DOCUMENT RESUME

ED 196 721 SE 033 907

AUTHOR Thompson, Ben, Ed.
TITLE Science for the Handicapped: An Annotated Bibliography.
INSTITUTION ERIC Clearinghouse for Science, Mathematics, and Environmental Education, Columbus, Ohio.
SPONS AGENCY National Inst. of Education (DHEW), Washington, D.C.
PUB DATE Dec 80
CONTRACT 400-78-0004
NOTE 99p.
AVAILABLE FROM Information Reference Center (ERIC/IRC), The Ohio State Univ., 1200 Chambers Rd., 3rd Floor, Columbus, OH 43212 ($3.50).

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS College Science; *Disabilities; Elementary School Science; Elementary Secondary Education; *Hearing Impairments; Higher Education; Multiple Disabilities; *Resource Materials; *Science Education; Secondary School Science; *Visual Impairments
IDENTIFIERS *Science Education Research

ABSTRACT

This annotated bibliography provides sources for information on science education for the handicapped. Listings are provided of general references and also those dealing with research in the three areas of the visually impaired, the hearing impaired, and other handicapping conditions. (CS)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED196721

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

SCIENCE FOR THE HANDICAPPED

AN ANNOTATED BIBLIOGRAPHY

EDITOR

BEN THOMPSON

SCIENCE FOR THE HANDICAPPED ASSOCIATION

UNIVERSITY OF WISCONSIN

EAU CLAIRE, WISCONSIN

AUTHORS

MARIE EGBERT

NATIONAL TECHNICAL INSTITUTE FOR THE DEAF

ROCHESTER, NEW YORK

ROBERT GLASS

AMERICAN PRINTING HOUSE FOR THE BLIND

LOUISVILLE, KENTUCKY

KEN RICKER

UNIVERSITY OF GEORGIA

ATHENS, GEORGIA

DECEMBER 1980

SE 033 907

INTRODUCTION

Through knowledge of science people can replace fear and ignorance with understanding.

Through knowledge of science people can make wise choices.

Through knowledge of science people can see the true beauty of the universe.

This annotated bibliography is a unique collection. It represents for the first time, a single source of information on science education for the handicapped.

The bibliography holds two lessons. One is that there are many dedicated people attempting to fill a real void in our education system. They are the ones whose names you will find inside.

The second lesson is that much remains to be done. There are serious gaps in all phases of science education for the handicapped. Let us hope the next decade will change that.

B.T.
December 1980

The ERIC Clearinghouse for Science, Mathematics, and Environmental Education is pleased to cooperate with the Science for the Handicapped Association in producing this bibliography. We believe that this publication will be of value to teachers at all levels who are concerned with teaching science for the handicapped.

We invite your comments and suggestions for future publications.

Stanley L. Helgeson
Associate Director
Science Education
ERIC/SMEAC

Patricia E. Blosser
Faculty Research Associate
Science Education
ERIC/SMEAC

John A. Novak
Faculty Research Associate
Science Education
ERIC/SMEAC

This publication was prepared with funding from the National Institute of Education, U.S. Department of Education under contract no. 400-78-0004. The opinions expressed in this report do not necessarily reflect the positions or policies of NIE or U.S. Department of Education.

TABLE OF CONTENTS

	Page
Introduction	i
The Visually Impaired - General	1
The Visually Impaired - Research	41
The Hearing Impaired - General	51
The Hearing Impaired - Research	71
Other Handicapping Conditions - General	77
Other Handicapping Conditions - Research	95

Citations containing ED information indicate documents available from ERIC Document Reproduction Service, P.O. Box 190, Arlington, Virginia 22210.

THE VISUALLY IMPAIRED

GENERAL

ANNOTATED BY

ROBERT GLASS

NATIONAL PRINTING HOUSE FOR THE BLIND

Akey, John M. "An Audiovisual Presentation for Non-Audiovisual Students." Science Teacher, 41(9): 52-53, December, 1974.

This study describes how a planetarium demonstration can be adapted for blind students and deaf students.

Allen, Edward E. "Opening Windows on Nature for Blind Boys and Girls." School Life, 17(2): 21-22, 31, October, 1931.

The program of nature study at the Perkins School for the Blind is presented. Stuffed animals, actual specimens, and models are used and the variety of plant life on the school's 34 acre campus is described. Students are encouraged to care for livestock owned by the school.

American Association of Instructors of the Blind. General Science: A One Year Course of Study Adapted for Use in Schools for the Blind. New York: American Foundation for the Blind, 27p., 1933.

Reported is a complete course of general science study prepared by the General Science Committee of the American Association of Instructors of the Blind.

American Foundation for the Blind. An Introduction to the Development of Curriculum for Educable Mentally Retarded Visually Handicapped Adolescents. New York: American Foundation for the Blind, 46 p., 1968. ED 026 785.

Suggestions for curriculum development for educable mentally handicapped, visually impaired students between the ages of 13 and 18 years are presented. A discussion of communication skills includes the areas of listening, oral communication, reading, writing, and spelling and teaching methods for each. The goals of the computation skills sequence, basic understanding of mathematical concepts, and transfer of knowledge to other situations are discussed along with skills to be taught. A comprehensive secondary school curriculum is described which includes specific recommendations for the teaching of science courses.

American Foundation for the Blind. Products for People with Vision Problems: Twenty-Fifth Anniversary Edition. New York: American Foundation for the Blind, 162 p., Fall, 1979.

This catalog contains over 400 products useful to the visually impaired. Devices applicable to science instruction and the blind include: brailled stopwatches, timers, game equipment, barometers, thermometers, compasses, talking thermometers and calculators, magnifiers, writing aids, slide rules, protractors, compasses, rulers, micrometers, audible multimeters, and scales.

American Printing House for the Blind. Educational Aids for the Visually Handicapped. Louisville, Ky.: American Printing House for the Blind, 27 p., February, 1969. ED 030 242.

Listings specifying sources and costs of tactile aids and materials designed for the visually handicapped are provided. Items are presented in the following categories: supply sources and catalogs for aids; braille devices, including duplicators; reading and writing aids; reading readiness materials; writing machines; slates and styluses; deafblind aids; electronic devices; games; mobility aids; optical aids and instruments; paper and binders; personal aids; preschool devices and materials; recording and sound equipment. Additional categories of listings are in the subject areas of geography and social studies, handwriting and typewriting, health education, language arts, mathematics (general, counting, geometric, linear measurement, slates, and time), music, physical education, practical arts (cooking and sewing), science, and vocational education (industrial arts). Supplements are issued periodically and information regarding current educational materials for the sciences can be obtained from the APH, P.O. Box 6085, Louisville, Ky. 40206

American Printing House for the Blind. The Central Catalog: Instructional Materials Reference Center. Louisville, Ky.: American Printing House for the Blind, 771 p., 1968. (Grant No. OEG-2-6062289-1582). ED 035 114.

Intended as a source of information for the benefit of transcribers, school administrators, teachers, librarians, students, parents, and all workers for the blind, the catalog contains an alphabetical listing, by subject area, of completed titles of books listed in the central catalog of volunteer produced braille, large type, and recorded textbooks. Commercially produced large type textbooks and supplementary reading materials are also cited. Although the catalog cannot be supplied to individuals, copies are available at all residential schools for the blind, state departments of education, instructional materials centers, major volunteer transcriber groups, agencies for the education of the visually handicapped, and commercial producers of large type. Supplements are issued periodically.

Andrews, Francis M., Jr. "The Biology Laboratory Period." Teachers Forum, 6(5): 82-83, May 1934.

Discussed are methods and materials for conducting high school biology laboratory exercises involving the dissection of insects, earthworms, clams, starfish, fish, frogs, snakes, and chickens. The use of preserved or freshly killed specimens is preferred over the use of models.

Ballard, Byron B. "The Physical Sciences in the Junior High School." American Association of Instructors of the Blind, Thirty-fourth Biennial Convention, pp. 188-190, June 1938.

The special advantages derived from teaching physical science and biology in schools for the blind are discussed as they relate to increasing the blind child's awareness and understanding of the environment. Difficulties to overcome are addressed and the suggestion is made that schools offer one kind of instruction for college bound science students and a different, lay-oriented instruction for other students who need to know practical applications of science to daily life.

Baughman, James and Dean Zollman. "Physics Labs for the Blind." Physics Teacher, 15(6): 339-342, September, 1977. EJ 166 575.

This study describes laboratory equipment which has been modified to accommodate visually handicapped students enrolled in regular university level laboratory science courses.

Bechthold, E. "Die Naturbeobachtung des Schulers in der Blindenschule." Blindenfreund, 40: 157-164, 1920.

Suggestions for making the teaching of exact sciences in schools for the blind alive, understandable, and related to the daily experience of the student are presented. A list of problems assigned to upper class students during the years 1916-1917 are included in the paper.

Benham, Thomas A. "Aids for the Blind." Electrical Engineering, 66(2): 178-182, February, 1947.

Reported are several practical instruments developed by the author, a blind electronic engineer, to facilitate the performance of various kinds of electrical measurements by blind persons.

Benham, Thomas A. "Science for the Blind." American Journal of Physics, 23(3): 177-178, March, 1955.

This article proposes that recorded versions of scientific textbooks and journals be made available to the visually handicapped. Suggestions and ideas are solicited for lists of materials to record, possible recording sites, and sources of funding. The writer is a blind physics teacher of sighted students.

Benham, Thomas A. "Science for the Blind." American Journal of Physics, 24(1): 45, January, 1956.

This article reports the findings of a proposal to begin recording science textbooks and journals for international distribution to the visually handicapped. Institutional support for the effort came from Science for the Blind, a department of the Pennsylvania Association for the Blind. Subscriptions are solicited.

Benham, Thomas A., John Dupreas, Clifford Witcher, Kathern Gruber, and Arthur Helms. Recording Science Texts for the Blind. New York: American Foundation for the Blind, 40 p., July, 1957.

The procedures and suggestions which appear in this publication were made possible largely through the direct experience of Dr. Benham in his actual recording of scientific material for Science for the Blind. The contents include reader qualifications, editing, explanation of graphic material, reading equations and formulas, reading footnotes and references, recording tables of contents, spelling, making braille diagrams, securing permission to record, and putting graphs, diagrams, and structural formulas into words.

Bluhm, Donna L. Teaching the Retarded Visually Handicapped: Indeed They Are Children. Philadelphia: W. B. Saunders Co., 127 p., October, 1978. ED 026 773.

Guidelines for a program of instruction with individualized teaching for retarded blind children are provided. Areas covered are living skills, handwork, learning through music, reading readiness, recognition of the braille alphabet, mathematics, science, social studies, self expression, creativity, recreation, and suggested poetry and songs. Five appendices discuss regional educational centers for the blind, parent-child relations, adjustment problems, learning from and teaching the children. Photographs of 19 teaching aids are provided.

Botts, J. H. "Our New Course in General Science." American Association of Instructors of the Blind, Thirty-second Biennial Convention, pp. 127-131, June, 1934.

Current materials and laboratory exercises for the general science teacher in residential schools for the blind are discussed. Principles considered essential to the successful teaching of general science are described.

Botts, J. H. "What Features Should Be Considered in Selecting a Text in Biology for the Blind." American Association of Instructors of the Blind, Thirty-Fifth Biennial Convention, pp. 161-166, June, 1940.

Current topics in biology are presented as guidelines for text selection. Textbooks which include Darwinian Theory and Mendelian Law, hereditary aspects of blindness, sex hygiene, and personal hygiene, as well as the study of plants and animals are preferred.

Boyle, J., W. Jacobs, and N. Loeber. "A Braille Code for Interactive Terminal Use." American Foundation for the Blind Research Bulletin, 27(1): 267-272, April, 1974.

In order to support a wide variety of interactive computer terminal applications, a single-celled braille code is presented which consists of alphabetical characters, numbers, punctuation, and those special symbols most frequently encountered in secretarial, scientific, legal, educational, and some programming applications. This one celled code could be used for such on-line activities as computerized text entry and editing, data base inquiry and update, computer-assisted instruction, and programming in languages such as PL/1, COBOL, and 360/370 assembly language source code.

Branch, Hazel E. "That the Blind May See." American Biology Teacher, 5(1): 34-36, October, 1942.

Described are methods for making illustrations, diagrams, and models understandable to a blind student of biology.

Brett, James J. "Pathways for the Blind." Conservationist, 25: 13-16, June-July, 1971.

Describes the Oerwood Braille Trail in York Co., Pa., a self-guided nature trail designed for sighters and partially-sighted persons.

Brier, H. S. "Oscar, A Milliammeter for Sightless Amateurs." C.O., The Radio Amateurs' Journal, 4: 22-25, July, 1948.

Describes methods for constructing a device that uses sound in tuning ham radio transmitters.

Brooks, G. W. "Biology for the Blind Student." The Teaching of Science and Mathematics to the Blind (with section on Raised Diagrams). Report to the Viscount Nuffield Auxiliary Fund, R. Fletcher(ed), London: Royal National Institute for the Blind, pp. 33-34, 1973.

A secondary school biology program for the blind which emphasizes human anatomy, hygiene, physiology, and the use of live and preserved specimens is described.

Brown, Dean R. "Science Instruction of Visually Impaired Youth: A Research and Review of Relevant Literature." American Foundation for the Blind: Practice Report Series, 20 p., 1979.

This report is a review of the literature on teaching science to visually impaired students at elementary, secondary, and higher education levels, and emphasizes how science concepts are learned. The report also discusses adaptation and modification of materials and equipment, and views the pairing of visually impaired students with sighted peers as the key to teaching science.

Bryan, Arthur H. "Biology for Blind Students." Teachers Forum, 4(3): 42-47, January, 1932.

The special projects, problems, and methods encountered in teaching biology to the blind are discussed. Clay models used in biological and botanical microscopy are described. Methods are presented for teaching topics such as yeasts, molds, mushrooms, mosses, ferns, sponges, corals, starfish, worms, insects, crayfish, snails, clams, fish, frogs, birds, and rodents. Sighted laboratory partners and the use of actual specimens are integral to the methods given.

Bryan, Arthur H. "Science for the Blind." Baltimore Bulletin of Education, 19(1): 47, September, 1941.

This article describes the activities of and methods used by blind students enrolled in regular classes in physics, biology, and chemistry at Baltimore City College. The results of permitting the visually handicapped to enroll in these previously closed classes is the central theme.

Bryan, Arthur H. "Methods of Teaching Biology to Blind Students with the Seeing." American Biology Teacher, 12(4): 75-81, April, 1950.

Discussed are the problems of the blind student in college level biology classes. Recommendations are made for a multi-sensory approach, the use of instructor-made clay models where possible, and vocational guidance. Special emphasis is given to the teaching of morphological biology and the intimate study of skeletal forms, botany, and nature appreciation.

Bryan, Arthur H. "Sciences for the Blind." Baltimore Bulletin of Education, 29(1): 14-15, September, 1951.

Several methods and materials for instructing the blind in biology, physics, chemistry, general science, zoology, and human physiology are briefly presented. Possible science hobbies and vocations are also suggested.

Bryan, Arthur H. "Physics for the Blind." Science Education, 35(12): 271-274, December, 1951.

Teaching aspects related to the blind student enrolled in regular, secondary level physics classes are discussed. Suggestions are made for adapting laboratory exercises. The use of sighted lab partners is also encouraged.

Bryan, Arthur H. "Chemistry for the Blind." Science Education, 36(3): 91-95, March, 1952.

Methods for adapting the high school chemistry curriculum, including laboratory exercises and teaching facilities, are described in this article. Major instructional objectives are also included.

Bryan, Arthur H. "General Science for the Blind." Science Education, 41(2): 26-30, February, 1957.

This article presents suggestions for the integration and instruction of the blind student enrolled in secondary level general science courses in public schools.

Bryan, Charles A. "Secondary School Sciences for the Blind." International Journal for the Education of the Blind, 6(1): 11-18, October, 1956.

It is the writer's thesis that the blind are entirely educable. Described are instructional objectives and alternative teaching strategies for visually impaired students in the secondary school sciences of biology, physics, and chemistry.

Bunner, William R. and Richard T. Bunner. "What About Your Visually Defective Students?" The American Biology Teacher, 30(2): 108-109, February, 1968.

The problems of teaching biology to the blind are discussed and practical suggestions for teaching the visually handicapped are offered. Partially sighted students are encouraged to dissect and work with the microscope and totally blind students are recommended as data recorders in laboratory exercises. Suggestions for making tactile schematics and models are provided and the use of the Sewell Raised Line Drawing Kit is described.

Burde, E. "Die Pflanzenkunde in der Blindenschule." Blindenfreund, 40: 105-109, 1920.

The fundamental principles of teaching botany in schools for the blind are discussed. Included in the paper is a course of study of the subject for the year 1920 for the school for the blind in Silesia.

Burke, Emily A. "Laboratory Work in Science for the Blind." Teachers Forum, 4(3): 48-49, January, 1932.

This report describes how useful laboratory specimens are obtained from a local museum for use in science courses at the Western Pennsylvania School for the Blind. Through this arrangement, considerable expense to the school in accumulating exhibit material is avoided and the overall program in science instruction is greatly enhanced.

California School for the Blind Staff. "The Teaching of Nature Study." Teachers Forum, 2(1): 6-7, September, 1929.

A description is presented of methods and materials for teaching nature study in a residential school for the blind.

Carver, Thomas R. "The Design and Use of a Light Probe for Teaching Science to Blind Students." American Foundation for the Blind Research Bulletin, No. 16, pp. 79-91, May 1968.

The evolution, design, and use of an optical light probe particularly suited to teaching laboratory science skills to blind students is described. A simple pocket-sized light probe with certain necessary features proved to be the missing link which enables blind students to do ordinary physics laboratory experiments.

Champion, Richard R. "The Talking Calculator Used with Blind Students." Education of the Visually Handicapped, 8(4): 102-106, Winter, 1976.

This study demonstrated that blind children in grades three through eight were able to achieve greater speed and accuracy in mathematical computations using the talking calculator after one hour of individualized instruction and three weeks of informal practice. Implications for modifications in operational procedures are also discussed. The APH Speech Plus Calculator is available from the American Printing House for the Blind, Louisville, Kentucky.

Charleston, Stewart E. and others. "Training Blind and Visually Handicapped Computer Programmers." California State Department of Rehabilitation, Sacramento; System Development Corporation, Santa Monica, California, 7 p., July, 1976. ED 125 579.

The state of California and System Development Corporation have developed, implemented, and evaluated a training program in computer programming for the blind and visually impaired. Students are selected according to general aptitude, interests, general intelligence, previous educational achievement, health, and personal qualities. The eight-month course in programing involves 120 classroom hours per month. The curriculum is modular to allow flexibility in introducing new computer technology and languages as they become available. Students record lectures on tape recorders. Closed circuit television systems for low-vision students and the OPTACON for the totally blind are also used. Recorded retention in the program and job placement and performance have been successful.

Chatfield, Alice. "Capitalizing the Value of Models to Meet the Demands of the Current Trend in Primary Education." American Association of Instructors of the Blind, Thirty-fifth Biennial Convention, pp. 52-54, June, 1940.

Discussed is the use of three-dimensional educational models in a school for the blind.

Cochran, Carolyn B. "Creating a Nature Interest in the Kindergarten." American Association of Instructors of the Blind, Thirty-ninth Biennial Convention, pp. 60-62, June, 1948.

Reported are simple efforts to create interest in nature study in kindergarten pupils. Described are visits to a dairy farm, a bakery, a vegetable garden, and special units that require active participation by the children.

Coon, Nelson. "The Relation of the Museum to Tactual Education." Teachers Forum, 14(1): 33-34, 39, September, 1941.

Reported are experiments carried out at Perkins Institution over a period of two years in making the museum collection a vital part of the school and in encouraging its regular and systematic use.

Cooper, Katherine E. and Herbert D. Thier. "Do You Have to See it to Believe It: Laboratory Science for Visually Impaired Children." Learning, 2(8): 54-55, April, 1974.

The adaptation for the visually impaired of the Science Curriculum Improvement Study (SCIS) materials is reported. Concepts taught and materials included in the Adapting Science Materials for the Blind (ASMB) program are described. A representative lesson for fourth-grade students on relative position and motion is presented.

Cooperman, Susan. "Biology for the Visually Impaired Student." The American Biology Teacher, 42(5): 293-294, 304, May, 1980.

A beginning course in college biology for visually impaired students is described. Equipment for instruction is discussed and methods for using the materials are included. Topics included in the course are chemical bonding, diffusion and osmosis, cell structure, meiosis and mitosis, reproduction, behavior, nutrition, and circulation.

Coville, M. Genevieve. "Science Committee Notes: Laboratory Work." Teachers Forum, 4(5): 90, 93, May, 1932.

Principles governing progressive educational procedure are presented along with criteria for laboratory materials selection. A simple project involving root, stem, and leaf systems is described.

Coville, M. Genevieve. "Content of a Course in General Science Adapted for Use with the Blind." American Association of Instructors of the Blind, Thirty-first Biennial Convention, pp. 773-775, July, 1932.

After careful consideration of the results of a national survey of general science curricula in schools for the blind, a 14-unit plan of sequenced general science topics was recommended for teachers of the blind and a detailed outline of the content of each topic was formulated.

Cranmer, T. V. "Liquid Level Indicator for the Blind: Electronic Device." Popular Electronics, 26(5): 59-60, May, 1967.

A light sensitive, electronic device which has been found useful for determining the levels of fluids in transparent containers is described.

Cravats, Monroe. "Biology for the Blind." The Science Teacher, 39(4): 49-50, April, 1972.

Several laboratory exercises for the visually impaired biology student are presented which study the aspects of human digestion. No tactual models are required. Materials used are simple and easily available.

Crockett, Myrtle C. "The Field Trip." International Journal for the Education of the Blind, 7(4): 136-137, May 1958.

The value of the field trip as a teaching procedure for blind students is discussed. Several checklists are provided to aid the teacher in preliminary preparation, classroom preparation, and trip evaluation. Important points to remember and causes of difficulties are also listed.

Cuthbertson, N. D. "Blind Nature Study." Teacher of the Blind, 17: 188-194, 213-218, 1929.

A group of blind girls was taken on country rambles to study wildflowers and trees, and to learn to distinguish the songs and notes of birds. Accounts of these trips were written by the student participants, one of whom was deaf-blind.

