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DESCRIPTORS Achievement Tests; Attitude Tests; *Educational Testing; *Resource Materials; *Science Education; Student Ability; Student Characteristics; *Test Reliability; Tests; *Test Validity

ABSTRACT

A brief description of 156 unpublished evaluation instruments constructed mostly between 1964 and 1968 is presented in this handbook to facilitate selection of appropriate test forms by researchers in science education. The instruments are related to all levels of elementary, secondary, and college instruction and classified under the headings: Achievement in Science, Achievement in Processes and Skills of Science, Characteristics and Abilities of Students, Attitudes, Knowledge of the Nature of Science, and Professional Practices. The achievement section is identified with such science areas as: general biology, ecology, zoology, earth science, anthropology, astronomy, geology, chemistry, physics, and general physical science; the professional practices section is divided into instructional activities, beliefs and attitudes, supervisory practices, and teacher expectations of students. Title, factors, format, population, reliability, norms, validation, and reference are entries described in detail for each instrument. Preparation of the second volume to fill in the gap between 1968 and the present is underway. (CC)
SMEAC/SCIENCE, MATHEMATICS, AND ENVIRONMENTAL EDUCATION
INFORMATION ANALYSIS CENTER

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OCCASIONAL PAPER SERIES - SCIENCE PAPER 7
HANDBOOK OF UNPUBLISHED EVALUATION INSTRUMENTS IN SCIENCE EDUCATION

by

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January, 1973
The Science, Mathematics, and Environmental Education Information Reports are being developed to disseminate information concerning documents analyzed at the ERIC Information Analysis Center for Science, Mathematics, and Environmental Education. The reports include four types of publications. Special Bibliographies are developed to announce availability of documents in selected interest areas. These bibliographies will list most significant documents that have been published in the interest area. Guides to Resource Literature for Science, Mathematics, and Environmental Education Teachers are bibliographies that identify references for the professional growth of teachers at all levels of science, mathematics, and environmental education. Research Reviews are issued to analyze and synthesize research related to science, mathematics, and environmental education over a period of several years. The Occasional Paper Series is designed to present research reviews and discussions related to specific educational topics.

The Science, Mathematics, and Environmental Education Information Reports will be announced in the SMEAC Newsletters as they become available.
The Occasional Paper Series (Science) is designed to review literature related to specific topics or educational programs related to the teaching and learning of science. We hope these papers will provide ideas for implementing research, suggestions for areas that are in need of research, and suggestions for research design.

Stanley L. Helgeson
Editor

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The primary purpose of the Handbook is to provide the researcher in science education with a ready and comprehensive source of information on unpublished evaluation instruments designed for science education studies. It is hoped that the Handbook will find wide usage and will result in more frequent utilization of available instruments than has occurred in the past. It is the opinion of the compiler of the Handbook, that much energy has been wasted in the development of instruments to measure characteristics already measureable by existing instruments. Also it is hoped that a comprehensive compilation such as represented here will also lead to identification of areas in which there is a paucity of useful instruments and thereby stimulate instrument development in these areas. The author is currently working on a review paper which will summarize this type of information.

Instruments were identified in two ways. A questionnaire was sent to the National Association For Research In Science Teaching membership in the Autumn of 1970 requesting information on instruments developed at the member's institution. A follow-up questionnaire was mailed in Autumn, 1971. Twenty-four instruments were identified in this manner. The bulk of the 156 instruments included in the Handbook, however, were identified through a search of the holdings of the Science, Mathematics, and Environmental Education Information Analysis Center.
The following criteria were used in determining whether an instrument was to be included in the handbook:

1. **Objectivity** - A scoring system is presented which is readily usable by other researchers. The bulk of the instruments would be classified as of the "objective" type.

2. **Respondent completed** - The instrument measures some characteristic held by the respondent or asks the respondent to characterize something he is familiar with. Researcher-completed observational instruments are not included.

3. **Availability** - The instrument must be readily available to the researcher. There are four general sources: University Microfilms for instruments included in dissertations; ERIC Microfiche collections for instruments included in documents having an ED number; a journal article for those few instruments which have been published this way; and directly from the author for those instruments sent in response to the questionnaire.

4. **General usefulness** - The compiler came across many content achievement instruments. Many were designed for a particular local curriculum, or to determine content outcomes of specific instructional media, such as films. Unless such instruments presented a novel format or design, they were not included.

