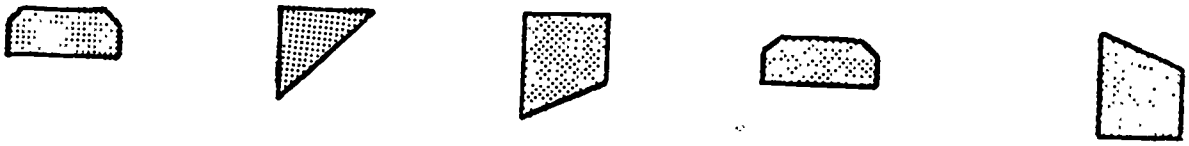

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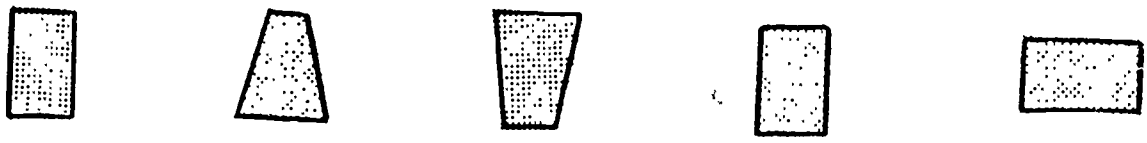

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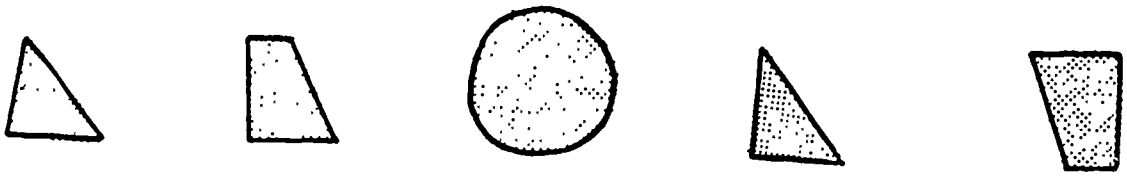

10

APPENDIX G

Summary of School Originated Questionnaire in Three Foreign Language Classes

		Yes	No
1.	Can the teacher be heard when the Optacon is used?	75	9
2.	Can other students be heard when the Optacon is used?	72	12
3.	When you work individually does the Optacon sound bother you?	44	40
4.	Would you mind if someone used the Optacon in other classes?	16	67
5.	Are there classes where this would be a problem?	39	38
6.	Does it bother you when someone is using a braillewriter in class?	51	33
7.	Did you enjoy the demonstration of the Optacon?	77	5
8.	Did you like to feel letters with the Optacon?	66	12
9.	Do you think it would be easy to read with the Optacon?	12	63
10.	Do you have anything special to say about the Optacon? (positive = yes; negative = no)	41	19

END