Dawson, James R. "Biology for the Blind." American Biology Teacher, 20(2): 42-44, February, 1958.

The use of modeling clay to create three-dimensional study models for blind biology students is described. Students manipulated clay chromosomes to conceptualize the events of mitosis and meiosis and also formed clay models of various human organs. It was concluded that blind students had the ability to form, retain, and recall what could be described as a "visual image" as well as their sighted peers.

de Haaff, Susan Jean. "A Creative Science Project for Blind Children." Journal of Visual Impairment of Blindness, 71(10): 458-459, December, 1977.

A lesson plan based on a conventional fifth grade science text and adapted to suit the needs of visually handicapped students is presented. An experiment with yeast which shows how a one-celled plant multiplies and grows is described. A multi-sensory technique is employed to give the student a better understanding of the cause and effect relationship of nourishment, growth, and energy.

Demal, F. "Zur Praxis des Tastens." Zeitschrift fur das oesterreichische Blindenwesen, 8: 1449-1453, 1921.

Discussed is the practical use of the sense of touch in the education of the blind, with special emphasis on getting the most benefit out of available models and objects.

Egelston, Judy C. "Editorial Comment on Adapted Science Materials for the Blind (ASMB): Student Outcomes." Science Education, 59(2): 235-236, Spring, 1975.

This article prefaces research on ASMB by Linn and Thier (1975). Intended for the regular public school science teacher with mainstreamed, visually handicapped students, this article briefly discusses some myths and facts related to educating the blind.

Eichenberger, Rudolph J. "Teaching Science to the Blind Student." Science Teacher, 41(9): 53-54, December, 1974.

This study describes how to adapt physical science laboratories which depend on visual data input for blind students. Instructions for graph construction, use of the tape recorder, solving mathematical problems with a braille abacus, and other suggestions for physical science labs are also included.

Enis, Carol A. and Michael Cataruzolo. "Sex Education in the Residential School for the Blind." Education of the Visually Handicapped, 4(2): 61-64, May, 1972.

The problems related to sex education and the visually handicapped are discussed. The results of a questionnaire seeking information regarding programs in sex education in all of the U.S. residential schools for the blind are summarized. Seventy-five percent of the schools responded in this report.

Evans, E. "Notes on Elementary Science." Teacher of the Blind, 15: 113-115, 1927; and 16: 10-12, 36-39, 1927.

A series of lessons in elementary level science is introduced.

Fisher, G. "Physik. Mell." Enzyklopadisches Handbuch des Blindenwesens, pp. 591-593, 1900.

Methods and materials for teaching physics in schools for the blind are described.

Fletcher, R. C., ed. The Teaching of Science and Mathematics to the Blind (with Section on Raised Diagrams): Report to the Viscount Nuffield Auxiliary Fund. London: Royal National Institute for the Blind, 172 p., 1973.

Worcester College for the Blind was given a two-year grant in 1965 (later extended to three years) to encourage the development of science teaching in secondary schools for the blind, and to give pupils in all schools for the blind a better opportunity to study mathematics in accordance with modern approaches. This book contains reports on various aspects of the project which involved science and mathematics teachers at the Royal National Institute for the Blind, Worcester College for the Blind, and several secondary schools for the blind throughout England.

Fletcher, R. C. "The Science Laboratory in a School for the Blind: General Science--A Suggested Two-Year Syllabus." The Teaching of Science and Mathematics to the Blind (with section on Raised Diagrams): Report to the Viscount Nuffield Auxiliary Fund, ed. R. Fletcher, London: Royal National Institute for the Blind, pp. 35-48, 1973.

The physical plan and equipment of science laboratories for the blind that are compatible with laboratories for the sighted are described. A two-year syllabus for general science emphasizing biology, hygiene, and chemistry is presented along with illustrations and applications of useful laboratory apparatus.

Francoeur, Pearl and Bihah Eilam. "Teaching the Mammalian Heart to the Visually Handicapped: A Lesson in Concrete Experience." Science Teacher, 42(10): 8-11, December, 1975.

This study utilized programmed instruction with concrete experiences and raised diagrams to teach the mammalian heart to an integrated high school classroom (one containing sighted and visually handicapped students).

Franks, Frank L. "Educational Materials Development in Primary Science: An Introductory Science Laboratory for Young Blind Students." Education of the Visually Handicapped, 7(4): 97-101, December, 1975.

This study provides a retrospective view of the early development of educational aids for the blind, describes the aids research efforts at the American Printing House for the Blind, and presents an operational construct for the development of educational aids.

Franks, Frank L., and LaRhea Sanford. "Using the Light Sensor to Introduce Laboratory Science," Science and Children, 13(6): 48-49, March, 1976.

An instrument which affords blind students opportunities for direct observation, experimentation, and discovery is described. Accompanying the light sensor is a manual containing 25 experiments.

Franks, Frank L. "The Tactile Modality in Adapting and Developing Science Materials." Science Education and the Physically Handicapped: Sourcebook, H. Hofman and K. Ricker, (eds.) Washington, D.C.: National Science Teachers Association, pp. 189-199, 1979. (Stock No. 471-14760).

The history of adapting and developing tactile aids is discussed along with the changing attitudes of science educators towards the blind. Production guidelines from educational research into adapting and developing educational aids are presented, followed by a list of science materials and studies which utilized these research guidelines. The implications for other material needs are given.

French, R. S. "General Science: A Necessary Factor in a Modern Curriculum." American Association of Instructors of the Blind, Twenty-seventh Biennial Convention, pp. 152-154, June, 1924.

This report describes the principles, methods, and materials employed in adding a course in general science to the curriculum at the California School for the Blind. Classtime allotments and evaluation tests are also discussed.

Froneberg, E. "Naturgeschichte in der Blindenschule Mell." Enzyklopadisches Handbuch des Blindenwesens, pp. 542-545, 1900.

The historical background of nature study in schools for the blind and the importance of the subject in the curriculum are discussed in this article.

Fulker, Wilber H. and Mary Fulker. Techniques with Tangibles. Springfield, Ill.: Charles C. Thomas Publisher, 72 p., 1968.

This manual for teaching the blind with tangible apparatus was developed by the principal of the Blind School of the Colorado School for the Deaf and Blind and his wife. Much of the book is devoted to applications of the thermoform vacuum duplicating machine. Examples of thermoform masters which illustrate Mendel's Law, cell division, the human eye, and geographical and earth science maps are shown. Descriptions and illustrations of other handmade apparatus and models such as the suspension bridge, thermometer, vacuum and pressure pump, thermocoupler, and solar system are given. Suggestions for adapting commercial teaching aids and toy models are also given. The use of field trips, concept corners, and creative art work is encouraged.

Laedeke, C. "Der naturkundliche Unterricht in der Blindenanstalt." Blindenfreund, 97-101, 113-117, 129-132, 1887.

Presented is an explanation of how botany, zoology, mineraology, and physics are taught in a German school for the blind, what equipment has been found necessary, and what means are used for connecting these subjects to the daily life of the students.

Gibson, Chester A. "Science Committee Notes." Teachers Forum, 4(3): 50, January, 1932.

Teachers of general science in schools for the blind are encouraged to use simple and inexpensive materials wherever possible to demonstrate important principles. As an example, an experiment showing the tremendous force exerted by the pressure of the atmosphere is presented.

Gibson, Chester A. "The Value of General Science to the Blind." American Association of Instructors of the Blind, Thirty-first Biennial Convention, pp. 771-773, July, 1932.

This report describes the history and popularity of general science courses in the secondary schools. Recommended topics for the science teacher to include in these courses are: personal and community hygiene, orientation in the field of science, science applied to home maintenance, environmental principles in the community, developing problem solving abilities, and science related hobbies.

Gladstone-Millar, Linda. "Studying Science by Touch and Ear: An Edinburgh Course for the Blind and Partially Sighted." London Times Education Supplement, No. 3149, pp. 46-47, Friday, October 10, 1975.

The curriculum changes in science instruction at the Royal Blind School, Edinburg, are reported. Two courses are briefly outlined: science for the general citizen and science for intending scientists. The advantages of including sighted students from a nearby high school in the programs are discussed.

Gold, Milton J. Hunter College Observation Television Center Catalog. New York: Hunter College of the City University of New York, 65 p., 1967. ED 018 912.

This catalog lists and annotates 112 titles of lessons first recorded on videotape and then transferred to film as kinescopes. The lessons are filmed in a specially prepared classroom equipped with remote controlled cameras and microphones. During recording, the class and teacher are alone in the classroom. Five of the films in this collection are on the special education of the blind. The kinescopes may be rented (some may be purchased) for use in pre-service or in-service teacher education programs by public and private universities, colleges, secondary, and elementary schools.

Gough, Elva Ruth. "Common Sense and Sensitivity in Teaching the Blind." Science Education and the Physically Handicapped: Sourcebook, H. Hofman and K. Ricker (eds.), Washington, D.C.: National Science Teachers Association, pp. 206-209, 1979. (Stock No. 471-14760).

This article is intended for public school science teachers with no experience in teaching visually handicapped students. Steps to consider in accommodating a blind student in the science classroom, sources of materials, and practical suggestions for special instruction are described.

Gough, Elva Ruth. "Blind Students Succeed in the Lab--Any Lab." A Working Conference on Science Education for Handicapped Students, H. Hofman (ed.) Washington, D.C.: National Science Teachers Association, pp. 96-101, 1978.

Several misconceptions harbored by science educators toward blind students in the science laboratory are discussed. Practical suggestions are offered for teaching basic chemistry skills, such as handling fire and corrosives and the accurate use of the balance; basic biology skills, such as measurement, dissection, and cell study, and astronomy. Skills for environmental field activities are also considered.

Graham, Milton D., ed. Science and Blindness: Retrospective and Prospective. New York: American Foundation for the Blind, 212 p., 1972.

The reports contained in this book grew out of the American Foundation for the Blind 50th Anniversary International Symposium on Science and Blindness, held in New York City in October, 1971. Contributions range from biostatisticians concerned with the numbers of blind people and their principal characteristics to engineers concerned with applications of space technology to problems of orientation and mobility.

Green, C. H. "Nature by Sound and Touch." Nature Magazine, 42: 413-416, 452, 1949.

The nature study curriculum at the North Carolina School for the Blind is described.

Gunderson, R. W. "Blind Improved Test Gear." Radio Electronics, 22(6): 28-30, June, 1951.

Circuit testing devices developed for use by the blind are described.

Hadary, Doris E. "Picking Up Good Vibrations from Science for the Handicapped." Science Teacher, 42(10): 12-13, December, 1975.

This study describes the following programs for blind and handicapped students: a four-year science curriculum for elementary students and an enrichment science laboratory for secondary students.

Hadary, Doris E. "Science and Art for Visually Handicapped Children." Journal of Visual Impairment and Blindness, 71(5): 203-209, May 1977.

Described are the design, adaptation, and evaluation of a special four year program in laboratory science, art, and music for elementary school blind children.

Hadary, Doris E. "Laboratory Science and Art for Blind and Deaf Children." Science Education and the Physically Handicapped: Sourcebook, H. Hofman and K. Ricker (eds.), Washington, D.C.: National Science Teachers Association, pp. 87-93, 1979. (Stock No. 471-14760).

This article describes a program at The American University of laboratory science and art for blind and deaf children. The project is a small, mainstreamed, multidisciplinary program for handicapped children which combines the inextricable elements of teacher training with emphasis on content and communication, curriculum design and implementation. Approximately 150 science lessons with matching art lessons have been designed, adapted, implemented, and tested in biological and physical sciences, interactions and systems, subsystems and variables, and energy sources.

Hadary, D. E. and M. A. Cohen. Laboratory Science and Art for Blind, Deaf, and Emotionally Disturbed Children--A Mainstreaming Approach. Baltimore: University Park Press, 1978, 383 pages.

This is the only book devoted to teaching science (and art) to the handicapped. The first section is a discussion of reasons for using science and art in the education of handicapped children. Section II gives specific activities in a lesson plan format with suggested adaptations for blind children. Background information in science is the topic of Section III. Art lessons constitute the bulk of Section IV. They follow the same pattern as the science activities with suggested adaptations for the blind. Many of the art lessons integrate science and many of the science lessons lead to or integrate art.

Hadary, Doris E., Susan H. Cohen, Tamara Denise Hadary, and Ruth Levine. "Interaction and Creation Through Laboratory Science and Art for Special Children." Science and Children, 13(6): 31-33, March, 1976.

Experiments with adapted apparatus which allow blind children to discover principles are described. Specifically designed, individualized experiences are developed in four curricular areas and a sample lesson is presented.

Hamilton, Dale W. "The Laboratory in Schools for the Blind." American Association of Instructors of the Blind, Thirty-first Biennial Convention, pp. 775-777, July, 1932.

The performance and discussion of laboratory experiments by the science teacher instead of active involvement by the blind student is strongly discouraged. Many deficiencies in laboratory sciences for the blind are discussed and solutions are offered. Methods, materials, and guidelines for apparatus adaptation collected from successful residential school science programs are presented.

Hamilton, Dale W. "What Science Teaching is Advisable in Our High School Departments." American Association of Instructors of the Blind, Thirty-second Biennial Convention, pp. 131-136, June, 1934.

An argument for including sciences in the residential school curriculum is made and the benefits of science instruction for blind students are discussed. General science, hygiene, sex education, biology, and physics are sciences considered appropriate for blind students. The study of chemistry is discouraged because no satisfactory instructional program exists that permits laboratory applications.

Hance, R. T. "Laboratory Work for the Blind." Science Counselor, 1(4): 4, 34, April, 1935.

Laboratory work in biology performed by blind students enrolled in the University of Pittsburg is described.

Hance, R. T. "Mendelism for the Blind." Journal of Heredity, 27: 151-153, 1936.

Laboratory courses in biological sciences that were being taught successfully to blind students at the University of Pittsburg are described.

Harwood, R. "The Teaching of Science of Blind Students." The Teaching Science and Mathematics to the Blind (with section on Raised Diagrams), Report to the Viscount Nuffield Auxiliary Fund, R. Fletcher, London: Royal National Institute for the Blind, pp. 12-29, 1973.

A college class in advanced physics which integrates blind with sighted students is described. Illustrations, uses, and sources of special and adapted laboratory apparatus are presented.

Hatlen, Phillip. "Educational Research and Severe Visual Impairment." Science and Blindness: Retrospective and Prospective, M. Graham (ed.), New York: American Foundation for the Blind, pp. 29-42, 1972.

The relationship between educational research and the needs of practicing teachers of the blind is described. Research in the area of the visually handicapped is viewed to be of practical value and educationally sound when a close working relationship is established among educators, technologists, engineers, and scientists. The development of the Science Curriculum Improvement Study (SCIS) program is described along with several other projects as exemplary of the union between education and research.

Hayes, Julia L. "Museum Program at the Connecticut School for the Blind." New Outlook for the Blind, 46(5): 133-135, May, 1952.

The establishment of a program of regular weekly visits to the Children's Museum at Hartford is reported. The museum staff act as teachers.

Hebbeln, Harold J. "Adaptation in Teaching Physics to the Blind." Teachers Forum, 13(2): 54-58, November, 1941.

The nature of educational aids adaptation and its application to the study of physics is discussed. Current trends in methods of teaching physics are also described.

Hebbeln, Harold J. "Some Uses of Hearing in the Study of Physics." Teachers Forum, 4(5): 91, May, 1932.

A method of detecting small electrical currents through the sense of hearing is described.

Hebbeln, Harold J. "A Survey of Physics Courses in Schools and Classes for the Blind." Teachers Forum, 13(2): 26-30, November, 1940.

The survey attempts to determine to what extent physics is being taught in schools and classes for the blind, and what provisions have been made for laboratory work at the senior high school level.

Heisler, William T. "Tree Study." Outlook for the Blind, 38(6): 160-162, June, 1944.

A description of a course in dendrology, the study of trees and shrubs, undertaken at the Pennsylvania Institution for the Instruction of the Blind is presented.

Heisler, William T. "The Need for Three-Dimensional Instruction in Science Curricula." American Association of Instructors of the Blind, Thirty-eighth Biennial Convention, pp. 103-104, June, 1946.

Subtleties of tactual discriminatory skills are listed and a method of classifying sensory aids is presented. Methods of teaching the blind are viewed as fitting into three general categories: words, partial experiences, and full experiences. The role of three-dimensional contact experiences in subjects studied is discussed as it relates to pupil comprehension.

Henderson, David R. "Laboratory Methods in Physics for the Blind." Pittsburg: University of Pittsburg, 77 p., September, 1967. ED 011 155.

This paper describes auditory and tactile adaptations of physics laboratory apparatus for use by blind students, together with five methods of drawing raised line and indented diagrams for use in physics experiments. A survey of physics laboratory methods in schools for the blind in the United States and seven foreign countries is described. Two simple physics experiments for blind high school students are included.

Hershkowitz, Aaron. "Conservation of Quantity, Mass, and Volume in Blind Children." Social Research on Blindness: Present Status and Future Potentials, M. Graham (ed.) , New York: American Foundation for the Blind, pp. 82-83, 1960.

Three groups of seven children each (blind, blindfolded, and sighted) children were matched for age, intelligence, and socio-economic level and compared on abilities to conserve quantity in this investigation of the role of vision in solution of Piagetian conservation problems presented under varying conditions of instructions and modality. No conclusions were reported.

Hiemenz, Paul C. and Elizabeth Pfeiffer. "A General Chemistry Experiment for the Blind." Journal of Chemical Education, 49(4): 263-265, April, 1972.

This study describes a quantitative chemistry experiment, conductometric titration, which was adapted for a blind student. Other areas are also indicated which can be adapted for similar experiments.

Hill, O. J. "Another Beam of Light through the Darkness." Teachers Forum, 11(4): 62-65, 72, March, 1939.

This article discusses how students at the Ohio State School for the Blind were given a more accurate idea of birds and animals, and trees and buildings through models constructed on a WPA project.

Hill, O. J. "How Scaled Models are Used to Teach the Blind." American Association of Instructors of the Blind, Thirty-fifth Biennial Convention, pp. 145-147, June, 1940.

Methods of using educational models in science instruction at the Ohio School for the Blind are described.

Hofman, Helenmarie, ed. A Working Conference on Science Education for Handicapped Students: Proceedings. Washington, D.C.: National Science Teachers Association, 392 p., April, 1978. ED 161 714.

This conference attempted to assess the state of the art and develop recommendations for new directions in science education and careers in science for handicapped students. Panel discussions were held on such topics as: (1) attitudinal barriers and other obstacles to handicapped students; (2) current practices relating to all physical handicaps; (3) mainsteaming and the law; (4) current practices related to auditorially handicapped students; (5) visually handicapped students; (6) science education, the handicapped, and careers; (7) orthopedically handicapped students; and (8) science careers for handicapped students. Through working sessions the conference participants developed a positi statement of science education for the physically handicapped st ıt. Recommendations for action are addressed to various groups.

Hofman, Helenmarie H. and Kenneth S. Rucker, eds. Science Education and Physically Handicapped: Sourcebook. Washington, D.C.: National Science Teachers Association, 285 p., 1979. (Stock No. 471-14760).

This sourcebook is an attempt to distribute on a national level the proceedings of the 1978 National Science Teachers Association's conference on science education for handicapped students (Hofman, 1978). The articles and papers have been divided into ten sections: "Science Education and the Handicapped," "Science for Everyone," "Preparing Teachers to Work with the Handicapped," "Resources for Teachers/Schools," "Science and the Auditory Handicapped," "Science and the Orthopedic Handicapped," "Science and the Visually Handicapped," "Extending the Science Program Beyond the School," "The Handicapped and Careers in Science and Related Fields," and "Science Education and the Handicapped, Implications for the Future."

Hoover, William C. "The Technique of Physics Instruction for the Blind." Teachers Forum, 9(4): 73-78, March, 1937.

Teaching methods employed in physics classes at the Kansas School for the Blind are outlined in this article.

Hurst, A. D. "Ways and Means of Teaching General Science to Blind Students." Teachers Forum, 6(2): 34-37, November, 1933.

This report describes how some laboratory equipment and experiments useful in general science instruction can be adapted for blind students. Simple laboratory exercises are presented on the topics of molds, yeasts, major organs, leaf structures, flower parts, tree identification, generation of gases, weather, distillation, refrigeration, electricity, and astronomy.

Johnston, Susanne C. "Science for a Partially Sighted Junior High Child." Science Education and the Physically Handicapped: Sourcebook, H. Hofman and K. Ricker (eds.), Washington, D.C.: National Science Teachers Association, pp. 66-72, 1979. (Stock No. 471-14760).

This article describes how a junior high science teacher in a public school adapted course instruction to accomodate a mainstreamed, partially sighted student. Topics discussed include changes in classroom materials, use of sighted lab assistants, and approaches to teaching microscope work, genetics, chromatography, capillary action, and diseases.

Joint Committee of the College of Teachers of the Blind and the National Institute for the Blind. The Education of the Blind: A Survey. London: Edward Arnold Co., pp. 129-132, 1936.

Findings of the Committee regarding the nature knowledge and elementary science in schools for the blind are reported.

Kaschner, Susan K. "Viewing the Earth with Closed Eyes." Science Activities, 15(3): 12-13, Fall 1978.

This article suggests that teachers try to view the earth with their eyes shut as a means of better understanding a blind child's perspective. Modifications of activities in earth science which can be used with visually impaired students are described.

Kaufman, Abraham S. "Tutoring a Visually Handicapped Student in High School Chemistry." New Outlook for the Blind, 65(10): 313-317, December, 1971.

Described are teacher developed materials and techniques used by a high school teacher for tutoring a visually handicapped student in high school chemistry.

Koehne, Grace. "The Place of Science in the Elementary Curriculum." American Association of Instructors of the Blind, Thirty-second Biennial Convention, pp. 125-127, June, 1934.

The importance of science instruction in the elementary grades is discussed and the science curriculum in grades 1-8 at the Indiana School for the Blind is described. Results of a national survey of residential school elementary science programs are presented. At the time, only ten schools in the U.S. had such programs.

Kraus, S. "Physik in der Blindenschule." Blindenfreund, 22: 27-28, 1902.

This article contains directions for making certain experiments in physics intelligible to blind students.