This compilation includes instruments primarily from studies completed between 1964 and 1968. It is comprehensive for that time period. It also includes some from older studies and a number from more recent studies. An effort is now underway to fill in the gap between 1968 and the present. A second volume will be available by the end of 1973. The compiler would like to receive comments and suggestions on the usefulness of the current format and also information on additional instruments from the science education.
community. These will be taken into account in the updating of the Handbook.
It should be noted that the Handbook includes instruments for all levels of
elementary, secondary and college instruction so the reader will need to
examine each section to determine the appropriateness of an instrument within
a topical area.

Frequently used symbols:

\[ r = \text{reliability} \]

\[ \bar{X} = \text{mean} \]

\[ \text{S.D.} = \text{standard deviation} \]

\[ \text{S.E.} = \text{standard error} \]

\[ \text{BSCS} = \text{Biological Sciences Curriculum Study} \]

\[ \text{CHEMS} = \text{Chemical Education Materials Study} \]

\[ N = \text{Population size} \]

\[ \text{K-R 20} = \text{Kuder - Richardson 20} \]
I. ACHIEVEMENT IN SCIENCE

A. Biological Science

1. General Biology

Title: LIFE SCIENCE CONCEPT TEST

Factors: Selected life science concepts

Format: Six pictures are presented for each concept; each picture representing a characteristic of the concept. Understanding is assessed on basis of student responses to each picture.

Population: Children in grades one through six

Reliability: \( r = .84 - .94 \) (test - retest) \( N = 192 \)

Norms:
- \( \overline{X} = 6.22 \) \( S.E. = .64 \) (grade two)
- \( \overline{X} = 18.91 \) \( S.E. = 1.25 \) (grade six)

Validation: Concurrent validity; correlation coefficient with Otis Test of Mental Ability ranged from 0.31 to 0.67.


Title: GENERAL BIOLOGY - FINAL EXAM

Factors: Achievement in biology

Format: 80 multiple-choice items

Population: General Biology students in Jamestown Community College and in the State University of New York at Buffalo

Reliability: Not available

Norms: No overall statistics given

Validation: Content validity based on table of specifications for course content common in the two schools. Most taken from Dressel and Nelson Questions and Problems in Science (1960).

Reference: Kochersberger, Robert. "A Comparison of Achievement of General Biology Students in a Community College with

| Title: | 1) HOMEOSTASIS  
|        | 2) LEVEL OF ORGANIZATION  
|        | 3) PLANT KINGDOM  
|        | 4) METABOLIC RATE TEST  
|        | 5) PROBLEMS IN BOTANY  
| Factors: | Knowledge acquisition(1-3), analytic ability (4-5)  
| Format: | 15 to 20 true-false or multiple-choice items on each instrument  
| Population: | Freshman and sophomore elementary education majors  
| Reliability: | Instruments 1-3: r = .76 - .82 (Pearson product-moment correlation of split-half analysis)  
|             | Instruments 4-5; r = .67 - .74 (Pearson r correlation of test-retest scores)  
| Norms: | Not available  
| Validation: | Not available  

---

Title: BSCS BIOLOGY, SM EVALUATION 1968-69 (UNIT TESTS)  
Factors: Achievement in five areas of the course materials of Biological Science: Patterns and Processes. The areas include: ecological relationships, cell energy processes, reproduction and development, genetic continuity, and organic evolution.  
Format: Two test forms (A and B) were developed for each of the five areas. Tests consist of multiple-choice items.  
Population: Students using the Biological Science: Patterns and Processes; primarily suburban and rural 10th graders, with some inner-city students and 9th, 11th and 12th grade students.
<table>
<thead>
<tr>
<th>Test</th>
<th>N</th>
<th>SE*</th>
<th>Number of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecology</td>
<td>289</td>
<td>7.9</td>
<td>24</td>
</tr>
<tr>
<td>Cell Energy</td>
<td>259</td>
<td>7.9</td>
<td>30</td>
</tr>
<tr>
<td>Processes</td>
<td>259</td>
<td>4.1</td>
<td>30</td>
</tr>
<tr>
<td>Reproduction and</td>
<td>220</td>
<td>3.9</td>
<td>30</td>
</tr>
<tr>
<td>Development</td>
<td>220</td>
<td>3.9</td>
<td>30</td>
</tr>
<tr>
<td>Genetic Continuity</td>
<td>189</td>
<td>3.7</td>
<td>27-26</td>
</tr>
<tr>
<td>Evolution</td>
<td>No information</td>
<td>16</td>
<td></td>
</tr>
</tbody>
</table>

Pretest statistics on each of the two forms (A and B) for four unit tests.