Laetsch, F. "SAVI (Science Activities for the Visually Impaired)." Berkeley: Lawrence Hall of Science, University of California, 1977.

A partially completed program of individualized, hands-on, science activities for visually impaired students age 9-12 is described. Two activity modules, "Structure of Life" and "Scientific Reasoning" are described.

Langworthy, Jessica L. "An Experiment in Teaching Astronomy." Teachers Forum, 7(3): 53-55, January, 1935.

A brief course of 12 lessons, given at Perkins Institution, covering the story of the solar system, the tides, the history of the calendar, the principal constellations, and related topics are described.

Lennon, Elizabeth M., John L. Feirer, and William K. Purdy. "Metrics for Visually Impaired Persons." New Outlook for the Blind, 70(1): 1-4, January, 1976.

The Center for Metric Education at Western Michigan University, under a U.S. Office of Education grant entitled, "Metric Conversion in Vocational Education," has developed a number of aids to be used by visually impaired persons in learning and using the metric system. Linear measurements (and their relationships to volume and weight) for general use and measures commonly used in the kitchen have been emphasized.

Levine, Helen G. and Muriel C. Lass. "Recorded and Braille Textbooks: Everything the Blind Student Needs to Know: The National Braille Association." New Outlook for the Blind, 40(7): 516-517, April, 1974.

Textbooks in braille are prepared by certified volunteer transcribers all over the country. Master copies of over 1,100 textbooks, from which thermoformed duplicates can be made, are located in the Braille Book Bank of the National Braille Association. Nearly 200 scientific and mathematical tables in braille are available through the Association's Braille Technical Tables Bank. The Instructional Materials Reference Center maintains a Central Catalog of braille books and their location in various other depositories. Full instructions for the use of the various services of Recording for the Blind, Inc. and the National Braille Association are included in this two-part article.

Lindecker, Ruth C. "Teaching Human Reproduction to the Visually Impaired in Science Classes." In a Working Conference on Science Education for Handicapped Students, H. Hofman, Washington, D.C.: National Science Teachers Association, pp. 108-113, 1978.

This report addresses the unique problems of teaching human reproduction and sexuality to the blind. No definite solution is offered after the scope of the problem is discussed. However, a wide range of suggestions is presented for the science teacher to consider in meeting the individual needs of the student. Parental involvement in securing live models is encouraged.

Long, R. E. "The Importance of a Laboratory in Science Classes--What Shall be in It?" American Association of Instructors of the Blind, Thirty-fifth Biennial Convention, pp. 173-175, June, 1940.

The importance of the laboratory for adding concrete experiences to the study of sciences in grades 1-12 is described. Although specific examples of appropriate laboratory apparatus are omitted in this discussion, consideration is given to the philosophy of the laboratory in residential school science programs in hope that agreement on approach will permit suitable solutions to the problems of materials acquisition.

Loomis, Madeline S. and Paul C. Mitchell. Braille Chemical Notations and How to Use Them. New York: New York Institute for the Education of the Blind, Monograph No. 8, 28 p., 1939.

The rules and symbols for braille chemical notations contained in this booklet were developed during three years of class and laboratory work in chemistry at the New York Institute for the Education of the Blind. These symbols have been selected with great care, used under actual laboratory conditions, and have served well in preparing pupils for college entrance and New York State Regents examinations.

Lowenfeld, Berthold. "Education Models in Schools for the Blind." Outlook for the Blind and Teachers Forum, 36(1): 35-37, February, 1942.

Modern psychological concepts of learning have exerted a strong influence of teaching methods in schools for the blind. Efforts are being made to prepare and collect educational models intended to give blind children concrete experience with objects.

Maley, Patrick V. "Suggestions for Using the Senses in Teaching Science." American Association of Instructors of the Blind, Fortieth Biennial Convention, pp. 125-127, June, 1950.

Suggestions for increasing olfactory, gustatory, cutaneous, and static sensitivity are presented to provide insight into the development of new laboratory projects for blind science students. An example is given of a physics exercise on the relativity of motion.

Malone, Lawrence and Linda DeLucchi. "Life Science for Visually Impaired Students." Science and Children, 16(5): 29-31, February, 1979.

This article describes how selected Science Activities for the Visually Impaired (SAVI) lessons were applied in a class of visually handicapped students to enrich science learning experiences. Activities with live crayfish, snails, and plants are presented and a method of integrating the experiences of indoor and outdoor biology activities is presented.

Maynz, J. "Gipsmodelle im Blindenunterricht." Arbeitschule, 44: 248-250, 1930

Directions are given for making plaster models for use in the science education of the blind.

McCarley, Orin, editor. "Science Education News." Washington, D.C.: American Association for the Advancement of Science, Fall, 1978/Winter, 1979

This issue of the American Association of the Advancement of Science (AAAS) newsletter is devoted to the science education for physically, visually, and aurally handicapped children. Articles include thoughts on teaching deaf students and blind students, a brief description of a science program for young physically handicapped children, aids in teaching field aspects of science to the physically handicapped, and counseling of the handicapped for a career in science. A collection of addresses of organizations and sources of information for teachers who have handicapped students in their classes is included.

McHugh, Dorothy A. "The Teaching of Chemistry in a School for the Blind." The Teaching of Science and Mathematics to the Blind (with section on Raised Diagrams): Report to the Viscount Nuffield Auxiliary Fund, R. Fletcher(ed.), London: Royal National Institute for the Blind, pp. 30-32, 1973.

Specific suggestions for conducting certain laboratory experiments in chemistry are presented.

McIntyre, Margaret. "Early Childhood and Science: Science Is for All Children." Science and Children, 13(6): 50-51, March, 1976.

Some ways in which exploratory activities of the preschool child involve science concepts are described; the role of the adults' knowledge about both science and child development is stressed. Emphasis is placed on hands-on experiences.

Meisinger, F. "Der Unterricht in der Naturgeschichte. Mell." Blindenunterricht, pp. 154-170, 1910.

Suggestions and directions are provided for teaching anatomy and hygiene, zoology, botany, and mineralogy in a school for the blind. Much of the paper discusses the advantages of field trips.

Mell, M. "Der Unterricht in der Naturlehre. Mell." Blindenunterricht, pp. 170-179, 1910.

Discussed are methods and materials useful in teaching general science in a school for the blind.

Miller, Marion. "A Circus in the Primary Grades." Outlook for the Blind, 23(2): 25-27, September, 1929.

This article describes how nature study is made alive and interesting to blind children through the staging of a circus.

Mitchell, Paul C. "Some Ways of Teaching Attitudes and Methods in Science." American Association of Instructors of the Blind, Thirty-fifth Biennial Convention, pp. 171-172, June, 1940.

Consideration is given to the realm of science instruction as an ideal place for developing proper attitudes and methods of life, especially for the blind student. General aims in teaching science and specific objectives of an enriched science program are presented.

Myers, S. O. "The Teaching of Science in Schools for the Blind." Teacher of the Blind, 23: 90-93, 1935.

An outline for a course in general science study is presented.

Myers, S. O. "General Science in Schools for the Blind." Outlook for the Blind, 37(3): 72-73, March, 1943.

The suggestion is made that the general science syllabus be divided into three parts: an introductory period for pupils below the age of 13, the senior school main course, and a scheme for continuation classes.

Myers, S. O. "Current Research into the Teaching of Primary School Science." The Teaching of Science and Mathematics to the Blind (with section on Raised Diagrams): Report to the Viscount Nuffield Auxiliary Fund, R. Fletcher(ed.), London: Royal National Institute for the Blind, pp. 160-161, 1973.

Described is a research project related to the teaching of science to blind primary pupils, age five to eleven, of normal intelligence and secondary students, age 12-16, of below average ability. The project emphasizes student discovery and exploration of environmental concepts.

Napier, Grace D. "Special Subject Adjustments and Skills." The Visually Handicapped Child in School, ed. B. Lowenfeld, New York: The John Day Company, pp. 221-277, 1973.

Methodology is presented for teaching science to the blind in this chapter, which also includes methods in mathematics, social sciences, music, arts and crafts, foreign languages, home economics, and physical education. Techniques for teaching hygiene, human reproduction, earth and space science, chemistry, physics, and biology are discussed. The use of sensory approaches is emphasized, and a broad variety of enrichment activities is listed for each subject area.

National Academy of Sciences. "Science and Technology in the Service of the Physically Handicapped: Summary." Washington, D.C.: National Academy of Sciences-National Research Council, Division of Medical Sciences, 30 p., August, 1976. ED 151 996.

The report of the committee on national needs for the rehabilitation of the physically handicapped focuses on the current problems in the field, the areas in which additional knowledge is needed, and directions in which society and government should move, both with respect to the acquisition of new knowledge, and to a more effective organization of effort. Listed among recommendations is that for major areas of disability, a comprehensive national overview should be developed outlining in full its demography, national cost, and related social and organizational structure. Rehabilitation is discussed in terms of the medical and social framework, demography, organizations and programs, the policy picture, and economics. A section on the state of the art in science and in technology and their application covers research and development, blindness and low vision, hearing and speech, manipulation and locomotion, and basic neuroscience and rehabilitation.

National Institute for the Blind. Museums and the Blind. London: National Institute for the Blind, Bulletin No. 2, 12p., 1930.

This report presents a survey of the use made by public museums in the instruction of the blind, with a list of English museums prepared to offer special facilities to the blind.

National Science Teachers Association. "Bibliography: Science and Visually Handicapped." Science Education and the Physically Handicapped: Sourcebook, H. Hofman and K. Ricker (eds.), Washington, D.C.: National Science Teachers Association, pp. 111-115, 1979. (Stock No. 471-14760).

This bibliography contains 64 entries related to science education and the visually handicapped.

Ohio Works Project Administration Writers' Program. Models for the Blind. Columbus: Ohio School for the Blind, 197 p., 1941.

Described is a collection of models constructed by a WPA project for the Ohio School for the Blind.

Oppel, F. "Die Naturgeschichte in Blindenanstalten." Blindenlehrerkongress, Frankfurt, pp. 198-209, 1882.

Discussed are methods of teaching botany, zoology, and mineralogy in schools for the blind.

Overbeay, Donald W. "Enriching and Extending the Science Program to Meet Post-War Needs." American Association of Instructors of the Blind, Thirty-eighth Biennial Convention, pp. 100-102, June, 1946.

This report recommends that science be taught in schools for the blind from grades one through twelve. Science is viewed as the best medium for educating youth for participation in a democracy. The principle objectives of science instruction are outlined and suggestions are offered for enriching the science program.

Overbrook School for the Blind Staff. "Practical Physics at Overbrook." Outlook for the Blind, 36(5): 296-298, December, 1942.

Described is a course which emphasizes the laws and practical applications of physics rather than the more technical and abstract phases of the subject.

Pappas, Christos, Jr. "Teaching Chemistry at Perkins." American Association of Instructors of the Blind, Fortieth Biennial Convention, pp. 127-129, June, 1950.

This paper describes the chemistry course at Perkins Institution as a tailored, trimmed, and streamlined course taught on the basis of student interest and relation to daily living, as opposed to a chemistry course taught in a "college dictated" manner. The content of class lectures and laboratory experiments is discussed along with solutions to the special problems encountered.

Pease, Loretta C. "The Science Laboratory in the Elementary School for the Blind." Outlook for the Blind and Teachers Forum, 40(6): 159-164, June, 1946.

The importance of elementary level science programs in schools for the blind is discussed and criteria for selecting indoor and outdoor laboratory equipment are presented. To illustrate the organization of outdoor laboratory equipment and the value of simple indoor equipment to supplement it, detailed programs on trees and gardening for primary age blind students are provided. Many questions that teachers and students might ask are addressed.

Perkins, H. F. "Helping the Blind to 'See' a Museum." Red Cross Courier, 19(11): 17-18, November, 1940.

This report describes the Robert Hull Fleming Museum which holds exhibitions for and by the blind and which circulates a seventy-five object collection of various specimens.

Peterson, Edwin G. "The Extent and Importance of Laboratory Work in Biology Classes." American Association of Instructors of the Blind, Thirty-fifth Biennial Convention, pp. 158-161, June, 1940.

Current practices in teaching biology to the blind are described and curriculum deficiencies are addressed. Basic objectives of teaching biology to the blind are listed as well as these general principles: (1) use real materials in preference to models, but, when models must be used, have them as life-like and life size as possible; (2) teach what is of immediate interest, that is, local flora and fauna; (3) do as much practical laboratory and field work as possible; and (4) study nature in its natural state.

Pickles, A. O. "Radionic Constructional and Experimental System." The Teaching of Science and Mathematics to the Blind (with section on Raised Diagrams): Report to the Viscount Nuffield Auxiliary Fund, London: Royal National Institute for the Blind, pp. 49-52, 1973.

A systematic method of constructing radio and electronic circuits without the use of solder is described. The circuits are easily assembled, adapted, or dismantled without damaging delicate components. Designed for the blind student, the system is in complete harmony with the modern physics syllabus in England.

Piltz, Albert. "Gardening for the Blind Child." Science and Children, 6(2): 25, October, 1968.

A set of gardening tools specially developed for visually handicapped students in the Detroit Public Schools is reported. A planting board, router, and brailled plant markers were used by blind students to plant, tend, and harvest a garden crop during a one year period.

Prilop, P. "Das Problem des Naturgeschichtsunterrichts in der Blindenschule." Blindenfreund, 52: 252-257, 1932.

A survey of 35 students in a school for the blind brought out the fact that nature study was of predominating interest to most of them. Various suggestions for making the subject intelligible to the blind student are given.

Ramsey, G. F. Educational Work in Museums of the United States. New York: H. W. Wilson Co., pp. 97-105, 1938.

Chapter V, "Museum Work for Handicapped Children," tells of classes for blind children given at the American Museum of Natural History in New York and by museums in other parts of the country.

Redden, Martha Ross and Cheryl Davis. "Mainstreaming: The Kurzweil Reading Machine and Science Education for the Handicapped." The Kurzweil Reading Machine, Boston: Exception Parent Press, (In Press).

This article was unavailable for review at press time.

Reese, Phillip and Edward Zero. Nature Trail for the Blind. A copy of this book was unavailable for review at press time.

Riddle, C. F. "Science in the Elementary Grades." American Association of Instructors of the Blind, Thirty-eighth Biennial Convention, pp. 105-107, June 1946.

The theme of this paper is that science should supply the materials for the basic concepts of learning; that without clear concepts of, and experience with, the objects and materials of one's environment, learning is impossible; and that the most frequently met barrier to educational progress is the lack of such concepts and experiences. The importance of science in early childhood is discussed as it relates to learning through concrete experiences.

SAVI Newsletter, Science Activities for the Visually Impaired, Berkeley, California, February, 1977, January, 1978, January, 1979.

SAVI (Science Activities for the Visually Impaired) involves many of the same team that produced SCIS (Science Curriculum Improvement Study) with their endeavors at the Lawrence Hall of Science in Berkeley, California. The purpose of this program is to design a series of individualized activities to make concrete experiences in science available to visually impaired children from nine to twelve years of age. These newsletters contain reports from field testing and materials development through national teacher trials in order to get information and feedback which can be used to make SAVI activities as effective and helpful as possible to the broadest spectrum of visually impaired youths.

Schatz, Dennis and Holly Overman. "The Role of the Science Museum in Science Education of the Handicapped." Science Education and the Physically Handicapped: Sourcebook, H. Hofman and K. Ricker (eds.), Washington, D.C.: National Science Teachers Association, pp. 237-241, 1979. (Stock No. 471-14760).

Developed is the idea that science museums are natural locations for resource centers to provide in-service workshops concerning the teaching of science to handicapped students and for depositories for loan of adapted science activities, aids, and appliances. Particular attention is given to resources for the visually handicapped that have a broad application across disability areas.

Schatz, Dennis and Herbert D. Thier. "Increasing the Accessibility of Hands-on Science for Blind Students." New Outlook for the Blind, 70(2): 61-63. February, 1976.

The Adapting Science Materials for the Blind (ASMB) project has developed a number of individualized sets of science activities and experiments for upper-elementary level visually handicapped students. Working independently or in small groups, students are able to learn fundamental scientific principles and the basics of the scientific method using the hands-on approach. The ASMB materials are tested in actual classroom situations and then refined further.

Schatz, Dennis, Frank L. Franks, Herbert D. Thier, and Marcia C. Linn. "Hands-On Science for the Blind." Science and Children, 13(6): 21-22, March, 1976.

This study stresses the fact that science activities can be styled to the visually handicapped students' levels and degrees of independence. Use of extensive hands-on, concrete experiences as emphasized by Adapting Science Materials for the Blind (ASMB) is encouraged.

Schnur, Ronald and Carl F. Berger. "SAVI (Science Activities for the Visually Impaired): Developing a New Science Curriculum." Association of Educators of the Visually Handicapped: Proceedings, 54th Conference, pp. 42-46, June, 1978.

Content and design principles of Science Activites for the Visually Impaired (SAVI) are described. The program consists of nine, individualized, hands-on, science activity modules, containing two to eight activities per module that can be used by students nine to twelve years of age with great flexibility and without the need of specialized equipment.

Schwartz, Jonathan R. "Survey of Nature Trails for the Visually Impaired." Journal of Visual Impairment and Blindness, 71(2): 54-61, February, 1977.

In order to develop design criteria for interpretive nature trails for the visually impaired, this study first investigated existing trails to determine how effective they were, and to discover what problems have emerged in their administration. Since it was not feasible to survey visually handicapped persons directly, certified orientation and mobility instructors were surveyed to obtain information on the opinions of visually impaired persons.

Science for the Blind. Science for the Blind. Bala Cynwyd, Pa.: Science for the Blind, 70 p., 1967. ED 018 055.

The report on Science for the Blind, a non-profit organization, details past and planned growth. The organization has been providing scientific information on tape since 1955. Over 2,000 tapes are currently circulated monthly with selections from scientific periodicals, lectures, and books. In 1964 the instrument and aids project was begun to provide special instruments and apparatus to the blind working in scientific and technical fields so they could compete on a more equal basis with their sighted co-workers. The project also aims to assist any blind person who needs instruments to perform tasks connected with hobbies and everyday life, as well as work. Included in this report are the organization's financial requirements and descriptions of the jobs within it. Current and future projects and equipment are detailed.

SCIS Newsletter. The Science Curriculum Improvement Study, Berkeley, California, No. 20, Spring, 1971; No. 22, Winter, 1971; No. 23, Fall, 1972, No. 24, Spring, 1973.

Updated information on field testing and materials development of the SCIS (Science Curriculum Improvement Study) program adapted for visually handicapped students is presented in these newsletters.

Sharpless, Nanale S., Geerat Vermeij, and John Gavin. "Achievement in Science." Science Education and the Physically Handicapped: Sourcebook, H. Hofman and K. Ricker(eds.), Washington, D.C.: National Science Teachers Association, pp. 42-47, 1979. (Stock No. 471-14760)

This account contains a brief autobiography of Dr. Geerat Vermeij, a blind professor of zoology at the University of Maryland, who completed his undergraduate work at Princeton and received his Ph. D. from Yale. Obstacles to his educational and career pursuits are discussed.

Sheldon, D. D. The Blind Child in the World of Nature. New York: American Foundation for the Blind, 8 p., 1929.

A nature study project conducted at the Department of Special Studies at Perkins Institution is reported.

Shugrue, Sylvia K., Walter M. Morris, and Carolyn H. Kuhne. "Braille Trail Model." Science and Children, 6(2): 23-24, October, 1968.

This report describes the development of a raised relief map for use by blind people who visit the Touch and See Nature Trail at the National Arboretum. The three-dimensional scale model of the trail was developed as a school project for sighted primary classes in a public school.

Stainton, Edna. "Nature Study Class." Outlook for the Blind, 24(1): 34-35, June, 1930.

This article reports that a class of fifteen blind students was held by the Buffalo Association for the Blind under the auspices of the Buffalo Museum of Natural Science for the purpose of making the blind more familiar with certain phases of nature study.

Stelle, May. "The Introduction of Science in the Intermediate Grades." American Association of Instructors of the Blind, Thirty-eighth Biennial Convention, pp. 67-72, June, 1946.

The study of science is discussed as it relates to children's knowledge of the environment through concrete experiences. Principles of science instruction as practiced in the intermediate grades of the Florida School for the Deaf and Blind are presented. Beginning science instruction in the primary grades is encouraged.

Stephens, W. Beth, Joseph Fitzgerald, Jo Hitt, and Carl Grude. Student Activity Guide: A Piagetian Perspective. Richardson, Texas: University of Texas at Dallas, 193 p., 1977. (Grant No. 600-74-07445, Project No. 443 CH50410).

Application of Piagetian-based strategies in classrooms with visually handicapped students has resulted in this student activities manual which has numerous modules on classification, conservation, spatial relations/mental imagery, and abstract (formal) operations.

Stephenson, S. C. "The Teaching of Science at Worcester College for the Blind." The Teaching of Science and Mathematics to the Blind (with section on Raised Diagrams): Report to the Viscount Nuffield Auxiliary Fund, R. Fletcher (ed.), London: Royal National Institute for the Blind, pp. 7-12, 1973.

The science curriculum at Worcester College for the Blind which focuses on biology and chemistry is described. A description is also included of the program's education materials: textbooks, embossed diagrams, recorded journal articles, special and adapted laboratory devices.

Stephenson, S. C. "Further Notes on Teaching Science to the Blind." The Teaching of Science and Mathematics to the Blind (with section on Raised Diagrams): Report to the Viscount Nuffield Auxiliary Fund, R. Fletcher, London: Royal National Institute for the Blind, pp. 162-165, 1973.

This article updates the list of laboratory apparatus which has been found useful in teaching general science, biology, chemistry, and physics at Worcester College for the Blind.

Tallman, Dennis E. "pH Titration Apparatus for the Blind Student." Journal of Chemical Education, 55(9): 605-606, September, 1978.

Described is the adaptation and application of a Beckman Zeromatic II pH meter for use by a blind college student enrolled in an analytic chemistry course. The adaptations allowed the student to gain experiences with analyzing changes in solution composition when titrant is added in neutralization titrations.

Thier, Herbert D. "Laboratory Science for Visually Handicapped Elementary School Children." New Outlook for the Blind, 65(6): 190-194, June, 1971.

This report describes the adaptation of the Science Curriculum Improvement Study (SCIS), an ungraded, sequential, physical and life science program for the elementary school, for use by visually handicapped students. The purpose of Adapting Science Materials for the Blind (ASMB) is to provide an experience-centered instructional program in science; a program which in essence turns the classroom into a laboratory.

Thier, Herbert D. "Fostering Observation in a Science Program for the Young Blind Student." Science Education and the Physically Handicapped: Sourcebook, H. Hofman and K. Ricker (eds.), Washington, D.C.: National Science Teachers Association, pp. 200-205, 1979. (Stock No. 471-14760).

This article discusses the value of observation in science and describes the typical approaches to teaching observation to the young blind student, with a focus on the shortcomings of these approaches. The author emphasizes what is possible for the blind student and describes the materials development of the Science Curriculum Improvement Study (SCIS) program adapted for the visually impaired.

Thier, Herbert D. and others. Adapting Science Materials for the Blind, Report of an Evaluation Planning Conference. Berkeley, Ca: California Univ., 11 p., December, 1969. ED 038 282.

Science educators and individuals who had extensive experience working with visually handicapped children were brought together to establish some baselines and beginning ideas of approaches to the evaluation of a laboratory-centered science program (Science Curriculum Improvement Study) as it is being used with visually handicapped children. Areas in which participants were in agreement relative to evaluation in the project are discussed.

Thier, Herbert D. and Doris E. Hadary. "We Can Do It, Too." Science and Children, 11(4): 7-9, December, 1973.

This study describes some of the adaptations of science exercises found in the program, Adapting Science Materials for the Blind (ASMB). This program enables blind and other visually impaired pupils to participate in the activities of the Science Curriculum Improvement Study (SCIS).

Thier, Marlene. "Utilizing Science Experiences for Developing Visual Perception Skills." Science and Children, 13(6): 39-40, March, 1976.

Described are alternative approaches for developing visual perception skills found in selected science experiences. Use of various science programs available, such as ESS, SCIS, OBIS, and MATAL, is suggested. Visual sequencing is prescribed and described.

Thomas, Barry. "Environmental Education for the Blind." Instructor, 86(9): 106-107, May, 1977.

Six lesson plans used with blind multihandicapped students in an environmental education workshop are presented. The goals for each lesson include making a predator device that can catch a prey, creating an animal and a plant that can survive in a particular niche, finding different plants, inventing ways of seed dispersal, and studying animal motion.

Tiller, James E., Hilary la Mothe, and Lawrence C. Walker. "An Experimental Rodent Chamber for Blind Students." Behavioral Engineering, 4(1): 1-3, Fall, 1977.

Described is a procedure for modifying a standard experimental rodent chamber so that a blind college student could complete the requirements for a heretofore visually oriented introductory course in the experimental analysis of behavior. The requirements of the course that the student completed are listed, and implications of meeting the needs of visually handicapped college students are discussed.

Tombaugh, Dorothy. "Laboratory Techniques for the Blind." American Biology Teacher, 34(5): 258-260, May, 1972.

This study describes modifications of laboratory procedures for the BSCS Green Version Biology, including dissection, microbiology, animal behavior, physiology, biochemistry, and genetics that make the methods suitable for direct experimentation by blind students. The use of models as substitutes for microscopy is also discussed.

Tombaugh, Dorthy. "Mainstreaming Visually Handicapped in Biology." A Working Conference on Science Education for Handicapped Students, H. Hofman (ed.), Washington, D.C.: National Science Teachers Association, pp. 167-171, 1978.

The use of sighted lab partners is encouraged as a method for teaching high school biology to the blind. Helpful suggestions and adaptations are presented for laboratory work involving microscopy, dissection, biochemical equations, and the study of genetics. A minimum of special equipment is recommended and several alternative strategies are discussed for laboratory exercises involving organisms or materials that are inappropriate for blind students, such as the substitution for Tes-tape of limewater, silver nitrate, and other solutions that produce precipitates.

Tombaugh, Dorothy. Biology for the Blind. Euclid, Ohio: Euclid Board of Education, 75 p., 1973. ED 077 677.

This manual provides advice and guidance to teachers of biology who may have blind children in a class of students with normal sight. The author stresses that in the objectives of high school biology curricula, there is no goal that is beyond the reach of a blind person. The first section provides suggestions for assisting blind students under the following headings: class orientation, laboratory assistants, classroom procedures, tests, equipment, and techniques. The second section is a teachers' guide to Biological Science Curriculum Study (BSCS) Green Version high school biology for blind students. Here the author gives specific suggestions and advice on techniques which enable the blind student to take a fully active role in laboratory investigations. Supplementary readings in biology (available as recordings), supplementary biology materials, and sources of materials for the blind are listed.

True, Nancy A. "Museum Work for Partially and Totally Blind Children." Teachers Forum, 2(3): 2-4, January, 1930.

The work of the American Museum of Natural History with classes of blind and partially sighted children is described.

Turner, Sadie. "Making Use of our Museum." Teachers Forum, 2(3): 12-13, May, 1930.

This article reports on the use of models from the museum at Perkins Institution to illustrate simple stories of animals and birds in elementary nature study.

Vaughn, R. "A Course in Nature Study and Science." Teacher of the Blind, 17: 288-289, 1929; and 18: 11-12, 37-39, 63-64, 90-91, 114-115, 1930.

A course of study in six stages, each stage divided into three terms, with ten lessons suggested for each term, is presented.

Walker, I. Constance. "Computer Programming for the Blind and Visually Impaired: A Case for Quality Standards and Professionalism." American Foundation for the Blind Research Bulletin, No. 24, pp. 95-112, March, 1972.

The purpose of this paper is to specify a bench-mark standard for the quality training of blind and visually impaired computer programmers. Training methods are described which, on the basis of several years of experience, have produced graduates who are competent.

Walker, I. Constance. "Preparing the Severely Visually Impaired for the Professions." Science and Blindness: Retrospective and Prospective, M. Graham (ed.), New York: American Foundation for the Blind, pp. 73-79, 1972.

Methods of training blind computer programmers at Systems Development Corporation are presented which have produced competent, well paid, computer professionals. The use of sighted partners is employed in training and no equipment has been specially adapted for the blind worker.

Wanecek, O. "Uber Lehrmittel im tierkundlichen Unterricht." Zeitschrift fur das oesterreichische Blindenwesen, 2: 311-313, 1915.

This article discusses the use of objects and models in zoology classes in schools for the blind.

Waterhouse, Edward J. "Enrichment Through Models." American Association of Instructors of the Blind, Thirty-fifth Biennial Convention, pp. 148-149, June, 1940.

The advantages and limitations of models are discussed and criteria for selecting and developing models are presented.

Weems, Bruce. "A Physical Science Course for the Visually Impaired." Physics Teacher, 15(6): 333-338, September, 1977.

This study describes a university level laboratory science course designed for visually handicapped students.

Wellington, J. A. and D. H. Morgan. "Visual Aids in the Teaching of Astronomy to the Blind." Teachers Forum, 12(4): 66-67, 72, March, 1940.

Presented is an illustrated description of several models, showing the relations between the sun, moon, and earth, which were constructed at the California School for the Blind.

Wexler, A. Experimental Science for the Blind. London: Pergamon Press, 1963.

This manual contains many illustrations and descriptions of various science activities and laboratory experiments that have been used successfully with visually handicaped science students in England and Australia.

Whitfield, Eddie. "Experiments on Tape." Science and Children, 13(6): 47, March, 1976.

The use of science experiments on tape are shown to provide for individual differences varying from the gifted to the handicapped child in developing skills in the language arts area, developing significant concepts, and making learning come alive.

Willoughby, Doris, Shirley Lansing, Mary Barber, and Patricia Maurer. Your School Includes a Blind Student, Chatsworth, CA: National Federation of the Blind, Teachers Division, 36 p., 1978.

The Teachers Division of the National Federation of the Blind offers this booklet as a guide for the genuine integration of the blind student into the regular educational system, as a preparation for normal, responsible adulthood. Included in this comprehensive guidebook are suggestions for teaching science. The use of sighted laboratory partners is recommended.

Witcher, Clifford M. "Laboratory Work for the Blind." In Blindness: Modern Approaches to the Unseen Environment, P. Zahl (ed.), Princeton, N.J.: Princeton University Press, pp. 247-258. 1950.

Popular misconceptions regarding the blind working in laboratory sciences are dismissed and support is given to the increasing needs of blind students take laboratory courses. Desirable qualifications for blind laboratory workers and laboratory work in schools for the blind are reviewed. Case studies of four blind students wishing to pursue laboratory work are offered. Research as a possible career for the blind is discussed.

Wright, Richard B. "Laboratory Exercises for Visually Handicapped Botany Students," Journal of Visual Impairment and Blindness, 72(10): 67, February, 1978.

This report is an account of the experiences that a college instructor had in teaching botany to a blind student. A multi-sensory, audio-tutorial approach is described which employed actual specimens, commercial and clay models. A technique for making raised line drawings with white glue is presented. The use of sighted assistants and recorded lectures is also suggested.

Zahl, Paul A., ed. Blindness: Modern Approaches to the Unseen Environment. New York: Hafner Publishing Co., 601 p., 1962.

In this book a very diverse group of experts, brought together by invitation of the National Research Council under the auspices of the U.S. Veterans Administration, join in discussing the problem of adjustment of the blind to life in today's world of science and industry. Several sections of the book are devoted to the role of the blind in science and applications of science and technology to problems of blindness.

THE VISUALLY IMPAIRED

RESEARCH

41/42 C4

Boldt, Werner. "The Development of Scientific Thinking in Blind Children and Adolescents." Education of the Visually Handicapped, 1(1): 5-8, March, 1969.

The development of the concept formation of scientific and technical phenomena was researched empirically to clarify the pedagogical-psychological presuppositions of teaching science to the blind. The study gives an informative view into the way in which blind pupils theorize. Basic forms of scientific thinking in their specificity and in their effect for the development of an "objective" understanding of the environment are considered.

Brekke, Beverly, John D. Williams and Perla Tait. "The Acquisition of Conservation of Weight by Visually Impaired Children." Journal of Genetic Psychology, 125(5): 89-97, May, 1974.

A modification of Furth's conservation of weight problems was administered to 72 legally blind children 6-14 years of age; 46 of the Ss resided in institutions for the blind, and 26 Ss lived in a family situation. A control group of sighted children matched for age was also tested. There were no differences in conservation between the blind group living at home and the sighted group. Both the sighted group and the blind group living at home conserved more often than did the institutionalized blind Ss ($p < .05$). Further investigations of the differences between the two groups of blind Ss showed that degree of blindness was of lesser importance than was place of residence.

Franks, Frank L. "Measurement in Science for Blind Students." Teaching Exceptional Children, 3(1): 2-11, Fall, 1970.

Instruments necessary to teach measurement operations and basic properties of matter were identified. As a result a thermometer, a ruler in inches and centimeters, and a spring and a pan balance were adapted for tactual inspection of blind students. In the study 86 percent of the measurements and simple experiments were successfully performed by 51 junior high and 19 elementary school students using the aids.

Franks, Frank L. "Introduction to Map Study: Teaching Locational and Directional Referents to Young Blind Students." Doctoral dissertation, George Peabody College for Teachers, 1974.

Three maps which sequentially introduced areal, linear, and point symbols were developed. The format facilitated the interrelation of fundamental map reading concepts with the classroom, the school environment, and with natural and cultural features within the community. Eighty legally blind students (grades K-6) were used in the study. Computations using the Kuder-Richardson Formula 20 to determine consistency of the pretest and the posttest revealed a reliability of .95 for the pretest and a reliability of .95 for the posttest. Significant gains in learning beyond the .01 level of significance were reported for 26 of the 30 concepts taught in the program. The small increase in learning on the four remaining items was attributed to prior knowledge.

Franks, Frank L. and Richard M. Baird. "Geographical Concepts and the Visually Handicapped." Exceptional Children, 38(4): 321-324, December, 1971.

The results of this study indicate that the series of three-dimensional raised surface landforms reported provide highly discriminable illustrations of 40 basic geographical terms for use by visually handicapped students. The system of tactile and chromatic coding which was developed provides easily discriminable cues and surface areas, even for some braille readers with extremely limited residual vision. Overall percentage of correct identification of the features illustrated on the landforms was 83.5 percent.

Franks, Frank L. and Lawrence H. Butterfield, Jr. "Educational Materials Development in Primary Science: Simple Machines." Education of the Visually Handicapped, 9(1): 51-55, Summer, 1977.

The study evaluated the ability of 27 legally blind students from the elementary grades (ages 7-13) to identify and manipulate the parts of the lever, the inclined plane, the wheel and axle, and the pulley. Performance scores exceeded 90 percent responses on each machine.

Franks, Frank L. and Roger Huff. "Educational Materials Development in Primary Science: Dial Thermometer Instructional Unit." Education of the Visually Handicapped, 8(4): 120-124, Winter, 1976-1977.

The results of this study indicate that the majority of 61 legally blind subjects (grades 2-4) were able to locate and recognize the point, areal, and linear symbols tested on the dial thermometer schematic, to locate specific lines, and to locate specified point and linear symbols using a pointer as set by the examiner. One hundred percent of the subjects located and recognized four distinctive features on the dial thermometer schematic: any raised line, the raised circle, the raised rough surface, and the pointer.

Franks, Frank L. and Roger Huff. "Educational Materials Development in Primary Science: The Pull-Apart Cell." Education of the Visually Handicapped, 8(1): 16-20, Spring, 1976.

This study evaluated the ability of 61 visually handicapped students (grades 2-4) to discriminate textures and to utilize them in locating and identifying the layers on a pull-apart cell model (schematic). The study also evaluated the ability of students to manipulate the pull-apart features of the cell model. As a group, the students scored well above the chance level on discrimination and identification-location tasks. Ninety-seven percent of the subjects were able to identify all discriminations correctly. The results confirm that young visually handicapped students in this study were able to perform the discrimination and identification-location tasks necessary for learning the parts of a simple plant and animal cell with pull-apart features.

Franks, Frank L. and Roger Huff. "Educational Materials Development in Primary Science: Insect Identification Kit." Education of the Visually Handicapped, 8(2): 57-62, Summer, 1976.

The primary purpose of this study was to determine if 71 young visually handicapped students (grades 2-4) could learn to identify the basic body parts of an insect on a three-dimensional model (schematic) using a set of training materials. The combined performance scores for braille and large print students using the insect models ranged from 91 to 100 percent. The complete kit contains a set of five models.

Franks, Frank L. and Roger Huff. "Educational Materials Development in Primary Science: Linear Measurement for Young Blind Students." Education of the Visually Handicapped, 9(1): 23-28, Spring, 1977.

A tactile ruler instructional unit was evaluated using 37 legally blind students (grades 2-4). Tasks in counting inch and centimeter lines exceeded the criterion of 80 percent correct responses.

Franks, Frank L. and Marvin J. Murr. "Biological Models for Blind Students." Journal of Visual Impairment and Blindness, 72(4): 121-124, April, 1978.

In response to an expressed need for inexpensive biological models for blind students, the American Printing House for the Blind has developed a set of 19 plastic models (schematics) which illustrate representative species of the major invertebrate phyla and component structures of flowering plants. The biological features depicted on the models were found to be highly discriminable in a test of legibility (95 percent overall correct responses) with 42 legally blind students (grades 7-12). The models emphasize simplicity, but offer additional cues where complexity occurs. Texture, size, shape, and relief were used for maximum legibility. Chromatic color coding was employed to maximize color and luminance contrasts for low vision students. The models average nine inches (22.9 cm) in length on their longest sides.

Franks, Frank L. and Carson Y. Nolan. "Measuring Geographical Concept Attainment in Visually Handicapped Students." Education of the Visually Handicapped, 3(1): 11-17, March, 1971.

A forty-item test measuring geographical concept attainment of visually handicapped students was developed which allowed students to record their own responses. A comparison of performance scores of braille readers and large print readers indicates that the pattern of performance for these groups tested on the short-form test (40 items) is comparable to the pattern of performance of braille students tested on the longer individual test (70 items). No significant differences were found between braille readers and large print readers on the 40-item test. A practical application of the 40-item test verified its reliability with the population tested as an instrument for evaluating geographical concept attainment of visually handicapped students in educational programs.

Gough, Elva Ruth. "The Science-Related Problem-Solving Processes of Visually Impaired Adolescents." (Indiana University, 1977) Dissertation Abstracts International, 38(6): 3399-A, June, 1977. (University Microfilms No. 77-27,000)

The purposes of this descriptive study were to: (1) identify the processes employed by individual visually impaired secondary students to solve multiple-choice biology problems and essay environmental problems; (2) determine whether there was a difference in the solution processes used to attain correct solutions and incorrect solutions; and (3) determine if a difference existed between the processes employed to solve multiple-choice biology problems and those used to solve essay environmental problems. Tape recorded protocols of thought processes verbalized by nine legally blind Ss as they solved the various problems were analyzed using a classification code designed for this study. Differences significant at the .05 level of confidence were identified in individual solution processes.

Linn, Marcia C. "An Experiential Science Curriculum for the Visually Impaired." Exceptional Children, 39(1): 37-43, September, 1972.

Adaptation and evaluation of a materials centered experiential curriculum for elementary age visually impaired children is described. The adaptations of both the physical and the life sciences units can be used in classes with one or two visually impaired students and in classes of all visually impaired students. Evaluation measures were designed to assess the major objectives of each unit. Classroom trials of two of the adapted units revealed that visually impaired students made significant gains in understanding both content and process objectives of the units.

Linn, Marcia C. "Adapting Science Materials for the Blind (ASMB): The Development of Logical Thinking." Paper presented at meeting of the Association for Education of the Visually Handicapped, San Francisco, California. 11 p., June, 1974.

A description is given of the Science Curriculum Improvement Study (SCIS) program and the adaptations developed by Adapting Science Materials for the Blind (ASMB). Characteristics of the logical development of the visually impaired child are discussed, the aspects of ASMB that foster logical thought are delineated, and some research on ASMB and logical thought is presented that replicated and extended a study by Linn and Peterson (1973). Results obtained from 117 legally blind, first-grade pupils revealed that all Ss who studied Material Objects exceeded controls in logical thinking skills. Results for visually impaired and culturally diverse paralleled those of Linn and Peterson. For middle-class Ss, Linn and Peterson found no gains, while the replication study revealed that their logical thinking skill increased.

Linn, Marcia C. and Rita W. Peterson. "The Effect of Direct Experience with Objects on Middle Class, Culturally Diverse, and Visually Impaired Children," Journal of Research in Science Teaching, 10(1): 83-90, January, 1973.

Piaget's theory of equilibration was investigated by comparing the effect of direct experience with objects on the logical reasoning ability of middle class (MC), culturally diverse (CD), and visually impaired (VI) children. In experiment I, a Piagetian task with floating and sinking objects was used to compare the classificatory ability of MC, CD, and VI groups studying SCIS Material Objects with those who had not studied the unit. Experimental CD and VI Ss performed significantly better on the task than did the controls; no significant differences were found between MC experimentals and controls. MC groups performed better than did CD and VI groups in both experimental and control conditions.

Experiment II measured Ss' ability to name properties and materials and to sort objects. Both MC and VI Ss improved in ability to describe objects and sort objects. Both MC and VI Ss improved in ability to describe objects and sort them using a descriptor of their own choice. There were no differences between MC and VI Ss on these tasks after they had studied Material Objects.

Linn, Marcia C. and Herbert D. Thier. "Adapting Science Materials for the Blind (ASMB): Expectation for Student Outcome." Science Education, 59(2): 237-246, Spring, 1975.

This study reports an investigation concerning whether additional concrete experiences with objects will foster the logical development of blind children. The success of the Adapting Science Materials for the Blind (ASMB) units for various goals and various learner groups are discussed and tentative conclusions drawn. Significant gains were made.

Long, Nancy Thurston. "Science Curriculum Improvement Study (SCIS): Its Effect on Concept Development and Manipulative Skills in Visually Handicapped Children." (University of California, 1973) Dissertation Abstracts International, 34(4): 1738-A, April, 1973. (University Microfilms No. 73-21, 621).

This study examined the effectiveness of the Science Curriculum Improvement Study (SCIS) materials for visually handicapped children. Fourteen students, ranging in age from 9 to 19 and working in small groups with student teachers, received science instruction using the adapted version of the SCIS program. Control subjects were matched closely on age, medium of reading, socioeconomic status, and additional handicaps. These children participated as usual in the science program offered at their schools. Both groups were tested in the Fall and in the following Spring. Posttest data showed a superior performance by the experimental group over the control group on the three tests, "Histograms," "System and Intraction," and "Science and Learning," beyond the .05 level of significance.

Mallinson, George G. Programmed Learning Materials for the Blind. Kalamazoo, Mich.: Western Michigan University, 85 p., March, 1967. (Contract No. OEC-7-32-0580-191). ED 014 193

In this research study, tests determined that the most efficient braille stimulus-braille response format was a booklet in which the braille frame appeared on one page and the correct response on the next. Commercially available programs for junior high school science were modified for use with blind students in accordance with the study findings. Two 50-frame programs reproduced in braille were tested with 57 blind junior high school students. Results indicated that students could handle these programmed materials in a reasonable amount of time with a high degree of accuracy. Instructions were followed with minimal difficulty. Performance improved with the second book. In modifying the program for use with the blind, 32 symbols were developed for the most frequently used science terms in order to reduce the bulk of braille materials. To determine whether blind students could discriminate among the symbols and between the symbols and braille, 43 blind students (grades 6-10) were given tests containing the various science symbols. Scores improved with increasing IQ and grade levels through junior high, although high school students reacted poorly. Scores and times improved with a second trial. Appendices contain sample science programs on "Physical and Chemical Change," "Symbols and Formulae," and "Plastids."

Mallinson, George G. and Jacqueline V. Mallinson. "Symbolic Science Learning for the Blind." School Science and Mathematics, 67(5): 432-449, May, 1967.

Discussed is the development and testing of braille-type science symbols for blind secondary school science students. A review of secondary science textbooks, state science syllabi, courses of study, and vocabulary lists was used to identify 50 important recurring science terms. The terms were submitted for evaluation to university scientists, science educators, and specialists in the teaching of blind children. Meaningful symbols were developed for 332 of the terms, and symbol revisions were made on the basis of a pilot test with blind children. Results indicated that average students had little difficulty distinguishing between different science symbols and between science symbols and braille symbols. Intelligence and emotional stability were significantly related to student performance. Test performance generally improved with practice.