* Hoyt analysis of variance

** % correct

Validation: Each area of study was analyzed for concepts which then served as guides for item development.


ED 039 149  MF $0.65  HC $9.87  262 pp.

Title: THE BIOLOGICAL PRINCIPLES TEST

Factors: Ability to identify and apply major biological principles

Format: 50 multiple-choice items

Population: High school seniors

Reliability: $r = .73$ (Split-half technique with Spearman-Brown Correlation)

N = not available

Norms: $\bar{X} = 25.28$  

Validation: Content validity estimated from comparison with published lists of biological principles. Construct validity
established through evaluation of items by high school biology teachers.


| Title: | UNIT ACHIEVEMENT TEST |
| Factors: | Knowledge of respiration (BSCS unit) |
| Format: | 40 multiple-choice items |
| Population: | 9th grade biology students |
| Reliability: | $r = .86$ (K-R 20) $N = 180$ |
| Norms: | Not available |
| Validation: | Items were selected from questions contributed by 12-member jury on basis of discrimination and difficulty indices using limits established by Garrett. (Henry Garrett, Statistics for Education and Psychology, New York: Longman, Green and Company, 1962, p. 351.) |

| Title: | EXAMINATION IN BIOLOGY |
| Factors: | Knowledge of biological concepts |
| Format: | Six subtests of 50 multiple-choice items each |
| Population: | High school biology students |
| Reliability: | Ranged from $.71 - .81$ on subtests. Established through alternate form method. ($N = 421$ to 607) |
| Norms: | Percentile norms given on pp. 108-110 |
| Validation: | Concurrent validity for subtests established by comparison with total score. Content validity established by panel. |
University Microfilms Order No. 68-6185

Title: FINAL EXAMINATION
Factors: Biological facts and concepts
Format: 50 multiple-choice items
Population: Students enrolled in first course in college biology
Reliability: $r = .93$ Guilford method of rational equivalence
Norms: $\bar{X} = 27.7$ S.D. = 6.96 $N = 234$
Validation: Content validity determined by author
University Microfilms Order No. 68-14,237

Title: LESSON TESTS 1-11
Factors: The achievement of concepts related to the biological cell at three levels; Knowledge, Comprehension and Application (based on Bloom's Taxonomy).
Format: Combinations of multiple-choice and yes-no questions. 36 items on each test
Population: Students in grades 2 through 6; 20 students from one class at each grade level
Reliability: Varied on each test between cognitive levels; maximum range -.47 to .73, minimum .83 - .89; range for total reliability .44 to .85.
Norms: Not available
Validation: Not available
Title: UNIT TESTS

Factors: Achievement on each of eight topics:

I  Botany       VI  Learning and the
II Nutrition and digestion   Nervous System
III Respiration     VII Reproduction
IV Blood and Circulation  VIII Genetics
V  The Conquest of Disease

Format: Objective items including matching, multiple-choice and
true-false

Population: Ninth and tenth grade students of University High School,
Minneapolis

Reliability: Hoyt's variation of K-R 20*

I  r = .86       VI  r = .80
II  r = .92      VII  r = .84
III  r = .90      VIII  r = .85
IV  r = .83
V  r = .76

* C. J. Hoyt "Note on A Simplified Method of Computing Test
Reliability." Educational and Psychological Measurement, I.
(January, 1941) pp. 93-5.

Norms:

I  \( \bar{X} = 32.83 \) - 37.08  S.D. = 6.53 - 9.34 (53 items)
II  \( \bar{X} = 40.39 \) - 51.92  S.D. = 9.73 - 12.69 (66 items)
III  \( \bar{X} = 28.30 \) - 34.79  S.D. = 8.64 -11.14 (66 items)
IV  \( \bar{X} = 37.70 \) - 44.33  S.D. = 6.26 - 7.71 (54 items)
V  \( \bar{X} = 20.09 \) - 25.04  S.D. = 4.72 - 5.97 (35 items)
VI  \( \bar{X} = 19.26 \) - 24.42  S.D. = 4.70 - 6.43 (32 items)
VII  \( \bar{X} = 24.35 \) - 30.85  S.D. = 5.97 - 7.93 (41 items)
VIII  \( \bar{X} = 19.61 \) - 22.77  S.D. = 4.73 - 6.45 (32 items)

Validation: Internal consistency determined through a method outlined
by Frederick B. David, Items Analysis Data, Cambridge,
Massachusetts: Harvard University, 1949.

Reference: Walters, Louis Lloyd. "A Comparison of Achievement in
High School Biology When Taught to Ninth Grade and Tenth
Grade Pupils." Unpublished doctoral dissertation, Uni-
University Microfilms Order No. 61-3690
2. Botany

Title: BOTANY FACTUAL EXAMINATION

Factors: Ability to record and identify specific items of information in botany

Format: 51 items including multiple-choice, short answer and pictorial

Population: Students enrolled in College Botany at The University of Toledo

Reliability: \( r = .81 \) (K-R 21) \( N = 84 \)

Norms: Not available

Validation: Comparison of items with lecture topics for content validity

University Microfilms Order No. 66-0307

3. Ecology

Title: POST TEST

Factors: Knowledge, comprehension and application of ecological concepts

Format: 60 multiple-choice items

Population: Seventh and ninth grade students

Reliability: \( r = .82 \) (Analysis of variance)

Norms: \( \bar{X} = 22.34 \), \( S.D. = 8.29 \)

Validation: Not available

University Microfilms Order No. 67-17040
4. Zoology

Title: ZOOLOGY FINAL

Factors: Achievement in zoology content

Format: 75 matching and multiple-choice questions and three essay questions

Population: 10th grade biology students in Wausau, Wisconsin

Reliability: Not available

Norms: No overall mean or standard deviation given. N = 176

Validation: Not available


University Microfilms Order No. 65-5108
B. Earth Sciences

1. Earth Science

Title: EARTH SCIENCE ACHIEVEMENT TEST

Factors: Achievement in cognitive areas of traditional earth science course

Format: 75 multiple-choice items

Population: Ninth grade earth science students

Reliability: \( r = .83 \) (K-R 20) \( N = 1002 \)

Norms: Means reported in dissertation

Validation: Items developed by earth science teachers. Trial with 121 earth science students provided item analysis information for final revision.

University Microfilms Order No. 70-15,522

Title: STUDENT EARTH SCIENCE TEST

Factors: Earth science knowledge

Format: 40 multiple-choice items

Population: Junior high school students

Reliability: Not available

Norms: Not available

Validation: Items written and selected by science educators

Reference: Earth Science Education Project
Box 1559
Boulder, Colorado 80306 (John Thompson)
Title: 1) ACHIEVEMENT TEST  
2) UNIT TESTS (4)

Factors: 1) Subject matter achievement (earth science)  
2) Achievement in geology (2), meteorology, astronomy

Format: 60 multiple-choice items on each test

Population: Sophomore college students enrolled in physical science at SUNY College at Buffalo

Reliability: 1) $r = .71 - .85$ (K-R 20) $N = 245$  
2) $r = .70 - .82$ 

Norms: 1) Post-test $\bar{X} = 29.64$ (experimental)  
2) Range $\bar{X} = 33.45 - 42.05$ S.D. = 7.87 - 7.59 
$N = 119$ (experimental)

Validation: Content validity determined by author

University Microfilms Order No. 69-15,195

2. Anthropology

Title: EARLY MAN IN AMERICA

Factors: Achievement in facts and concepts concerning early man

Format: 60 multiple-choice items

Population: Eighth-grade earth science students

Reliability: $r = .85$ (K-R 20) $N = 143$

Norms: Not available

Validation: Not available

University Microfilms Order No. 68-16865
3. Astronomy

Title: TRIAL TEST II

Factors: Achievement in the content of Chapter Four "Charting The Earth" from the text Charting the Universe developed by the Illinois Elementary School Science Project

Format: 55 multiple-choice items

Population: Sixth grade students

Reliability: \( r = .922 \) (Kuder-Richardson) \( N = 62 \)

Norms: \( \bar{X} = 26.0 \) \( \text{S.D.} = 11.7 \) \( N = 62 \)

Validation: 93 item test administered to forty students who had completed Chapter Four. Difficulty level and internal validity of instrument determined by item analysis.