Merry, Frieda K. "A Study of the Merits of Animal Models Used in Teaching Blind Children." Teachers' Forum, 2: 12, 1930.

In three studies to determine the usefulness of animal models in teaching blind students, conclusions supported the need for beginning nature study with young blind students, the superiority of three-dimensional models over two-dimensional representations of three-dimensional objects, and the necessity of much care in selecting animal specimens for the use with blind students.

Nolan, Carson Y. and June E. Morris. "The Japanese Abacus as a Computational Aid for the Blind." Exceptional Children, 31(1): 15-17, September, 1964.

Forty-two junior high level students were instructed in the use of the soroban, a type of abacus. Prior to instruction, the students were tested with an easy test and a difficult test to determine their skill in computation of whole and decimal numbers. After four months and again after eight months of instruction and practice with the soroban, the students were tested with equivalent tests. The results demonstrated that the soroban is a practical and efficient approach for overcoming computational problems encountered by the blind.

Struve, Nancy L., Herbert D. Thier, Doris E. Hadary, and Marcia C. Linn. "The Effect of an Experiential Science Curriculum for the Visually Impaired on Course Objectives and Manipulative Skills." Education of the Visually Handicapped, 7(1): 9-14, March, 1975.

This study was conducted with 30 visually handicapped students to determine what effect the learning experiences of the Science Curriculum Improvement Study (SCIS) had on the manipulative skills of the upper elementary aged visually impaired child. In addition, the study was designed to investigate the relationship between improved manipulative skills and progress on the content, process, and logical thinking objectives of the adapted SCIS program. Improvement in many manipulative skills such as pouring, filtering, and organizing objects was found.

Struve, Nancy L., Herbert D. Thier, Doris E. Hadary, and Marcia C. Linn. "Materials Centered Science and Manipulative Skill." Exceptional Children, 40(7): 516-517, April, 1974.

The effects of experience with two physical science units adapted for use by the visually impaired on the manipulative skills of 14 visually impaired low income students from 9 to 19 years of age were evaluated.

Tobin, M. J., D. Clark, I. Lane, and V. G. Pittam. "Programmed Learning for the Blind: Some Exploratory Studies." Education of the Visually Handicapped, 2(1): 11-23, March, 1970.

Two studies from this broad collection of studies are related to the application of programmed audio instruction to lessons on electricity. The aim was to introduce some of the concepts at an elementary level and to engage the pupil in a variety of experiments illustrating the phenomena of static electricity by means of programmed instruction. Results suggest that a significant amount of learning can be achieved using group methods of programmed audio presentation that allow the teacher to retain control over the pace of learning.

THE HEARING IMPAIRED

GENERAL

ANNOTATED BY

MARIE EGBERT

NATIONAL TECHNICAL INSTITUTE FOR THE BLIND

Akey, John. "An Audio-Visual Presentation for Non-Audiovisual Students." The Science Teacher, 41(9): 52-53, December, 1974.

An account is presented of planetarium techniques used at the Scott Carpenter Planetarium with intermediate level hearing-impaired students from the Colorado School for the Deaf and the Blind. Such techniques as flourescent chalk on the fingers of the interpreter, the use of ultraviolet lights and the use of spotlighting for interpreting the needs are discussed. Alterations in the program by using specific slides to overlay the names of the constellations, stars, and other points of interest are also detailed. Because of the effectiveness of this latter method, the author emphasizes its use over those techniques tried earlier.

Anselmini, Andrew. "A Science Program in a School for the Deaf," Proceedings of the International Conference on Oral Education of the Deaf, Washington, D.C.: The Volta Bureau, 1967, pp. 1758-1777.

This account of a science program at the junior high school level in New York City includes a school focus and a science program focus. The school provides a careful sequencing of science topics in seven major course areas. The method of teaching is explained and examples given from the area of weather. Activities used and the move from simple to complex concepts are outlined. Expectations of the student at each level are also detailed. The junior high level science course revolves around four major science content areas. Again, the author provides the reader with a description of the features of the program and the need for administrative support for the best success of its use. The science fair is described as the significant part of the school year. A list of audiovisual materials available for use and textbook references conclude the article.

Berhow, Bennett F. "A Kindergarten Science Program for Handicapped Children: Existing Curricula." A Working Conference on Science Education for Handicapped Students: Proceedings. Helenmarie Hoffman (ed.), Washington, D.C.: National Science Teachers' Association, pp. 28-33, 1978.

This paper describes the development and implementation of science curricula for handicapped kindergarten students in Devils Lake, N.D. Based upon planning done by Ms. Debbie Foughty, the science curriculum was developed to meet the needs of the handicapped students in a specific kindergarten class. Five children were deaf, three had sight impairments, and the others had various impairments. The science curriculum used the Elementary Science Study Materials (ESS) as a basic format, but the identification of cognitive and developmental outcomes as objectives was based upon a total learning concept. A week's lesson plan is presented as an illustration of the science activity integration into the classroom schedule. Evaluation of success was measured by the behavioral changes observed in the students. The methods/techniques described indicate observable changes. Five major conclusions are drawn regarding the success of the adaptation of materials. Two conclusions regarding the difficulties of adapting those materials are also presented.

Brandenstein, Shirley: "Education for the Deaf," Change, 11: 13-16, February 1979.

Presented is a historical survey of the construction of the National Technical Institute for the Deaf (NTID). The writer describes the selections available to the enrolled students in the fields of concentration and in degrees desired. Jobs and graduate opportunities are also reported. The unique aspect of cross-enrollment into the Rochester Institute of Technology is also portrayed. Unique arrays of aids and other specific special services provided by the Institute are described. The author looks closely at the struggle many deaf students face as they enter the program and evaluates several reasons why this is true. While surveying the future impact NTID will have upon the field of technology in relation to the employability of deaf graduates, a comparison is drawn between course content available here and that which is available at other colleges which have programs for hearing-impaired students.

Brown, Dean. "Teaching Science to the Hearing-Impaired: A Research and Review of Pertinent Literature." A Working Conference on Science Education for Handicapped Students: Proceedings. Helenmarie Hoffman (ed.), Washington, D.C.: National Science Teachers' Association, pp. 64-70, 1978.

This paper provides an update on science instruction to the hearing impaired through a research of literature. This look at the science education begins with the numbers being served as well as a definition of terms used when referring to those with hearing losses. After mentioning the lack of science curricula and the need for a closer survey of language performance, the author addresses the goals of science education for the hearing-impaired. The most effective means of accomplishing those goals has been the inquiry method; the author refers to studies and articles which can be used to substantiate this fact. Other investigations of language in science and the implication of findings are discussed. Some examples cited are the SCIS and the BSCS "ME" programs. Several other noteworthy findings on existing or developing programs are also addressed. Innovative techniques, presentations, articles and relevant activities are sketched. All of these point out that there is a great need for more cooperative efforts by science, general, and special educators to work together in this area.

Burch, Daniel. "A Report From the National Demonstration School for the Hearing-Impaired: Science Curriculum Development." A Working Conference on Science Education for Handicapped Students: Proceedings, Helenmarie Hofman (ed.), Washington, D.C.: National Science Teachers' Association, pp. 90-95, 1978.

This paper elucidates the science curriculum at the Kendall Demonstration Elementary School (KDES). In order to achieve this purpose, the author discusses the historical background of the curriculum project which began in 1977 with the establishment of a

science committee. The committee generated a workable model based upon the philosophy of content/process approach in science instruction with heavy emphasis upon "hands on" experiences. This is exemplified by the adoption of Science: A Process Approach II into the classrooms. The processes have been separated into five integrated processes and a spiral approach for use in science education for the students. Kendall's approach at instruction within the school, the impact of Piaget upon the learning/content objectives, and the future of science curricula at KDES are outlined. The future is outlined in terms of objectives, activities, procedures for evaluation and teacher preparation. Revision methods and possible in-service training procedures are also described together with recommendations for expediting curriculum development.

Burch, Daniel D. and Dennis W. Sunal. "Science Curriculum for the Young Hearing-Impaired: Present State of the Art." A Working Conference on Science Education for Handicapped Students: Proceedings. Helenmarie Hofman (ed.), Washington, D.C.: National Science Teachers' Association, pp. 77-82, 1978.

This article is the result of questionnaire surveys of 86 schools in the US which serve hearing-impaired populations. The questionnaire was developd to survey the science curricula currently employed. The design of the selection of schools, the guidelines of analysis, and the result of those curricula surveyed are outlined. It was determined that most schools questioned used curricula designed for non-handicapped school instruction. The most frequently used commercial curriculum was the text series, Concepts In Science. The format lists information in six tables, which include science curriculum characteristics and regional science curricula characteristics. From these tables and other gathered information, characteristics of a science curriculum for schools of the hearing-impaired was drawn. An analysis of the state of the art shows that guidelines and concerns have thus far been superficial in aspect. To structure curriculum designs, the authors propose a guideline of four fundamental questions to be answered. These are listed and explained in greater detail for producing and selecting effective science curricula on a structured basis.

Bybee, R. W. "Review of Literature of Science for the Deaf." Science Education, 56(2): 237-242, April/June, 1972.

This article reviews books, articles, papers and reports which deal with science for the deaf at the elementary, secondary and college levels. After identifying the need for revising curricula, materials and teaching methods, the author quotes references from several books to elaborate the propositions put forth. Results from programs using specifically cited materials are also embodied. Included are SCIS, teacher-produced materials, problem-solving techniques, ESS materials, and workshop materials. There are 20 references cited and briefly outlined in this article.

Bybee, Rodger. "Science in a Silent World." Science Activities, 6(5): 25-27+, January, 1972.

Because of the nature of a hearing impairment, the author stresses the need for adapted materials to instruct science effectively to those with that handicap. The use of SCIS materials is advocated and the modifications which have been found effective are detailed. Suggestions are made for the use of all SCIS materials.

Cohen, Oscar. "Why Teach Science to Deaf Children?" Procedures of the International Conference on Oral Education of the Deaf, Washington D.C.: The Volta Bureau, pp. 1778-1791, 1967.

Opening his article with the scientific development of man, the author shows the need for a science program for deaf children which focuses upon the realm of curiosity. From that point, the place of science in the curricula of deaf children is demonstrated and related to their language development. Six reasons why science should be included precede the description of objectives for an effective science program for deaf youngsters. The objectives center on three main areas which are presented and expanded upon. The skills that are to be developed via these areas are also discussed. Content of science programs, according to the author, should be based upon concepts which are most beneficial to the child. The main focus should be on the individual and not on the class-centered curricula. Reasons and rationale for this belief are presented.

Collea, Francis P. "Science In Sounds." Science and Children, 13(6): 34, March, 1976.

This is a sketch of the SCIS program used at the Cralingua School for the Hearing-Impaired. Tha adaptation of SCIS, its easy integration into the total curriculum and the variety of lessons which SCIS provides for the development of a particular concept are detailed. Examples of concepts and activity adaptation are provided, as well as an example showing the use of science experiments to attain language development.

Cunningham, Paul and Harry Lang. "Aids in Teaching Laboratory Science to Deaf Students." Science Education News, Fall/Winter, pp. 7-8, 1979.

A close look at equipment aids and materials in a science classroom at a school for the deaf is provided. The authors have included both adaptations which they feel are necessary and an identification of those which may not be necessary for effective functioning. Hands-on experiences, the use of visual media, and focusing on sensory modes other than hearing are stressed. Suggestions for teachers who may encounter a deaf student in a mainstreamed setting are also tied to the examples and discussions.

Davis, Cheryl A. and Martha Ross Redden: "Achievement in Biology: An Introduction to Handicapped Biologists." The American Biology Teacher, 40(3): 175-178, March, 1978.

As an effort to reveal the talents and skills of three handicapped biologists, the article discusses the individual handicapping conditions, the achievement of each individual, and the goals and positive influences in each of their lives. John Gavin is the hearing-impaired professional discussed. His sudden onset of deafness, the necessary psycho-sociological changes incurred, and the steps he undertook to regain employment are the main features of this section. His slow but steady progress in the biological field where he had been previously employed and how he conquered the prejudices against his pursuit of the doctorate degree are highlighted by a portrayal of his successful position at Dome Laboratories. Several awards which he has received in the past years are also identified.

DeWalt, Patricia. "Adaptations of the Scientific Method for the Deaf Child." Volta Review, 70(3): 394+, September, 1968.

This is an account of a scientific method approach used at the Detroit Day School for the Deaf for the teaching of science. The author includes the aims and goals in using the scientific method and the special needs for development. Independence and objectivity are two important goals addressed in this program. The primary, reading-readiness, and fourth grade through ninth grade levels are included. Teaching approaches often include the team-teaching methods at several of the levels. Benefits of the program for teachers and students are identified. Also noted is the relationship of the approach to the development of language, reading and math skills, as well as vocational skills. The portions dealing with a look at visual aids, field trips, and science fair activity conclude the article.

Dodd, Judy Egelston. "Intervention Program for Occupational Stereotyping by Deaf Students." Working Conference on Science Education for Handicapped Students: Proceedings, Helenmarie Hofman (ed.), Washingon, D.C.: National Science Teachers Association, pp. 147-150, 1978.

Barriers faced by the deaf in successful career development in scientific and technological fields have led to stereotyping of socially-desirable world-of-work niches in the scientific environment. In this paper, the author presents stereotyping characteristics held by hearing persons which tend to lead deaf persons into further identification with sex-typed or low potential occupations. Intervention techniques designed to combat the problem by raising the awareness of student potential and the need to combat sexism and other discriminatory practices are discussed. Current programs, general trends, career development models, and recent technological developments in the world of work which represent positive changes that impact upon deaf students are also discussed. The infusion of career education into existing secondary curriculum offerings is explained in its four channels. These channels and their impacts upon science education are detailed. Results which can be expected are also addressed.

Egelston, Judy C. "Editorial Comment on Science for Handicapped Students: Deaf Education." Science Education, 59(2): 255, April/June, 1975.

A short discussion of the need for discovery-oriented learning, modification of existing materials, and the necessity of creating an intellectually challenging curriculum around the problems presented by language impairments of deaf students are the main foci of this editorial comment. Several cautions are identified, as well as are areas of difficulty which a science educator may encounter if he/she has hearing-impaired students in class.

Egelston, Judy C. and David Mercaldo. "Science Education for the Handicapped: Implementation for the Hearing-Impaired." Science Education, 59(2): 257-261, April/June, 1975.

As an address to science educators, this article presents information about the need for new models and the generation of new techniques when teaching science to the hearing-impaired youngsters. A look at the laws and their implications for education is also provided. Linguistic development, communication problems, and the necessary use of experiences and hands-on activities are also discussed. Some successful approaches and materials which can be easily used are identified. The article concludes with the mainstreaming aspects of science education to achieve quality programs for the hearing-impaired.

Eckstrom, Faith Fravel. "Studying Science in the Lower Grades." The Volta Review, 58: 75-76, February, 1956.

The development of a scientific attitude should begin as soon as formal education is underway. The article stresses this belief and emphasizes the importance of science concepts being in the curriculum. It provides the reader with anecdotal science lessons for the early grades. The first topic is weather with examples of observations to be made outdoors, and other activities to perform. The second topic is living things. Possible activities to use are also addressed. There are some simple ideas for beginning science, which may be helpful to new teachers in the classroom setting. Most of the ideas reflect the use of readily available materials and not special equipment.

Fellendorf, George W. "Technical Training for Deaf Students at a Community College." The Volta Review, 72(5): 296-302, May, 1970.

Described is a program at Delgado College in New Orleans, LA, which integrates deaf students into the regular classroom in trade and technical (science) areas. This article records the setting up of the college, the enrollment and admission procedures, and the evaluation of potentials and interests of the students. Interviews with professors and students are interspersed with the information about the program. The faculty and curriculum are described; some personal interviews are also included.

Fellendorf, George W. "NTID-After One Year." The Volta Review, 71(5): 269-307, May, 1969.

Written after the National Technical Institute for the Deaf (NTID) had been in existence for one year, this article describes the faculty, attitudes, program changes which were necessitated, the vestibule program for entering freshmen, and the broad career opportunities available for student enrollees. Identified also are the six colleges within the NTID walls, the computer assisted instruction used, and the interpreting and tutoring program. The role and design of the research department was outlined, with some programs which had begun and some which were prospective. Student activities available and the student counseling department are also described. Basic future plans are outlined, embodying decisions faced with regard to funding, numbers of students to enroll, and expectations for faculty and administration.

Fletcher, John D.: "Computer-Assisted Instruction for the Deaf." A Paper Presented at the American Educational Research Association Annual Meeting in Chicago, Illinois, 1974.

The paper discusses the design and evaluation of computer assisted instruction (CAI) at Stanford University for the Instruction of Math Studies in the Social Sciences. The project was designed for three years and used students from the California, Washington DC, Florida, Oklahoma and Texas Schools for the Deaf. Topics addressed include symbolic representation of the learning situation, strategies for teaching cognitive skills to learners, and economic and technical aspects of CAI. A description of the Stanford CAI system includes the identification of the central processor as well as the terminal sites and equipment. Symbolic representations of the learners are given in terms of mathematical models of learning and in the definition of grade placement and progression. The author also stresses the need to make the model more precise for the use with deaf learners. Teaching strategies focus upon four major issues, depending upon the design of the CAI. Three experiments designed for integration into the tutorial language of the computer and described in the paper are identified with outcomes. Cognitive skills of deaf subjects were investigated and two issues defined in terms of cognitive development. Economics and technology of CAI are identified and four alternatives presented which make the program more widely usable.

Gray, Virginia. "Curriculum for Older Low-Achieving Hearing-Impaired Students." The Volta Review, 68(9): 634-638, November, 1966.

This article is the result of information generated from a questionnaire sent to residential and larger enrollment day schools for the deaf. There were 14 questions regarding text, grade level used in, supplementary materials, language, social studies, science, health and mathematics. In the areas of science and health, most classroom teachers used teacher-written materials for low-achieving students. Student-controlled lab experiments were few in number. Health was often included in the reading program. Ideas from various other programs for the teaching of science were included.

Greenleaf, Gene. "A Trade and Technical Institute Program for Deaf and Hard-of-Hearing Students." The Volta Review, 72(6): 357-361, September, 1970.

The John A. O'Connel Trade and Vocational High School in San Francisco began its vocational program for hearing-impaired students in 1965. This article describes the development of the program, its make-up, and the degrees of success of the graduates. A description of the students, the faculty's field experiences and qualifications, the ratio of integration advocated, communication problems which have been encountered, and the functions and use of the resource teacher constitute the body of the article. Encouraging aspects of the program and the favorable placement record conclude the article.

Hadary, Doris E. "Laboratory Science and Art for Blind and Deaf Children: A Mainstream Approach," Working Conference on Science Education for Handicapped Students: Proceedings, Helenmarie Hofman (ed.), Washington, D.C.: National Science Teachers' Association, p. 162, 1978.

This is a report on project SEEFEE which was begun in 1971. The adaptation of materials for the deaf was added in 1975; mainstreaming in 1976. The project's elements, objectives, and approaches are described. The population used is from the Horace Mann Elementary School in Washington, DC. The relationship of science and art is developed through five scientific areas and involves 150 science lessons with matching art lessons. Impacts upon teacher training by the use of adapted lab materials is discussed. Pre-service training curriculum is shown along with the impact statement these objectives have made upon teacher-trainees. The advantages of mainstreaming in the science classrooms are also identified. Three advantages and the social implications of mainstreaming are discussed.

Hadary, Doris, Robert Haushalter and Richard Rosenberg. "Breaking Sound Barriers For the Deaf Child." Science and Children, 14(3): 33, November, 1976.

The program described is a comprehensive sequential laboratory science and art curriculum which changes the auditory activities to visual ones. The experimental group used is characterized, embodying the communication approaches used as well as materials. The curriculum's emphasis on discovery is explained along with the linking of science to art lessons. Programs which have been adapted for use with hearing-impaired students are shown, to depict examples of possible procedures to follow. The concern of the project is with curriculum design, adaptation, implementation and teacher training and programs for mainstreaming situations. This pre-pilot study identified challenges that are materials-centered as well as content-focused.

Hadary, D. E. and M. A. Cohen. Laboratory Science and Art for Blind, Deaf and Emotionally Disturbed Children -- A Mainstreaming Approach. Baltimore: University Park Press, 1978, 383 pages.

This is the only book devoted to teaching science and art to the handicapped. The first section is a discussion of reasons for using science and art in the education of handicapped children. Section II gives specific activities in a lesson plan format with suggested adaptations for deaf children. Background information in science is the topic of Section III. Art lessons constitute the bulk of Section IV. They follow the same patterns as the science activities with suggested adaptations for the deaf. Many of the art lessons integrate science and many of the science lessons lead to or integrate art.

Hayden, Jean S. and Helen M. E. Woodward. "Rationale for a Science Program." The Volta Review, 70(3): 159-165, March, 1968.

This article encompasses the stages of development of students at the elementary level in a school for hearing-impaired students. The use of language developed through the use of curriculum materials is stressed. Changes from naming to the seeing of cause-effect relationships, making generalizations, and using inductive thinking is covered. The authors strongly stress the need for recognition of stages of development in providing an effective science program. The levels addressed, children's characteristics, language difficulties, the function of question at each level, and expectations which may be set are important parts of this article. The maturation process, the setting of achievable goals, the transition need and the preparation process are important aspects of the science program approach.

Keller, E. C. and Helen E. Keller. "Experiences with Multiple Types of Handicapped Pre-college Students in an Integrated Marine Science Field Program." Working Conference on Science Education for Handicapped Students: Proceedings. Helenmarie Hofman (ed.), Washington, D. C.: National Science Teachers' Assocation, pp. 147-50, 1978.