Title: CHARTING THE UNIVERSE TEST

Factors: Achievement of concepts presented by Elementary School Science Project materials

Format: 37 multiple-choice items and five problems

Population: Fifth grade students in a university laboratory school

Reliability: \( r = .829 \) (K-R 20) \( N = 92 \)

Norms: \( \bar{X} = 12.98 \) \( \text{S.D.} = 4.47 \) \( N = 90 \) (Post-test)

Validation: Not available


ED 032 221 MF $0.65 HC $3.29 59 pp.
Title: ASTRONOMY TEST
Factors: Selected astronomy concepts
Format: 25 multiple-choice items
Population: Sixth grade students
Reliability: Not available
Norms: $\bar{X} = 14.21$  S.D. = 4.34  $N = 5,131$
Validation: Not available
University Microfilms Order No. 66-6906

Title: TEST ON ASTRONOMY FACTS
Factors: Knowledge of astronomy facts
Format: 30 multiple-choice items
Population: College students enrolled in a survey of physics course
Reliability: Not available
Norms: $\bar{X} = 19.5$ and 21.4  $N = 207$
Validation: Content validity judged by author
University Microfilms Order No. 65-13869

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4. Geology

Title: GEOLOGICAL CONCEPTS TEST, GRADES 4, 5, 6
Factors: Understanding of selected geological concepts
Format: 44 multiple-choice items
Population: High and low achievers in grades four through six
Reliability: $r = .84$ (K-R 20) $N = 293$
Norms: Not available
Validation: Jury established content validity
University Microfilms Order No. 65-4483
C. Physical Science

1. Chemistry

Title: (None)

Factors: The level understanding of chemistry information; 1) Knowledge 2) Comprehension 3) Application 4) Analysis

Format: Reading passage followed by 45 multiple-choice items

Population: Students enrolled in high school chemistry

Reliability: Not available

Norms: Listed on pp. 32-42 of dissertation (N's = 230 and 408)

Validation: Selection of items from Dressel and Nelson, Questions and Problems in Science -- Test Folio No. 1; additional items developed by investigator. Reading passage and items submitted to panels of judges.


Title: ACHIEVEMENT TESTS ON NUCLEAR CHEMISTRY

Factors: Two tests, each assesses achievement in nuclear chemistry

Format: 44 multiple-choice items

Population: High school chemistry students

Reliability: \( r = .841 \) and \( .882 \) (K-R 20) \( N = 638 \)

Norms: Not available

Validation: Face validity determined by five-member jury

Title: MATHEMATICS SKILL TEST IN CHEMISTRY

Factors: Measures student performance at three cognitive levels on ten basic mathematics skills: computation, signed numbers, use of parentheses, fractions, decimals, exponents, percent, one-variable equations, ratio and proportions, and graphing.

Format: 60 multiple-choice items

Population: High school chemistry students

Reliability: $r = .963$ (K-R 20) $N = 272$

Norms: $\bar{X} = 24.83$ $S.D. = 16.36$ $S.E. = .77$ $N = 272$

Validation: Judgemental validity by jury and item analysis. Concurrent validity by comparison with 1969 American Chemical Society High School Chemistry test ($r = .799$)

Reference: Rita T. Denny
Graduate School of Education
University of Pennsylvania
37th & Walnut Street
Philadelphia, Penn. 19104

Title: ONTARIO TEST OF ACHIEVEMENT IN CHEMISTRY

Factors: Achievement of cognitive objectives of knowledge, comprehension, application and analysis in chemistry

Format: Sixty multiple-choice items

Population: 12th grade chemistry students in college preparatory program of Ontario high schools

Reliability: $r = .819$ (K-R 20) $N = 2339$

Norms: $\bar{X} = 25.15$ $S.D. = 8.13$ $N = 2339$

Validation: Not available


ED 040 850 MF $0.65$ HC $16.45$ 421 pp.
Title: G 3B
Factors: Content achievement in general chemistry
Format: 100 multiple-choice items
Population: First quarter college chemistry students
Reliability: \( r = .84 \) (F-R 20) \( N = 120 \)
Norms: \( \bar{X} = 37.64 \) \( \text{S.D.} = 14.48 \) \( N = 701 \)
Validation: Three member jury of professional chemists

Title: (None)
Factors: Subject matter achievement in chemistry
Format: 30 multiple-choice items
Population: Students in secondary schools in Beirut, Lebanon
Reliability: Not available
Norms: \( \bar{X} = 17.08 \) \( N = 22 \)
Validation: CHEM Study achievement tests used as guide in development. Results of trial submitted to three-person panel for revision.

Title: GENERAL CHEMISTRY EXAMINATION
Factors: Achievement and problem-solving ability in chemistry
Format: 70 true-false items and 10 multiple-choice items
Population: College general chemistry students
Reliability: $r = .72$ (Split-halves technique using Spearman-Brown correction formula) $N = 149$

Norms: Experimental group: $\bar{X} = 32.81$  S.E. = .85  $N = 73$

Validation: Content validity estimated from normal distribution of test scores, examination of test by author and two chemistry professors and correlation with American Chemical Society Problem-Solving Examination.


Title: (SEVEN TESTS INCLUDING PRETEST, MIDTERMS AND FINAL ON CHEMISTRY)

Factors: Application of chemical concepts

Format: 25 to 40 items; multiple-choice or true-false

Population: High school chemistry students, not science oriented, probably not college-bound

Reliability: $r = .66$ (Test-retest of two of the instruments using Pearson Product-Moment Correlation) $N = 20$

Norms: $\bar{X} = 26$ (out of 40 items)  S.D. = 5.42 final exam, experimental group

Validation: Not available


2. Physics

Title: MATHEMATICS-PHYSICS SURVEY EXAMINATION

Factors: The use of mathematical skills in solving physics problems; 1) linear equations 2) inverse equations 3) inverse square equations 4) vector solution 5) equations involving trigonometric relations 6) graph interpretation 7) standard notation 8) simultaneous equations
Format: Section A: 20 physics problems involving the use of mathematical skills
Section B: 20 similar problems with appropriate formula following each item
Section C: 15 mathematical problems involving skills required in Sections A and B.

Population: Secondary school physics students in New York State schools

Reliability: \( r = 0.756 \) (Spearman-Brown using Split-half technique)
\( N = 56 \)

Norms:

A. \( \bar{X} = 14.848 \quad \text{S.D.} = 3.562 \)
B. \( \bar{X} = 16.036 \quad \text{S.D.} = 3.257 \quad N = 362 \)
C. \( \bar{X} = 13.420 \quad \text{S.D.} = 1.370 \)

Validation: Content validity established by five person jury

University Microfilms Order No. 67-107

---

Title: (FOUR "COLLEGE TESTS")

Factors: Achievement in physics

Format: 40 to 45 multiple-choice items in each test

Population: College physics students

Reliability: \( r = 0.87 \) to \( 0.92 \) (Split-halves method using Spearman-Brown Prophecy Formula)

Norms: Not available

Validation: Not available

University Microfilms Order No. 62-1459

---
Title: THEORY TEST IN PHYSICS

Factors: Knowledge of facts, principles and generalizations of physics

Format: Item types include multiple-choice, completion and true-false

Population: Students enrolled in a one-semester terminal physics course at Wisconsin State College in Stevens Point

Reliability: Split-half (Spearman-Brown) r = .88 N = 49

Norms: \( \bar{X} = 69.35 \) S.D. = 11.13

Validation: Not available

University Microfilms Order No. 14,680

Title: LABORATORY PERFORMANCE AND LABORATORY THEORY TEST

Factors: Knowledge of facts, generalization and principles of physics. Two factors identified; theory and performance.

Format: Practical examination with variable format including multiple-choice items

Population: Students enrolled in a terminal one-semester physics course at Wisconsin State College at Stevens Point

Reliability: Theory r = .73 Split-half technique using Spearman-Brown Correlation formula
Performance r = .54 N = 49

Norms: Theory \( \bar{X} = 23.25 \) r = 4.14 N = 49
Performance X = 23.22 r = 5.12

Validation: Not available

University Microfilms Order No. 14,680

22
Title: A TEST OF ABILITY TO IDENTIFY AND APPLY SELECTED PRINCIPLES OF PHYSICS

Factors: See Title

Format: Part I: For each of 19 items a principle is stated followed by an event or phenomenon (situation). Student selects the one of four responses which represents the correct application of the principle.