This paper discusses a project funded by the National Science Foundation which is designed to introduce outstanding handicapped pre-college students to the marine sciences. The approach was the traditional academic one with field trips and mini-research projects added. The paper discusses findings, importance and impressions of the project in academic and nonacademic aspects. The program is described in detail, including the method of instruction, subtopic division of content areas, scientific communication and methods, marine biology, and oceanography aspects. Nonacademic experiences are described as a part of the integral activities. Description of the program includes unique problems encountered in the free-time portion of the day due to the severity of handicaps. Academic problems, such as communication difficulties of the deaf participants and the implications of those problems upon the total aspect of the program are all detailed. The evaluation was performed in three areas: description/characterization of participants, personality profiles, and academic performance. The participant evaluation of the learning environment and the marine science program is also included.

Lang, Harry. "Metric Education for Deaf and Hard-of-Hearing Children." American Annals of the Deaf, 124(3): 358-360, June, 1979.

Test results of incoming students at the National Technical Institute for the Deaf (NTID) indicate that students show a lack of understanding of metric measures. This article suggests ways teachers may implement metrics into their existing curricula in order to combat this deficit. The spread of the use of metrics in the US is discussed as it relates to students with hearing impairments. Reasons why metric education must be provided, methods which will make comprehension easier, and the development of the curriculum to reflect this need are all covered. Results of the basic metric skills tests administered to 283 deaf high school graduates are detailed and the information categorized.

Lang, Harry G.: "Mainstreaming: A New Challenge in Science Education for the Deaf." Midwest Educational Review, 10(3): 13-27, Spring, 1978.

This is a review of the literature on adapting science curriculum materials for use with hearing-impaired students. The author discusses relevant issues in the movement to mainstream hearing-impaired students and their relationship to science teaching. The review covers curriculum on the elementary, intermediate, secondary, and post-secondary levels.

Lang, Harry G.: "Salient Traits of Hearing-Impaired Students and Implications for Instructional Strategies and Performance Evaluation in Mainstream Physics Classes." Invited paper presented at the American Association of Physics Teachers National Convention, Symposium on the Disabled Person and Physics. New York City, January 30, 1979.

The author discusses linguistic, cognitive, and experiential considerations in teaching physics to hearing-impaired students. Illustrations are provided to clarify certain traits of the students. The usefulness of criterion-referenced testing in identifying the specific strengths and weaknesses of each student in a physics course is discussed. Some examples of methods for demonstrating sound to deaf students in a physics classroom are also provided.

Lang, Harry G., and Judy Egelston-Dodd. "Mainstreaming Handicapped Students into Science Classes: A Unit for Pre-Service Teacher Training." Paper presented at the Association for the Education of Teachers in Science Regional Meeting, Teachers College, Columbia University, New York City, October 27, 1978.

Pre-Service and in-service courses should be developed to sensitize science teachers to the special needs of handicapped learners. The authors suggest some important components for such courses including: a review of legislation and litigation which led to Public Law 94-142; an overview of handicapping conditions; awareness of attitudinal, communicative, environmental and other barriers; methods and materials that are successful with handicapped students; evaluation and testing approaches; psycho-social dimensions of mainstreaming; and career planning aspects.

Lang, Harry. "Some Educationally Significant Traits of Hearing-Impaired Physics Students and the Implications for Teachers in the Mainstream." Working Conference on Science Education for Handicapped Students: Proceedings. Helenmarie Hofman (ed.), Washington, D.C.: National Science Teachers Association, p. 71-76, 1978.

Educationally significant traits of deaf students are presented as they pertain to the area of physics, but the information can be generalized to other disciplines as well. Three basic areas, (1) language, (2) cognitive growth, and (3) personal-social are used to present characteristics. The language difficulties encountered by students center around syntactics, lexicons and experentials. The author describes each of these in great detail and gives examples of successful strategies for teaching physics concepts. Cognitive development is shown to be lagging from two to four years, and the author shows why this lag may occur in terms of the varying processing traits. Psychological-social dimensions of deafness are described and personal observations are used to sketch a clearer picture. The impact of those characteristics on learning is also described. Following these outlines, the author provides the reader with a brief review of literature and a look at the mainstreamed student.

Lang, Harry. "Teaching Physics to the Deaf." Physics Teacher, 11(9): 517-531, December, 1973.

This is a description of National Technical Institute for the Deaf's Physics course for deaf students. The make-up of the course, including the four manuals of study, optional units for reinforcement, and in-depth look at SELFPACE (Self Execution Learning: A Flexible Physics Approach in Contemporary Education) are all described. Along with a personal look at the students, communication difficulties and their disordered backgrounds are depicted. Influences on motivation and attitudes, the setting of unrealistic goals, lack of decision-making skill, and a lack of self reliance are all related to the problem of teaching physics to the deaf. The author also addressed the needs to be met by both student and staff, the liaison work with the language syntactical study teams, and the academic and social competencies of students. Suggestions for physics teachers who encounter deaf students in their classes are provided.

Leitman, Allan. "Science for Deaf Children." Lexington School for the Deaf Education Series, Book V, Washington, D.C.: The Alexander Graham Bell Association for the Deaf, 1969.

This booklet is designed for use by teachers in schools for the deaf. It includes activities and units which are suggested for planning and developing a science curriculum for deaf students. Teaching methods that have been determined to be effective with hearing-impaired students are sketched. The focus is from preschool through advanced grades. Areas include the biological, physical, and earth sciences. Units and activities are designated at each competency level. Appendices contain equipment listings and illustrations of science projects which have been shown to be effective.

Leitman, Alan. "Science for Deaf Children." (Dissertation Summary) Proceedings of the International Conference on Oral Education of the Deaf, Washington, D.C.: The Volta Bureau, pp. 1730-1732, 1967.

The initial portion of the dissertation reflects a philosophy of education including the importance of the teachers' values affecting the student and the use of play as an education mode. The implications of that philosophy for fitting facts and skills of science into the classroom atmosphere and the educational programs are covered. The education of the deaf child and the challenge of teaching science to the deaf follow as a preview of science education for deaf children. The role of the teacher, the problems of language and communication, and the means by which science can teach language are a natural outcome of experimentation and questions. Methods of teaching science to the deaf include four major factors which must be taken into account. The author discusses those factors in relation to learning problems, intellectual capacity, experiences, individualized programming, the selection of science materials and programs, and teaching programs.

Lenth, J. William. "A Purpose for Science in a Curriculum for the Deaf." American Annals of the Deaf, 110(2): 376-378, 1965.

By first evaluating the relationship of science to society, the author sets the stage for comparing the deaf student's role in our scientific society with and without science education. The potential of deaf students when they can recite facts of science is compared to that when they can relate scientific experiences to their function within society. From that point, the educational goal in science is outlined and a process for reaching that goal is demonstrated.

Margaret S. Sterck School for the Hearing-Impaired (Delaware State School for the Deaf). Washington, D.C.: U.S. Dept. of HEW, 1968, ED 031-829.

Although the majority of this booklet deals with curriculum aspects of the school and new suggestions for revision, one section addresses itself to teaching science to the deaf. There are four factors listed which need to be taken into account. These are, basically, a lack of environmental information, limited reading ability, necessity of concrete experiences prior to the presentation of the abstract, and individual abilities ranges. Modern elementary science programs may be used as resource materials, but the majority of efforts should be placed upon laboratory experiences, according to the writers. Science lessons need to revolve around readily accessible materials. Curriculum content to be emphasized is presented. There are three emphases for the elementary ages: solar system, matter and energy, and living things. A further breakdown is given of each division unit to be taught. Objectives and curriculum outlines are detailed and include suggested filmstrips, as well as goal statements and general summary statements. Science teaching ideas are presented in the appendix along with instructions for the establishment of a science activities center. Mailing addresses for newsletters and publications for teaching ideas, along with a list of science room equipment and ways of using inexpensive materials, are included.

McCarley, Orin, editor. "Science Education News." Washington, D.C: American Association for the Advancement of Science, Fall, 1978/Winter, 1979.

This issue of the American Association for the Advancement of Science (AAAS) newsletter is devoted to the science education for physically, visually and aurally handicapped children. Articles include thoughts on teaching deaf students and blind students, a brief description of a science program for young physically handicapped children, aids in teaching laboratory science to visually impaired students and deaf students, aids in teaching field aspects of science to the physically handicapped, and counseling of the handicapped for a career in science. A collection of addresses of organizations and sources of information for teachers who have handicapped students in their classes is included.

McIntyre, Margaret. "Science is for All Children." Science and Children, 13(6): 50-51, March, 1976.

While identifying the need for science adapted for all children, the author pinpoints special needs for deaf, hearing-impaired and visually-impaired children. She stresses points such as altering experiences to make them appropriate for the special needs of the individual child. For example: tasting, touching, seeing and smelling are essential in communicating experiences for the hearing-impaired child. A general over-all view is presented of some processes to keep in mind while working with all handicapped children.

Menchel, Robert S. "A Lack of Science Education for the Deaf at the Elementary Level." A Working Conference on Science Education for Handicapped Students: Proceedings, Helenmarie Hofman (ed.), Washington, D.C.: NSTA p.14-16, 1978.

The author, a deaf scientist and teacher, is one who is well qualified to evaluate science programs in schools which he had visited. After his tour of 25 schools in ten states, the author determined that, at the elementary level and often the high school level, science education for the deaf in both special and public schools is lacking. After presenting arguments and excuses made by those schools for their lack of programming, Menchel shows problems which he saw as true reasons for this. He provides reasonable solutions to the problems which were confronted, and then addresses the need for teachers of the handicapped to rethink methodologies and forget their stereotyping habits.

Miller, Anne Small. "Personal Hygiene for Teenagers." The Volta Review, 66(4): 179-183, April, 1964.

Hygiene classes at the Clarke School for the Deaf provide information on sex education for teenagers. Personal conduct and attitudes towards self, opposite sex, sex and reproduction, and the problems of adolescents are all covered in class. Materials used include books and pamphlets for outside reading. A bibliography of books, films and educational materials is included. Steps for establishing procedures of conducting such classes are outlined. Honesty in answering all questions addressed to the adult by the child is stressed. If the involved person is not well acquainted with the necessary information, the author recommends the use of sources given in the included bibliography. Classes were conducted biweekly and as needs arose. If emergencies or special sessions were needed, classes were scheduled. Although the material is dated, it may provide information in certain areas.

Moore, Omar Khayyam. "The Responsive Environment Project and the Deaf," American Annals of the Deaf, 110(5): 604-614, November, 1965.

The Responsive Environment Project is designed and developed to theorize human problem solving and social interaction for help in the behavioral and formal sciences. By first outlining the formal science, the areas of investigation, and their connection to mathematics, the author shows the need for the project. The equipment used, the need for the adaptation of equipment, and its use with deaf children are all illuminated. The substantive notion is based upon the development of a rigorously formulated system of education. This theory is both identified and explained by the author as it applies to those with hearing impairments. The fourth area of concern is the laboratory. The use of the talking typewriter in formal laboratories is advocated. All of these discussions are then tied to the person with hearing impairments. The author presents the difficulties with which such a person may graft to a visual system and the social processes which impair this grafting. He provides the reader with some points to ponder in the environmental concerns of the hearing impaired.

Olson, James. "Viewing Solar Crescents." Science and Children, 7(5): 21, January/February, 1970.

The article describes activities and demonstrations used to view a solar eclipse by the faculty and students at the Oregon State School for the Deaf. Materials needed, procedures used, and the necessary adjustments to the equipment which are to be made prior to use are detailed. Continued use of the apparatus for other science projects is advocated.

Owsley, Peter J. "Development of the Cognitive Abilities and Language of Deaf Children Through Science." The Volta Review, 70(3): 389-393, September, 1968.

This is an address to the special needs of the deaf child in assessing a science program in a school setting. The article looks at a spiraling science program and the units generated. A scientific approach to experimentation and problem solving is applied to the development of cognitive skills and its application to language development is given. The inherent language difficulties of deaf children are also discussed. A close look at the teaching of science at the Pennsylvania School for the Deaf through units in natural sciences includes structure, syntactical formations, motivation techniques, material manipulation, and teacher-student relationships. The author concludes with an observation of the need for deaf children to find answers on their own to develop conceptual stuctures.

Owsley, Peter J. "Teaching Science to Deaf Children." American Annals of the Deaf, 107(3): 339-343, May, 1962.

This paper discusses the place of science for elementary children in residential schools for the deaf. The author stresses the inclusion of science as an answer to the need to foster curiosity for developing thinking processes. The rationale for including science in the curriculum, the need for teaching problem solving techniques and the development of a scientific approach to education are all stressed. Three goals of a science program, eight steps to follow in presenting experiments and demonstrations to children, and the ultimate success of equipping students with critical thinking habits form the conclusion.

Postlethwait, S. N. "A Multi-Faceted Approach to Teaching." American Annals of the Deaf, 111(5): 657-660, November, 1966.

A summary of the Purdue University approach to teaching freshman botany via a multi-faceted approach which allows students maximum control for their rate of learning is covered in this article. The programs' outline includes sessions and instructor-learner expectations. The general assembly session, integrated quiz session, and independent sessions are the make up of the multi-faceted approach. Student satisfaction with each of these areas is included. The equipment and time allotments are detailed prior to the discussion of success rates and percentages of involvements.

Schein, Jerome O. "The Deaf Scientist." Journal of Rehabilitation of the Deaf, 9(1): 17-21, July, 1975.

In order to become a scientist, the deaf person must confront several prejudices. This article begins by first making the distinction between deafness and hard-of-hearing and stresses the importance that the age of onset has upon the development of language. Data from the National Census of Deaf Population are quoted to reassure readers that deafness does not preclude the development of a career in science. The remainder of the article describes the educational preparation,

communication difficulties, college and university's acceptance/rejection policies, the need for more advanced secondary school preparation due to the low quality of that which is being provided is also mentioned. When educational barriers are overcome, the deaf applicant is then confronted by reluctant employers and other unnecessary barriers. On the job, problems exist because of the misunderstandings of colleagues. Personal experiences of the author and of others are given. The author also touches upon problems which may be encountered with those who have moderate degrees of deafness.

Schultz, Ora Ann. "Planetarium Astronomy for the Hearing-Impaired." Science Teacher, 40(4): 45-46, April, 1973.

The article consists of a portrait of Newark's School for the Hearing-Impaired planetarium space-science program. It includes problems encountered with the program and the trial-error solutions found. The main problem was the need for communication in a darkened room. The solution was to project written instructions onto the dome without using extraneous lights. The alterations and the methods which provide both successful and unsuccessful solutions are included. Clear descriptions of procedures including the need for light intensity controls are covered. The rationale for changes and the reinforcement techniques used conclude the article.

Stolte, Joanne B. and Thomas W. Biester. "Overcoming Barriers to Science Careers: An Investigation of Deaf Student's Career Development in Science." A Paper Presented at the 1979 Annual Meeting of the American Education Research Association. San Francisco, California, April, 1979.

This paper is an evaluation report of the career materials titled "Is Science A Possible Career For You?" after it was field-tested in nine sites. The program was designed for deaf students in order to meet the needs of language, science education and science and career development. It considers the syntax, vocabulary development and experiences, projective and imaginative thinking and inquiry skills needed by deaf students. There is also an overview of the audience and format and goals of the program. Eight specific objectives are listed for encouraging deaf students to consider the field of science as a possible career choice. Evaluation design and procedures are summarized focusing upon two major areas of effectiveness: career awareness and student activities. The data collection procedures and analysis plan are also outlined. Results and conclusions showed an impact in five areas of effectiveness. The experience was found to be generally valuable for those involved.

Sutman, Frank X., Dorothy Manou, and Frederick Haselton. "Self Esteem and Vocabulary Through Photography." Science and Children, 14(4): 17-18, January, 1977.

A pilot course in photography offered to middle school students at the Pennsylvania School for the Deaf is described. The physical setting, the characteristics of students, staff, and other individuals are all included. Logistical concerns are addressed and planning sessions described. Materials and equipment necessary are also outlined. The 12 weeks of activities including the making of the shoe-box camera prior to the use of the actual camera are also depicted. The effectiveness of the program is measured against the difficulties the students encountered in both the reading of materials and in personal-social-psychological interactions. Vocabulary increase was noted, as well as the generation of enthusiasm by students who were not involved in the program but who wished to be.

Vlug, Harry. "Science Education for the Deaf." Working Conference on Science Education for Handicapped Students: Proceedings. Helenmarie Hofman (ed.), Washington, D.C.: National Science Teachers Association, p. 86-90, 1978.

Achievement scores are used to reflect problems facing teachers of the deaf. Some of the implications of these data are refuted by Vlug's portrayal of successful deaf scientists. The remainder of the paper is in two sections: science curricula and an outline of the Model Secondary School for the Deaf Program (MSSD). The report concerns who writes curricula, how it is done, and which texts are used. Tables show that the larger percentages of responsibilities for curriculum development and writing lie with the individual teachers on a independent basis. Vlug then discusses the MSSD responsibility in the development and dissemination of curriculum materials - which to date have not been fully utilized. The materials being developed and those being field tested are described.

Updegraff, David R. et al. Career Development for the Hearing Impaired: Proceedings of Two Working Conferences, Gallaudet College, Washington, D.C., 1979.

Two working conferences on careers and the hearing impaired are covered in this publication. Participants were educators from residential schools with programs in career development. While the conference did not address itself to specific careers such as science, the generalized needs and problems encountered by hearing impaired programs with career orientation are identified. This background would be very useful for anyone who is interested in promoting careers in science for the hearing impaired. There is actually much similarity in the problems of career development for hearing impaired and other handicapped so the information actually has wide application in careers and the handicapped.

Walsh, Efthalia. "Lab Classroom: Breaking the Communication Barrier." Science, 196(4297): 1425, June, 1977.

By depicting discovery learning through a deaf child's exploration and inventiveness, the author stresses the need for activation of that curiosity and development of thinking skills in both handicapped and nonhandicapped students. The activity occurs in the Horace Mann school in Washington, DC. The approach used and described is the hands-on activity in the science laboratory and classroom, which has proved to be a good atmosphere for dealing with communication barriers.

Yonovitz, Albert. "Amateur Radio for the Deaf." The Volta Review, 71(5): 259-261, May, 1969.

The author, a ham radio operator for more than 12 years when this article was written, describes the independent study he undertook as a project in his college coursework. He developed an amateur radio program for two deaf high school boys. The training the boys underwent in order to receive their FCC license is described. How they used the Morse Code Sound System to aid their use of residual hearing, and ultimate success of the boys in receiving their licenses are all related in this article.

THE HEARING IMPAIRED

RESEARCH

Borron, Roberta. "Modifying Science Instruction to Meet the Needs of the Hearing-Impaired." Journal of Research in Science Teaching, 15(4): 257-262, July, 1978.

This is a report of an attempt to determine and classify factors which contributed to the success or failure of first grade students participating in Science-A Process Approach. The sample consisted of first grade hearing-impaired students at the Texas School for the Deaf, in Austin. The characteristics are outlined prior to the description of the study design. Pretest-posttest format was used in presenting Level B of Science-A Process Approach. Five major categories of change were necessary for the exercises due to the hearing-impaired condition of the students. These changes are identified. The results showed scores above the 82 percent level, with some at the 93.2 percent level. Significant gain was identified using the chi-square test. Factors of comparison and performance measures are detailed. Implications for teaching science to other hearing-impaired students are drawn. Because this approach is manipulative in nature, the author determined that successful performances were possible because science concepts are independent from language.

Boyd, Eunice and Kenneth D. George. "The Effect of Science Inquiry on the Abstract Categorization Behavior of Deaf Children." Journal of Research in Science Teaching, 20(1): 91-99, March, 1973.

This study of deaf students between the ages of 10-13 was based upon the theory that, provided with a series of specifically designed and structured science inquiry experiences, the students would develop a rapid change in categorization behavior. Thirty sessions were developed to test this theory. Pre-effort subject characteristics are outlined, including level of deafness, reading comprehension level and tested IQ level. The measurement instrument was the Goldstein-Sheerer Object Sorting Test which identified three cognitive styles and used free-sorting as well as compliant categorization. The procedures involved the use of a pretest-posttest control group, experimental treatment and minimal language lessons structure. A vocabulary test, a null hypothesis, a two-tailed test, and factorial analysis of variance for a two-factor experiment comprise the information tabulated and explained in the results. A significant change in compliant categorizing behavior was noted, as was a limit in the test of abstract categorization. Implications are drawn and explanations provided for each. The article concludes with suggestions for future research.

Bybee, R. W. and P. A. Hendricks. "Teaching Science Concepts to Preschool Deaf Children to Aid Language Development." Science Education, 56(3): 303-310, July-September, 1972.

By outlining the methods, materials, and preliminary results of a project for language growth of hearing-impaired students, this article stresses teaching language through teaching science concepts. The rationale for teaching science to deaf children is stated to

demonstrate the evolvement of the program itself. Formal learning of concepts is defined in terms of the science concepts themselves, receptors, and the need for classification. Problems confronted are identified, and the procedures in overcoming those problems are set forth. This is followed by the instructional program, materials used, target population and the description of the program. Procedures for presentation are also included. Evaluation procedures after ten weeks of concept building were formalized and results identified. In summary, the authors concluded that science concepts can be used to increase vocabulary and to make significant language development gains. Six other conclusions are drawn and discussed.

Fenner, Susan Wolski. "A Comparison of Programs and Techniques for Teaching Science to Handicapped Elementary Students." (University of Missouri-Kansas City, 1979) Dissertation Abstracts International, 40(10): 5387-A, April, 1980. (Order No. 8009367).

The purpose of this study was to: (1) document science programs and techniques being used to teach science to handicapped elementary students, and (2) compare three commercial science programs designed for the handicapped with regard to curricular orientation, design, and utilization. The three commercial science programs analyzed were: Adapting Science Materials for the Blind (ASMB); Science Activities for the Visually Impaired (SAVI); and ME NOW, a program designed for the mentally retarded. It was found that: (1) all three programs were suitable for their specified target populations, (2) with in regard to nontarget populations, all three programs could be used with other groups, and (3) certain non-handicapped individuals with learning problems could benefit from the special science programs.

Grant, William D, Joseph Rosenstein, and David A. Knight. "A Project to Determine the Feasibility of BSCS's 'Me Now' for Hearing-Impaired Students." American Annals of the Deaf, 120(1): 63-69, February, 1975.