Part II: Situation is described, student selects principle which is the major cause or explanation for the situation.

Population: 12th grade students

Reliability: Part I; r = .637 (K-R 20)  Part II; r = .719 (K-R 20)
N = 4434

Norms: Part I; X = 8.5 (19 items)
Part II; X = 10 (17 items)

Validation: Content validity determined by panel of judges

Reference: Brian J. Kearney
Slippery Rock State College
Slippery Rock, Pa. 16057

Title: PHYSICS TEST I

Factors: Recall, recognition and understanding of physics content

Format: 40 multiple-choice items

Population: College freshman

Reliability: r = .743 (Split-halves method using Spearman-Brown formula)
N = 211

Norms: Not available

Validation: Content validity by jury. Concurrent validity by comparison with standardized test results and teacher grades.

University Microfilms Order No. 62-1429
Title: MECHANICS ACHIEVEMENT EXAMINATION

Factors: Achievement in mechanics; used as a predictor of success in physics

Format: 50 multiple-choice items

Population: Eleventh graders at Bronx High School of Science

Reliability: $r = .87$ (K-R 20) $N = 127$

Norms: $X = 60.968$ $N = 124$

Validation: Item analysis of entire item pool produced indices of discrimination and difficulty. Items for final test form were selected from those close to the 50% level of difficulty and exceeding 0.20 in discrimination. This form was then modified on the basis of a second item analysis and jury recommendations.


3. General Physical Science

Title: THE TEST OF ELECTROSTATICS CONCEPTS

Factors: Achievement in additive and multiplicative classification, seriation and electrostatics concepts

Format: Practical test with 30 Piagetian-like tasks

Population: Third grade students from high socioeconomic area

Reliability: Not available

Norms: Not available

Validation: Not available


Title: ELECTRICITY AND MAGNETISM

Factors: Understanding of concepts presented in problem-solving situations
Format: 102 multiple-choice items matching ink drawings to vocabulary items
Population: Fifth and sixth grade students
Reliability: \( r = .90 \) (Split-halves method using Pearson product-moment)
Norms: \( \bar{X} = 62.9 \) to 67.0
Validation: Face validity established by four-member jury

Title: (None)
Factors: Application of concepts included in the topic "Light"
Format: 26 situation-based multiple-choice items
Population: Secondary school students in the country of Tanzania
Reliability: \( r = .81 \) (odd-even split-half technique) \( N = 162 \)
Norms: Not available - administered to over 500 students
Validation: Five-member panel of judges

Title: PHYSICAL SCIENCE TEST OVER HEAT AND TEMPERATURE
Factors: Understanding and application of knowledge about heat and temperature
Format: 60 multiple-choice items
Population: Eighth grade students enrolled in physical science classes
Reliability: Reliability coefficient of 88.6 computed from results of test administration to 110 ninth grade students.
Title: (INDIVIDUAL TEST ITEMS)

Factors: Test items were developed related to 25 selected concepts from the scheme, "the particle nature of matter."

Format: Items were of alternate response pictorial type, presented via motion picture film. Five items were developed for each concept. The verbal part of each question was read aloud while student viewed the written question and picture on the screen and in test booklets.

Population: Each item used at all grade levels 2-6

Testing of items: 104 of 125 items developed met at least 4 or 6 criteria established for judging the quality of items

Validation: Items designed to reduce demand on reading and verbal ability of students


Title: SEVENTH GRADE MATTER FINAL

Factors: Achievement of facts and concepts of matter

Format: 50 multiple-choice items

Population: Seventh grade students of a university school

Reliability: $r = .70$ (Kuder-Richardson) $N = 54$

Norms: $\bar{X} = 23.09$  S. D. 2.96  $N = 54$

Validation: Face validity
Title: NONE

Factors: Achievement in elementary atomic structure

Format: 30 multiple-choice items

Population: Eighth-grade general science students of middle class background

Reliability: $r = .73$ (K-R 20)  $N = 769$

Norms: Not available

Validation: Eight member jury of chemical educators


Title: A TEST OF GENERAL PHYSICAL SCIENCE

Factors: Achievement in physical science course content; Knowledge of facts, concepts and principles.