BSCS's special education, student-centered, life-science program called "Me Now" was tested on low verbal, hearing-impaired secondary students at Model Secondary School for the Deaf in Washington, D.C. This project determined the appropriateness of science programs for non-target populations. The "Me Now" series places emphasis on low-verbal content of science materials plus providing hands-on activities. The sample population was comprised of six students whose Stanford Achievement Test scores showed no substantial recent improvement in their school studies. The mean age was 18-1. Pre and posttest, treatment time and methodology are all discussed while the control of sources of invalidity found in other such experimental projects is elaborated upon. The instrument used, its impact and importance and the reason why the authors chose to develop an index of student affective design are discussed. The results of data generated by the study are displayed and summarized. Statistical treatment procedures showed significant gains in the areas tested. The affectiveness of materials was compared for target and non-target

populations. Affective test data are rank-ordered and an explanation of entering low ratings given. Positive changes occured in attitudes towards science. Conclusions reached were that the material used would be unsuccessful for hearing impaired students of higher ability and language development than this experimental group. Retention results indicated that "Me Now" was effective in dealing with higher level cognitive skills in the group tested.

Linn, Marcia, Doris Hadary, Richard Rosenberg, and Robert Haushalter. "Science Education for the Deaf: Comparison of Ideal Resources and Mainstreamed Settings." Paper Presented at the American Education Research Association Annual Meeting in Toronto, Ontario, Canada, 1978.

This report is the result of a study of ideal mainstreaming conditions to ideal resource conditions. Three questions are addressed for educational research purposes. The program used was developed by Doris Hadary at American University, using both science and art instruction. The program is described by design and by characterization of classes and personnel. Student selection was from the Horace Mann School in Washington, D.C. The deaf subjects were 21 mainstreamed students. Procedures for selection are outlined. Nonverbal interviews were initially set up to evaluate cognitive gains. The observation instrument and opinion survey are explained. Results of cognitive tests, observations and questionnaires are presented and explained. Evidence showed three advantages of mainstreaming. Additional needs and further areas of study are also addressed.

Roesch, Irving Herbert. "Analysis of Relationships Between Measures of Self-Actualization, Discovery-Teaching Climate and Selected Characteristics of Secondary Science Students in Residential Schools for the Deaf." (University of Idaho, 1975) Dissertation Abstracts International, 36(7): 4408-A, January, 1976. (Order No. 75-29, 94a)

Measurements of achievement in science, progress towards self-actualization, and high/low scores on science-related items on the self-actualization instrument were sought to determine the relationships of all of the above to the discovery-teaching climate. The target audiences were 257 students in 12 residential schools for the deaf and 15 science teachers. Materials, environmental concerns and measurement instruments are included along with educational data instruments. Findings include no significant relationship between climate and the actualization status, but achievement in science was found to be significantly related to the climate in the classroom. Other findings are also outlined.

OTHER HANDICAPPING CONDITIONS

GENERAL

ANNOTATED BY

KEN RICKER

UNIVERSITY OF GEORGIA-ATHENS

77/78

Beller, Joel. "Handicapped Students Learn a Helping Way of Life." The Science Teacher, 45(7): 25-26, October, 1978.

Presented is a description of a three year program in paramedical skills training initiated at Francis Lewis High School (Flushing, New York) for use with neurologically impaired and physically handicapped students. The students learn laboratory procedures and visit hospitals and nursing homes on a regular basis.

Bennett, Lloyd M. and Kay Downing. "Science Education for the Mentally Retarded." Science Education, 55(2): 155-162, April/June, 1971.

This article reviews much of the research that has been done on science education for educable mentally retarded children. It stresses the need for these children to have a science curriculum in order to understand their environment and to acquire critical thinking and problem solving skills. The authors feel more attention should be given to training teachers to teach science to the mentally retarded.

Boekel, Norma J. and Rodger W. Bybee. "The Influence of Science in a Program for Educable Mentally Retarded." Becoming a Better Elementary Science Teacher. Robert B. Sund and Rodger W. Bybee (Editors), Columbus, Ohio: Charles E. Merrill Publishing Company, pp. 123-136, 1973.

The authors feel strongly that science should be included in the curriculum of educable mentally retarded children. The teaching of science should be viewed as a thought process, an alternative to solving problems, and as a means to help them discover themselves as persons. Science teaching should be considered as a means of increasing and enhancing the total growth of "special" children rather than the transmission of facts.

Boekel, Norma and Joe M. Steele. "Science Education of the Exceptional Child." Focus on Exceptional Children, 4(4): 1-15, September, 1972.

This article is an extensive discussion of teaching science to the educable mentally retarded. The questioning techniques that a teacher should use with mentally handicapped students are described. Four science programs that are adaptable for use with mentally handicapped students are briefly described: Individualized Science (IS), Science Curriculum Improvement Study (SCIS), Elementary School Science (ESS), and Science - A Process Approach (SAPA). Two Biological Sciences Curriculum Study (BSCS) programs designed for use with mentally handicapped students are also described: ME NOW and ME AND MY ENVIRONMENT.

Brotski, David E. "A Pilot Science Curricula for Educable Mentally Handicapped Children Emphasizing Child-Centered Activities." Paper Presented at the Annual Meeting of the National Science Teachers Association, Detroit, Michigan, April, 1973.

This paper presents the initial efforts of a project to produce a science program for mentally handicapped students at four levels: lower primary, primary, intermediate, and junior high school. The project reported by Brotski and others, is "A Science Program for Children with Exceptional Needs" Manitowoc County Handicapped Children's Education Board, Manitowoc County, Wisconsin, September, 1973.

Brotski, David and others. "A Science Program for Children with Exceptional Needs." Manitowoc County Handicapped Children's Education Board, Manitowoc County, Wisconsin, September, 1973.

This publication describes a project to develop a science program for mentally handicapped students, sponsored in part by the U.S. Office of Education. Four levels of mentally handicapped students are considered: lower primary, upper primary, intermediate and junior high. The curriculum provides a systematic approach to logical thinking and child-centered activities. A review and analysis of available instructional materials is also made.

Brown, Dean R. "Helping Handicapped Youngsters Learn Science by 'Doing'." What Research Says to the Science Teacher, Vol. 2, Mary Budd Rowe (ed.), Washington, D.C.: National Science Teachers Association, 1979, pp. 80-100.

The author reviews literature on teaching science to visual, auditory and orthopedic handicapped students. Implications for classroom procedures and future research are identified.

Budoff, M. "An Educational Test of the Learning Potential Hypothesis with Adolescent Mentally Retarded Special Class Children, Volume 1, Final Report." Cambridge, Massachusetts: Cambridge Mental Health Center, 1969, pp. 242.

This report describes the use of a manipulative, nonverbal science unit with junior high mentally retarded pupils. The learning potential assessment procedure was a better predictor of pupil success in the unit than were the IQ scores of the pupils. See Volume II for description of the unit and also the following item: Budoff, M. and others. "Educational Test of the Learning-Potential Hypothesis."

Budoff, M. "An Educational Test of the Learning Potential Hypothesis with Adolescent Mentally Retarded Special Class Children, Volume II, Final Report." Cambridge, Massachusetts: Cambridge Mental Health Clinic, 1969, pp. 216.

This report describes a manipulative nonverbal science unit on electricity (modified ESS unit Batteries and Bulbs) that was used with pupils having different levels of learning potential. See Volume I of the Final Report for a description of the project and the following document for further details: Budoff, M. and others. "Educational Test of the Learning--Potential Hypothesis," American Journal of Mental Deficiency, 76(2): 159-169, 1971.

Bybee, Rodger W. "Helping the Special Student Fit In." The Science Teacher, 46(7): 22-24, October, 1979.

The author identifies general guidelines for a teacher to use to understand students with special needs. Specific suggestions for students with specific handicaps are given: hearing impaired; visually impaired; physically and health impaired; speech and language impaired; learning disabilities and mental retardation; and emotionally disturbed and disruptive students.

Callahan II, William P. "Science for the Mentally Retarded." The Biological Sciences Curriculum Study Journal, 2(3): 3-5, September, 1979.

This article summarizes the highlights of the BSCS effort to develop three programs for mentally retarded pupils: Me Now, Me and My Environment, and Me in the Future. Some of the facts the project developers learned about teaching mentally retarded pupils are described.

Clark, George M., editor. Biological Sciences Curriculum Study Newsletter. Boulder, Colorado: Biological Science Curriculum Study. Number 38, February, 1970; Number 43, September, 1971; Number 46, February, 1972; Number 48, September, 1972; Number 52, September, 1973; and Number 55, April, 1974.

These newsletters contain articles that describe the development and implementation of the BSCS special education program entitled ME NOW. This program was designed for use with mentally retarded students, ages eleven through thirteen.

Clark, George M., editor. Biological Sciences Curriculum Study Newsletter. Boulder, Colorado: Biological Sciences Curriculum Study. Number 46, February, 1972; Number 48, September, 1972; Number 52, September, 1973; Number 55, April, 1974; and Number 56, September, 1974.

These newsletters contain articles which describe the development and implementation of the BSCS special education program entitled Me and My Environment. This program was designed for use with mentally retarded students, ages thirteen through sixteen.

Classroom Management Systems for Implementation of Individualized Instruction: Utilizing Science in Programs for the Handicapped. Yonkers City, N. Y.: Yonkers City School District, 1974, pp. 101.

This publication reports on the proceedings and results of a conference on individualized instruction with elementary handicapped students. Both special education and regular classroom teachers attended the conference. The science activity cards which the teachers developed are included.

Cohen, Boaz and Howard L. Jones. "Establishing a Science Curriculum for Aggressive Children." The Science Teacher, 36(8): 61-63, November, 1969.

The desirability of modifying regular science programs to meet the needs of aggressive students is discussed. The necessity to recognize that these students frequently react to schooling with anxiety and impulsive responses is identified. The authors further establish the values of teacher-pupil-initiated, pupil-performed, and pupil-actualized success-producing tasks in the science program.

A Course of Study for the Educable Mentally Retarded: Primary, Intermediate, Junior High. Indianapolis, Indiana: Indianapolis Public Schools, 1975, pp. 249.

This course of study identifies what science units should be taught at the primary, intermediate and junior high school levels. The topics and activities for each unit are briefly identified.

Dailey, Rebecca F. "CEC ERIC's The Now Way to Know: ME NOW - Life Science for the Mentally Retarded." Education and the Training of the Mentally Retarded, 6(3): 127-131, October, 1971.

The author reports on the efforts on BSCS to develop and field test the ME NOW program for mentally retarded pupils.

Danglade, Ruth and Daniel W. Ball. "Science for Someone Special." Science and Children, 16(3): 23-24, November/December, 1978.

In the summer of 1975, Delaware County, Indiana, instituted a series of workshops to introduce special education staff members to the Elementary Science Study (ESS). Units were chosen to be incorporated in their special education classes. The children were very enthusiastic about their science lessons and showed measurable changes in observation, communicating and inference skills.

Davies, Janet Mansfield and Daniel W. Ball. "Utilization of the Elementary Science Study with Educable Mentally Retarded Students." Journal of Research in Science Teaching, 15(4): 281-286, 1978.

This article reports on a study conducted by one of the authors as a doctoral dissertation. See Mansfield, Janet. "The Effect on the Elementary Science Study on Selected Science Skills of Educable Mentally Retarded Students."

Davis, Cheryl A. and Martha Ross Redden. "Achievement in Biology: An Introduction to Handicapped Biologists." The American Biology Teacher, 40(3): 175-178, 190, March, 1978.

Biographical sketches of the lives of three handicapped scientists are given: a deaf biologist, an orthopedic handicapped biologist, and a blind zoologist. The attributes common to these three successful handicapped scientists are identified. Perhaps the foremost attribute is that none of these people assumed that their handicaps were a reason not to pursue their education and career in biology.

An Evaluation Design for the Educational Programs for Pupils Who Are Orthopedically Handicapped. Columbia, South Carolina: South Carolina State Department of Education, 1977, p. 75.

This booklet provides teachers with a procedure to collect data relevant to planning individualized educational programs for orthopedic handicapped students. Twenty-two science objectives for three levels (primary, intermediate and secondary) and for moderately or severely handicapped students are given. Teachers record the data of mastery and level of mastery for each student on each objective.

Gaskins, Marinda H. "Horseback Riding and the Handicapped." Science and Children, 13(6): 23, March, 1976.

Horseback riding is being used by the District of Columbia Public Schools as an instructional technique with various types of handicapped children. The author describes in detail the many areas in which the children benefit.

George, Kenneth D., James F. Galbally and Lowell J. Bethel. "The Language of the Classroom is a Barrier for Urban Children." Science and Children, 13(1): 19-21, September, 1975.

The authors consider the findings of 16 research studies and imply that children from lower income urban homes speak a dialect of English rather than the typical standard English of the middle-class-oriented school. They feel that the teaching of science through inquiry skills based on an activity rather than on a content emphasis, by a teacher who understands the language differences, will cultivate mutual understanding and raise the child's self-concept, personal worth, and achievement.

Grant, William D. "Me Now and Me and My Environment: Science for the Exceptional Student." Science Education, 59(2): 249-254, April-June, 1975.

This is a complete description of the Me Now program developed by the Biological Sciences Curriculum Study (BSCS) for Educable Mentally Handicapped (EMH) students in the eleven to thirteen-year-old age group. The program combines activities, and attractive teaching aids, with very little written material. The author feels that the program provides an adequate basis for teachers to help pupils develop skills of inquiry.

Hadary, Doris E. National Invitational Conference on Laboratory Science and Art For Blind, Deaf and Emotionally Disturbed Children in a Mainstream Setting, American University, Washington, D.C., 1978.

The purpose of this conference was to explore science education trends for handicapped children and to allow participants a chance to observe the program developed at American University for science and handicapped elementary children. The proceedings contain presentations by various leaders in the field of handicapped education. Most space is devoted to a description of the model science program which utilizes ESS, SAPA and SCIS materials for adaptation.

Hadary, D. E. and M. A. Cohen. Laboratory Science and Art for Blind, Deaf, and Emotionally Disturbed Children -- A Mainstreaming Approach, Baltimore: University Park Press, 1978, 383 pages.

This is the only book devoted to teaching science and art to the handicapped. The first section is a discussion of reasons for using science and art in the education of handicapped children. Section II gives specific activities in a lesson plan format with suggested adaptations for deaf and blind children. Background information in science is the topic of Section III. Art lessons constitute the bulk of Section IV. They follow the same pattern as the science activities with suggested adaptations for the deaf and blind. Many of the art lessons integrate science and many of the science lessons lead to or integrate art.

"Handicapped Students Get New Lab Bench." The Science Teacher, 45(7): 12, October, 1978.

A new lower, adjustable, and portable science laboratory bench was developed by the University of California at Davis. The lab bench makes it possible for wheelchair students to work without moving. The triangular shaped fume hood is one of its most innovative features.

Hofman, Helenmarie, editor. "A Working Conference on Science Education for Handicapped Students." Washington, D.C.: National Science Teachers Association, 1978, 194 pages.

This publication reports the results of a conference on teaching science to auditory, orthopedic, and visually handicapped students. The conference assessed the state of the art and developed a position statement on teaching science to handicapped students. Over fifty papers given at the conference are included in the publication.

Hofman, Helenmarie H. and Kenneth S. Ricker, editors. Sourcebook: Science Education and the Physically Handicapped, Washington, D.C.: National Science Teachers Association, 1979, p. 283.

This is a compilation of papers and articles on teaching science to auditory, orthopedic and visually handicapped students. The state of the art, a position statement and implications for the future on science education of the physically handicapped are presented. An extensive directory of resources for teachers and schools is given.

Holzberg, Robert. "The Educable Retarded." Science and Children, 13(6): 19, March, 1976.

The author expresses the danger of judging the educable retarded by mental age alone. He describes some common problem areas where they differ from other children of the same chronological age. Since these children have difficulty abstracting general principles from specific illustrations, they require small group instruction and greater repetition.

Humphrey, J. H. "Developing Science Concepts with Slow Learning Children Through Active Games." NSTA Twenty-Second Annual Meeting - Addresses and Reports, Chicago, Ill, 1974, pp. 95-97.

This report contains a description of how four common science concepts: shadows, friction, equilibrium, and electric circuits are taught through physical activity. Each case is concluded with an evaluation.

Humphrey, James H. Teaching Elementary School Science through Motor Learning. Springfield, Ill: Charles Thomas Company, 1975, 131 pages.

In this book Humphrey deals with the nature of elementary school science and current practices in this field. After an introduction to motor activity in general, the factors of human learning are discussed. The remainder of the book presents specific and detailed ways motor activities can be used to teach science, especially to the slow learner. Reading and language arts are not neglected.

Humphrey, James H. "The Use of Motor Activity in the Development of Science Concepts with Mentally Handicapped Children." NSTA - Twenty First Annual Meeting - Addresses and Reports, Detroit, Michican, April, 1973, pp. 1-10.

Mentally handicapped as defined in this paper broadly includes mental retardation, learning disability and a depressed potential resulting from other than intellectual subnormality. Motor activity [illegible]ing refers to things that children do actively in a pleasurable [illegible]on in order to learn. The author equates science experiences [illegible]us motor activities and illustrates how science may be taught [illegible]igh physical education activities. He reports favorable results on his efforts to teach science using physical education activities.

Katz, Paul J. "Science for the Educable Retardate." Science and Children, 2(4): 20-22, December, 1964.

The objectives commonly given for not including science in the curriculum for educable retardates are reviewed. A summary of a study conducted by the author that assessed, in part, the feasibility of teaching science to educable retardates is presented. See Katz, Paul J. "Transfer of Principles as a Function of a Course of Study Incorporated Scientific Method for the Educable Mentally Retarded." (Columbia University, 1962). Dissertation Abstracts International, 23(11): 42, 44, 1963.

Kratz, Robert N. "Everyone Has a Sky--A Planetarium Helps the Slow Learner." Clearing House, 43(6): 349-350, February, 1969.

The benefits of using the planetarium as a visual aid to teach space concepts to slow learners in junior and senior high special education classrooms are discussed. The concepts included in the special program are identified.

Lamendola, Angelo. "Science and the Emotionally Disadvantaged Child--A Case Study." Science and Children, 13(6): 17-18, March, 1976.

The author describes a series of lessons on seeds, taught to an emotionally disturbed, institutionalized, six year old boy. Progress from primary to secondary reinforcements for the child was achieved.

Lance, Wayne D. "Instructional Materials for the Mentally Retarded: A Review of Selected Literature." Education and Training of the Mentally Retarded, 10(3): 161-166, October, 1975.

This review provides information on the status of materials for use with mentally retarded pupils in several areas, including science education. It is apparent that there is a serious lack of field tested materials for teaching science to mentally handicapped students.

Littman, Karen and Diane T. Baron. "The Environmental Approach to Recreation Services." Science and Children, 13(7): 22-23, April, 1976.

An environmental recreation program has been instituted in Prince George's County, Maryland, for children with special needs. Since play activities are often limited for handicapped children, this environmental approach provides them with leisure time activities.

Lombardi, Thomas P. and Patrick E. Balch. "Science Experiences and the Mentally Retarded." Science and Children, 13(6): 20, March, 1976.

Since the educational goals for the mentally retarded are no different than for the non-retarded, science should not be omitted from their curriculum. The authors present principles and guidelines for teaching science to the mentally retarded and some benefits that can be gained.

"'Mainstreaming' the Learning Disabled: Success at Walpole High School." The Science Teacher, 46(1): 17, January, 1979.

This is a brief account of how a science teacher and reading specialist work together to teach a science course to a class of poorly motivated and learning disabled students in high school.

Mallinson, George G. A Summary of Research in Science Education - 1975. New York: John Wiley & Sons, 1977, p. 266.

This summary contains a section on special problems in science education. In this section reviews of research relating to handicapped students, slow learners, and bilingual students are included.

Mansfield, Janet L. and Daniel W. Ball. "Messing Around with EMR's." Paper presented at the Annual International Convention, The Council for Exceptional Children. Chicago, Illinois, April, 1976.

This paper reports on the study conducted by one of the authors as a doctoral dissertation. See Mansfield, Janet. "The Effect of the Elementary Science Study on Selected Science Skills of Educable Mentally Retarded Students." (Ball State University, 1976). Dissertation Abstracts International, 37(10): 6388-A, April, 1977. (Order No. 77-7309).

Mayer, William V., Editor. Planning Curriculum Development. Boulder, Co: Biological Sciences Curriculum Study, 1975, p. 89.

A model for curriculum development for mentally retarded students is presented. The model is based on the experiences of the BSCS projects in developing life science programs for educable mentally retarded students, ages eleven through nineteen. Experiences gained from these projects are used to illustrate various parts of the model.

McMahon, Kenneth V. "Science Program for the Educable Mentally Handicapped." Exceptional Children, 21(3): 80-90, December, 1954.

The author describes a project in which he developed science lessons on the needs and existing interests of a group of educable mentally handicapped boys. The lessons provided manipulative activities in which the boys could be successful. The lessons not only enhanced learning in science, but also in other academic areas, and in oral expression and social growth through group activies.

Menhusen, Bernadette R. and Roy O. Gromme. "Science for Handicapped Children--Why?" Science and Children, 13(6): 35-37, March, 1976.

This is a discussion of the reasons why educable mentally retarded children have been deprived of science education in the past. The "Me Now" and "Me and My Environment" programs are described. The assumptions and program objectives that were used as a basis for the development of the programs are identified.

Monaco, Theresa M. "Mainstreaming, Who?" Science and Children, 13(6): 11, March, 1976.

A definition of mainstreaming is followed by a discussion of the terms handicapping and disability. The author covers the effects of labeling and the need to individualize science instruction for all students.

Myklebust, Helmer R. "Learning Disabilities." Science and Children, 13(6): 12-13, March, 1976.

Brief descriptions are given of receptive and expressive aphasia, dyslexia, cognitive dysfunctions, and dlyscalculia. Some implications and suggestions on how to cope with them in the classroom are presented.

Owen, Janette Alsford, Martha Ross Redden and Janet Welsh Brown. Resource Directory of Handicapped Scientists, Washington, D.C.: American Association for the Advancement of Science, 1978, p. 78.

This directory contains over 500 names of handicapped persons who are pursuing science or science-related careers. These persons are willing to help other handicapped persons solve problems with which they themselves may have already had to cope. The directory provides information about each person with regard to his/her educational background, career, handicapping condition, and areas of expertise and consulting interests.

Post, Thomas R., Alan H. Humphreys and Mickey Pearson. "Laboratory-Based Mathematics and Science for the Handicapped Child." Science and Children, 13(6): 41-43, March, 1976.

The authors advocate a "hands-on" or laboratory approach to the teaching of physically handicapped children. Suggestions for the implementation of such a program and a description of the outdoor learning laboratory at a Minneapolis school are included.

Proscia, Vita, Phyllis Stearner, E. C. Keller Jr. and Donald L. Ballatyne. "A Challenge to Teachers from Handicapped Scientists." Science and Children, 13(6): 15-16, March, 1976.

Four members of AAAS discuss, in brief biographical articles, their physical handicaps and the problems they encountered pursuing their education and careers in science.

Redden, Martha Ross and Shirley Mahaley Malcom. "A Move Toward the Mainstream." Science and Children, 13(6): 14, March, 1976.

The authors describe the need to mainstream handicapped youngsters into regular science classes. Often these students do not receive an adequate program and fail to realize the career opportunities available. The AAAS Project on the Handicapped in Science which is working to remove educational and occupation barriers for the handicapped is described.

Redden, Martha Ross, Cheryl Arlene Davis and Janet Walsh Brown. Science for Handicapped Students in Higher Education, Washington, D.C.: American Association for the Advancement of Science, 1978, p. 74.

This publication presents the findings and recommendations of a conference on science education for handicapped persons at the post-secondary level conducted by the American Association for the Advancement of Science. While the focus of the conference was on higher education, much of the information presented is relevant to the barriers handicapped students face in pre-college science programs.

Redden, Martha Ross and Wayne Schwardt, editors. Science, Technology and the Handicapped, Washington, D.C.: American Association for the Advancement of Science, 1976, p. 108.

This publication is a compilation of papers presented at the symposium, Science, Technology and the Handicapped, held at the 1976 AAAS Annual Meeting in Boston. The symposium directed its attention to the need to involve science and technology in such a way that handicapped people would have adequate opportunities to reach their full potential. Several of the papers dealt with science education for pre-college students.

Ricker, Kenneth S. "Curriculum Rev (Me Now)." Science and Children, 13(6): 37-38, March, 1976.

This NSTA curriculum review provides a detailed description of the "Me Now" program developed by The Biological Science Curriculum Study (BSCS) for use with educable mentally retarded children, ages eleven to thirteen. Two other programs, "Me and My Environment" and "Me in the Future" are also noted.

Ricker, Kenneth S. "Science for Handicapped Students - A Neglected Area." Paper presented at the Annual Meeting of the National Science Teachers Association, Los Angeles, California, March, 1975.

The paper reviews the literature relating to the teaching of science to mentally, visually and mentally-visually handicapped students. This analysis of the literature revealed that there is a serious lack of knowledge to assist science teachers in meeting the demands that accompany mainstreaming. An extensive bibliography is included.

Ricker, Kenneth S. "Science and the Physically Handicapped." Viewpoints in Teaching and Learning, 55(1): 67-76, Winter, 1979.

More and more teachers are being asked to make their science classes fully accessible to physically (sensory and orthopedic) handicapped students. The author discusses instructional, teacher education and research considerations of this movement. The need to develop an organized body of empirical data on teaching science to physically handicapped students is established.

Rowe, Mary Budd. "Help is Denied to Those in Need." Science and Children, 12(6): 23-25, March, 1975.

The author cites many studies stressing the advantages of providing early extensive exposure to science for physically, mentally and socioeconomically deprived children. Although she feels that these children make substantial gains in language development through science, they are the least likely groups to have a science program offered in their classrooms.

Rudman, Solomon. "A Special Science Curriculum." The Clearing House, 37: 114-116, October, 1962.

The author explains why science has a definite role in the curriculum of slow and retarded secondary pupils. Science topics that should be included in the program to help these pupils learn to interact successfully with their environment are identified.

Schery, Stephen D. "Science Classes for Mentally Retarded Adults." The Science Teacher, 42(1): 44-46, January, 1975.

The author describes his experiences in teaching a variety of science lessons to a group of institutionalized, mildly to moderately mentally retarded adult males. Lessons involving manual procedures and vocabulary activities were successful. The author felt the lessons were beneficial, but raised several questions regarding the role of science education for the mentally retarded.

Science: A Guide for Teaching the Handicapped. Iowa City, Iowa: Iowa University, 1970, p. 162.

This guide presents a functional approach for teaching science to educable mentally retarded pupils as compared to teaching a series of science lessons on specific concepts. To assist the teachers in accomplishing this, the guide identifies general objectives, an outline of content, suggested experiments and selected starter units. Four levels are considered: primary, intermediate, junior high and senior high school.

"Science Education, and the Physically Handicapped." Science Education News, American Association for the Advancement of Science, Fall, 1978/Winter, 1979, p. 12.

This issue contains articles on science education for auditory, orthopedic and visually handicapped students. Background information and aids in teaching these students are discussed. Addresses of organizations that may be helpful to teachers and a bibliography are given.

Shea, Dick. Instructional Materials for Science, Los Angeles, California: University of Southern California, 1974, p. 50.

This is an annotated bibliography of science instructional materials for use in grades K through 12. Materials that vary greatly in format are included and materials developed especially for "Special Education" are identified.

Shriver, Eunice Kennedy. "Physical Education: Shortest Road to Success for the Handicapped." Science and Children, 13(6): 24-26, March, 1976.

Sports and recreation are offered as two excellent ways to bring mentally retarded children into the mainstream of the public school. The author describes "The Special Olympics" and "Play to Grow" programs developed by the Kennedy Foundation as a means by which teachers may encourage physical education with handicapped students.

Shulene, John A. "Question: When is a Picture a Riddle? Answer: When the Riddle is the Picture!" Teaching Exceptional Children, 7(2): 68-69, Winter, 1975.

This article is based on the author's research study on using pictorial riddles to teach selected science concepts to mentally handicapped children. Several examples of pictorial riddles used in the study are illustrated. See Shulene, John A. "Inquiry-Oriented Pictorial Riddles in Science for Educable Mentally Handicapped Children." (University of Northern Colorado, 1972). Dissertation Abstracts International, 33(7): 3429-A, January, 1973. (Order No. 73-00311).

Stefanich, Greg and James O. Schunur. "Identifying the Handicapped-Gifted Child." Science and Children, 17(3): 18-19, November/December, 1979.

The authors identify reasons why handicapped-gifted students may not be identified as gifted. Procedures for overcoming the discrimination against handicapped-gifted students in the screening and identifying process are discussed.

Stern, Virginia W. and Martha Ross Redden. "Role Models for the Handicapped." The National Elementary Principal, 58(1): 43-45, October, 1978.

The authors describe the role model project of the American Association for the Advancement of Science. A handicapped scientist visited schools across the nation in which handicapped students were enrolled. The benefits that a school may gain by using handicapped role models are discussed.

A Suggested Course of Study and Curriculum Guide for Educable Mentally Retarded Pupils in Junior-Senior High School, Bakersville, California: Kern County Schools, 1970, p. 119.

This guide is intended to help teachers achieve identified curriculum objectives for junior and senior high levels educable mentally retarded pupils. For the area of science there are lists for each grade level in regard to: goals, activities, and suggested topics and units.

A Suggested Curriculum Guide for Educable Mentally Retarded Children in Elementary School. Bakersfield, California: Kern County Schools, 1970, p. 78.

This guide presents the school's philosophy and rationale for the curriculum for educable mentally retarded students. For the area of science the guide identifies the general goals for teaching science to students at three levels: primary, intermediate and junior high. A list of activities to do in science are given for each level.

Thier, Marlene. "Utilizing Science for Developing Visual Perception Skills." Science and Children, 13(6): 39-40, March, 1976.

The author explains in detail how science projects may be used to aid children with visual perception problems. In addition to a description of visual sequencing, experiences are given from programs by ESS, SCIS, OBIS and Matal. The relationship between visual perception and reading ability is discussed.

Thompson, Ben. "Myth and Science for the Handicapped." Science and Children, 17(3): 16-17, November/December, 1979.

The author establishes the falseness of several common myths about the capacity of handicapped students to achieve in science. References that help further explain away the myths are given.

Thresher, Janice M. "Science Education for Mentally Retarded Children: A Rationale." Mental Retardation, 1(3): 152-160, 186-188, June, 1963.

This is an extensive discussion of the role of science in the curriculum for trainable and educable mentally handicapped pupils. The nonexistence of research to substantiate the potential value of science teaching for these pupils is acknowledged. Hypotheses that are worthy of investigation are identified.

Vannan, Donald A. "Science Activities and the Retarded Child." Science Activities, pp. 37-38, December/January, 1974.

The author briefly summarizes ten resource articles and books published between 1960 and 1970 which emphasize the benefits of including science in the curriculum for elementary school students who are retarded or slow learners.

Watling, Carol and Raymond E. Hallard. "The Sea Beside Us." Teaching Exceptional Children, 17(1): 26-28, Fall, 1974.

This article describes a federally funded project that was designed to develop an overnight field trip to the seashore for mentally handicapped, physically handicapped, and learning disabled students. The primary focus of the learning experiences was on affective objectives. Another project goal was to increase the number of special education teachers who would include these kind of learning experiences in their classroom programs.

Wolinsky, Gloria F. "Science Education and The Severely Handicapped Child." Science Education, 49(4): 327-335, October, 1965.

The author makes a very convincing case for providing a meaningful science education program for physically (crippled and health impaired) handicapped children, particularly those children who are separated from their families or are restricted to a limited physical environment. Examples of what constitutes a meaningful science education program are given.

Yuker, Harold E. and others. The Modification of Educational Equipment and Curriculum for Maximum Utilization by Physically Disabled Persons, Educational and School Equipment for Physically Disabled Students. Albertson, N. Y.: Human Resources Center, 1967, p. 66.

This is one of a series of monographs concerned with severely orthopedically handicapped students. In this publication, school equipment that is not limiting to physically handicapped students is discussed. Modifications and specialized equipment are also considered. In addition to general school equipment, special attention is given to the science laboratory and green house. Pictures of accessible arrangements are included.

OTHER HANDICAPPED CONDITIONS

RESEARCH

Bacon, Walter E. "A Comparison of Two Science Teaching Methods for Educable Mentally Handicapped Children." (Loyola University of Chicago, 1976). Dissertation Abstracts International, 37(2): 780-A, August, 1976. (Order No. 76-15,457).

This study contrasted the efforts of two teaching methods on the achievement and retention for educable mentally handicapped students enrolled in the Biological Sciences Curriculum Study Me Now program. A deductive method was used with one group of students and a discovery method of teaching was used with a second group. No significant differences were found between these groups on the mean posttest and retention test scores. No interaction between reading ability and test scores was detected.

Bennett, Lloyd M. "Science and Special Students." Science and Children, 15(4): 12-14, January, 1978.

The author describes a study conducted to determine if children in elementary "special" needs classes could learn science concepts. Modules and units were developed and implemented in regular classes before being used with the physically handicapped, emotionally disturbed, educable mentally retarded, and trainables. Of the 113 children who completed the study, all but one scored higher on the posttest. It was also found that the special education teachers did not need special training to teach science to these children.

Budoff, M., J. Meskin and R. H. Harrison. "Educational Test of the Learning-Potential Hypothesis." American Journal of Mental Deficiency, 76(2): 159-169, 1971.

A nonverbal procedure (modified Kohs block design) was used to assess the learning potential of educable mentally retarded junior high students. This procedure was a better predictor than were the results of the IQ test of the student success in [illegible]ity type science lessons based on the ESS unit, Batteries and B[illegible] Data were obtained to support the hypothesis that the students with high learning potential were educationally retarded rather than mentally retarded.

Callahan, William P., "Me and My Environment, Formative Evaluation Report 5. Assessing Student Abilities and Performances: Year 3." Boulder, CO: Biological Sciences Curriculum Study, 1976, p. 35.

The data collected on the field testing of two units of the BSCS Me and My Environment program are presented. The results of a mini-field test of a game developed by the project are also given. The report summarizes the systems model approach that the project used to develop, field test, and revise science programs for educationally mentally handicapped students.

Cravats, Monroe. "A Study of the Value of Laboratory Exercises in a General Science Class of Low IQ Students in New York City." (Columbia University, 1968). Dissertation Abstracts International, 29(7): 2133-A, January, 1969. (Order No. 69-00686).

This investigator studied the effect of science laboratory exercises for students with low IQ's. No significant differences between the control and experimental groups were observed for gain in factual knowledge, level of critical thinking, or attitude toward science. Differences in growth that did occur appeared to be caused by a teacher factor. The students in the experimental group appeared to develop a better attitude toward school.

Ferraro, E., M. T. Lee and O. R. Anderson. "The Effects of Structure in Science Communications on Knowledge Acquisition and Conceptual Organization by Students of Varying Mental Maturity." Journal of Research in Science Teaching, 14(5): 441-447, 1977.

Reported is an investigation designed to examine the dependence of mentally retarded and normally intelligent students on structure in verbal communication with science materials. It was found that the mentally retarded students were particularly dependent on structure in verbal communication. Implications for curriculum materials to be used with mentally retarded students are identified.

Gromme, Roy O. "Me and My Environment,' Formative Evaluation, Report 4. Assessing Student Abilities and Performance: Year 2." Boulder, Colorado: Biological Sciences Curriculum Study, 1975, p. 32.

Data are reported on student performance for the second field trial of the first three revised units of the BSCS special education program, Me and My Environment. The results of the field trial are compared with the results from the first field trial. The data are analyzed on a variety of factors. Implications for teaching mentally handicapped students are identified.

Katz, Paul J. "Transfer of Principles as a Function of a Course of Study Incorporating Scientific Method for the Educable Mentally Retarded." (Columbia University, 1962). Dissertation Abstracts International, 23(11): 4244, May, 1963. (Order No. 63-3759).

This study sought to determine: (1) could secondary educable retarded students learn principles related to magnetism and electricity, (2) if a rote method and problem solving method were equally effective, (3) could students taught by the problem solving method solve more problems using the principles, and (4) could students taught by the problem solving method apply new principles acquired during the test situation. The data supported the first three research questions.

Kochevar, Robert E. "A Comparative Study of Filmstrip Utilization with Educable Mentally Handicapped Students." (University of Northern Colorado, 1972). Dissertation Abstracts International, 33(2): 631-A, August, 1972. (Order No. 72-22,410).

This investigation examined the effectiveness of three methods of using a filmstrip to teach first aid to educable mentally handicapped students in junior high. Each method used a filmstrip twice in the unit in combination with class discussion and demonstration. The sequence of these four events were different for the three experimental groups. The filmstrip was not used in the control group. The investigator concluded that the use of a filmstrip results in significant learning for the educable mentally handicapped students, and that the use of the filmstrip at the beginning of the unit was the best method.

Mansfield, Janet. "The Effect of the Elementary Science Study of [illegible] and Science Skills of Educable Mentally Retarded Students." (Ball State University, 1976). Dissertation Abstracts International, 37(10): 6388-A, April, 1977. (Order No. 77-7309).

This study examined the effects of using Elementary Science Study (ESS) units with educable mentally retarded students in the skills of communication, observation and inferences. Two experimental groups were used: one which used six perceptual oriented ESS units, and one which used six psychomotor oriented ESS units. The control group did not use ESS units. Three levels (primary, intermediate and junior high) of students were used in each group. Significant differences were found in favor of the experimental group at some levels for at least one of the science skills. Across all three levels the experimental group had a significantly higher frequency in mean verbal expression and mean observation scores. No significant difference was found in the mean frequency of inferences.

Meyer, Don E. and others. "Me and My Environment, Final Formative Evaluation Report. A Synthesis of Findings." Boulder, Colorado: Biological Sciences Curriculum Study, 1976, p. 23.

This is the last of a series of formative evaluation reports on the development, field testing, and revision of the BSCS program Me and My Environment. It is a three year program designed for educationally mentally handicapped students, ages 13 through 16. The report summarizes the objectives of the program, factors that influenced project decisions, and the various components of the program.

Nicholson, Charles L. "The Effect of a Series of Television Science Lessons on Learning by Cerebral Palsied Children." (University of Pittsburg, 1969). Dissertation Abstracts International, 30(9): 3818-A, March, 1970. (Order No. 70-4537).

This study examined the effects of two instructional strategies with 31 cerebral palsied children. The experimental group received science instruction via closed circuit television, with microphones present so each pupil could ask questions and participate in discussions. The control group received science instruction via a live teacher. No significant differences were found between the two groups in science achievement, or in the number of questions asked and amount of participation in class discussion. A significant difference in the attention given to the teacher was found in favor of the control group.

Robinson, James T. and Richard R. Tolman. "A Formative Evaluation of ME NOW, Unit I, Digestion and Circulation, Life Science for the Educable Mentally Handicapped Intermediate Grades (11-13 years)." Boulder, CO: University of Colorado, 1970, p. 106.

This report presents the data and interpretations of the data collected to evaluate the first unit of the BSCS special education program ME NOW. There were 139 pupils (mean IQ of 72 and mean CA of 144 months) in the experimental group and 154 pupils (means IQ of 70 and mean CA of 148 months) in the control group.

Shulene, John A. "Inquiry-Oriented Pictorial Riddles in Science for Educable Mentally Handicapped Children." (University of Northern Colorado, 1972). Dissertation Abstracts International, 33(7): 3429-A, January, 1973. (Order No. 73-00311).

The investigator studied the use of pictorial riddles to teach selected science concepts to educable mentally handicapped pupils, ages seven through sixteen. The concepts pertained to their living comfortably and safely in the physical environment. The results demonstrated that pictorial riddles were effective in assisting the mentally handicapped pupils to develop science concepts. A significant difference was obtained on the basis of the gain scores measures by pre- and post-tests.

Slavin, Laurence E. "A Viable Approach for LD/EH Students in a Biology Course." The American Biology Teacher, 41(3): 164-170, March, 1979.

A detailed description of a program in which learning disabled and/or emotionally handicapped secondary students were taught biology is presented. A specially designed biology course was taught to these handicapped students in a regular science classroom by a science teacher and teacher trained to work with students having these handicaps. The reasons for the success of the program and some recommendations for implementing a similar program are given.

Steele, Joe M. "Me and My Environment, Formative Evaluation, Report 1. Arranging Field Tests: Characteristics of Sites and Students." Boulder, Colorado: Biological Sciences Curriculum Study, 1973, p. 31.

Identified are the major questions which the field testing of the BSCS Me and My Environment program sought to answer. Information is given on the criteria used in selecting the teachers and districts for the field testing as well as the characteristics of the classes and pupils selected.

Steele, Joe M. "Me and My Enviroment, Formative Evaluation, Report 2. Assessing Student Abilities and Performances: Year 1." Boulder, Colorado: Biological Sciences Curriculum Study, 1973, p. 51.

This report summarizes the data gathered from the first field test of Units 1 and 2 of the BSCS Me and My Environment program. Student performance on the unit tests was analyzed with regard to a variety of factors. The development of the tests for testing mentally handicapped students is discussed.

Steele, Joe M. "Me and My Environment, Formative Evaluation Report 3. Design and Revision, Data Collection and Portrayal." Boulder, Colorado: Biological Sciences Curriculum Study, 1974, p. 52.

The report describes the process used by BSCS to develop special education programs in science for mentally handicapped students. The impact of authoritative reviews and data from field trials is illustrated. The procedures and instruments used in data collection and processing are given. A case-study of test classroom was used to identify factors that influence the data obtaining process.

Sweeters, William G. "Discovery Oriented Instruction in Science Skills for Educable Mentally Retarded Children." (University of Northern Colorado, 1968). Dissertation Abstracts International, 29(5): 1376-A, November, 1968. (Order No. 68-14739).

The investigator sought to determine if science lessons based on SAPA and ESS activities would help intermediate level educable mentally retarded pupils acquire the skills of making an inference and manipulating variables. No significant differences were found between the experimental and control groups. The pupils in the experimental group appeared to have a more favorable attitude toward the planned science lessons than toward the incidental science lessons they normally had.

Thompson, Ben. "Science in Special Education." NSTA Twenty-Second Annual Meeting - Addresses and Reports, Chicago, Illinois, 1974, pp. 97-98.

Concepts of magnetism and electricity were taught to a class of slow learners (EMR) over a period of one semester using a hands-on inductive approach. It was found that these children could learn basic concepts and generalize to some extent. Inferring concepts such as polarity of magnets and laws were not achieved.

Tolman, Richard. "Final Report: A Formative Evaluation of ME NOW, Life Sciences for the Educable Mentally Handicapped." Boulder, Colorado: Biological Sciences Curriculum Study, December, 1972, p. 305.

This report presents the data and interpretations of the data gathered in the 1970-1971 field testing of the BSCS ME NOW program. Extensive evaluation information on all four units of the program is given.

Tom, Brenda. "Developing a Materials Centered Science Program for Educable Mentally Retarded Children." Exceptional Child Abstacts, 2: 209-210, Abstract 805, August, 1970.

The investigator used the SCIS Materials Object unit to determine if it would help educable mentally retarded pupils, ages seven through thirteen, acquire the skill of grouping objects. While pupils in both the experimental and control groups had better scores on the posttest, there was a significant difference between these scores in favor of the experimental group. The younger pupils in the experimental group made the greatest change in the ability to group objects.

Wilson, John T. and John J. Koran, Jr. "Science Curriculum Materials for Special Education Students." Education and Training of the Mentally Retarded, 8(2): 30-32, April, 1973.

The authors describe a study involving a teacher, student teacher, and 11 handicapped students. Extensive case studies were done on the students to determine their capabilities so their individual differences could be considered. The science lessons were based on the Science-A Process Approach (SAPA) program. The SAPA materials, with structural modifications, provided the wide range of experiences necessary in making the science lessons a success.

Winn, Robert J. "The Survival of Educable Mentally Retarded Children in the Regular Classroom in Science and Social Studies as Related to Academic Deviation from Normal Children." (The University of Texas at Austin, 1975). Dissertation Abstracts International, 37(1): 230-A, July, 1976. (Order No. 76-14, 535).

The investigator compaired the academic achievement in science and social studies of educable mentally retarded students who had been placed in regular classrooms with the achievement of the non-handicapped students in those classrooms. A significant difference in achievement between these two groups was observed in both science and social studies. A significant interaction was also detected when grade level served as a covariate.