Format: 50 multiple-choice items (two forms)

Population: Elementary education majors in Massachusetts State Teachers Colleges

Reliability: Several methods used yielded reliabilities on post-test ranging between .63 and .87.

Norms: $\bar{X} = 40.34$ (post-test)  $S.D. = 11.56$  $N = 884$

Validation: Validation procedures used included; jury ratings of items, and the index of discrimination on items between high scorers and low scorers.

Title: MATTER, ATOMS, AND MOLECULES

Factors: Recall and application of content - from a unit in matter, atoms and molecules

Format: 60 multiple-choice items split between two subtests; recall and application

Population: Ninth grade physical science students

Reliability: r = .936 (K-R 20) N = 547

Norms: Means for three treatment groups ranged from 35.06 - 38.62

Validation: Three-member jury


University Microfilms Order No. 67-4466

Title: UNIT TEST - MACHINES

Factors: Content achievement in facts and concepts concerning machines

Format: 65 multiple-choice items

Population: 4th, 5th and 6th grade students

Reliability: Experimental groups: r = 0.84 (Kuder-Richardson "rational equivalence" method) N = 60 in each group

Norms: Post-test experimental groups: X (4th grade) = 35.08 X (5th grade) = 38.70 X (6th grade) = 42.85

Validation: 14-member jury established content validity


University Microfilms Order No. 68-9802
Title: UNIT TEST - ELECTRICITY
Factors: Content achievement in facts and concepts concerning electricity
Format: 65 multiple-choice items
Population: 4th, 5th, and 6th grade students
Reliability: Experimental groups: \( r = 0.84 \) (Kuder-Richardson "rational equivalence" method) \( N = 60 \)
Norms: Post-test experimental group, 6th grade \( \bar{X} = 45.95 \)
Validation: 14-member jury established content validity
University Microfilms Order No. 68-9802

Title: PHYSICAL SCIENCE SUBJECT MATTER TEST
Factors: Knowledge of facts and principles in physical science
Format: 59 multiple-choice items
Population: College sophomores enrolled in physical science
Reliability: \( r = .85 \) split-half technique using Spearman-Brown correlation
Norms: \( \bar{X} = 33.75 \quad S.E. \ 3.62 \quad N = 362 \)
Validation: Author selected and developed items with reference to course content. Two course instructors reviewed items for content validity, accuracy and clarity.
University Microfilms Order No. 66-9873
### D. Instruments Not Specific To A Science Area

#### 1. College Level

<table>
<thead>
<tr>
<th>Title</th>
<th>PHYSICAL SCIENCE 114 LABORATORY EXAMINATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factors</td>
<td>Achievement in general science topics</td>
</tr>
<tr>
<td>Format</td>
<td>27 multiple-choice items and one short answer problem</td>
</tr>
<tr>
<td>Population</td>
<td>Freshman and sophomore college non-science majors</td>
</tr>
<tr>
<td>Reliability</td>
<td>$r = .64$ (K-R 20) $N = 60$</td>
</tr>
<tr>
<td>Norms</td>
<td>Not available</td>
</tr>
<tr>
<td>Validation</td>
<td>Determination of internal consistency</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Title</th>
<th>SCIENCE FROM CONCEPTS ACHIEVEMENT TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factors</td>
<td>Measures knowledge of principles and generalizations, comprehension, interpretation, and application. Content areas represented in elementary science textbooks and series.</td>
</tr>
<tr>
<td>Format</td>
<td>64 multiple-choice items</td>
</tr>
<tr>
<td>Population</td>
<td>College students</td>
</tr>
<tr>
<td>Reliability</td>
<td>$r = .723$ (K-R 20) $N = 215$</td>
</tr>
<tr>
<td>Norms</td>
<td>Not available</td>
</tr>
<tr>
<td>Validation</td>
<td>Content validation by jury</td>
</tr>
</tbody>
</table>
| Reference | H. Gene Christman  
The University of Akron  
Science Education Center  
Akron, Ohio 44304 |
Title: GENERAL SCIENCE KNOWLEDGE

Factors: Knowledge of general science concepts

Format: 30 multiple-choice items. Respondent indicates his degree of certainty that he has selected the correct response.

Population: Students in professional education classes

Reliability: $r = 0.680$ (K-R 20) $N = 60$

Norms: $\bar{X} = 7.02$ S.D. = 2.73 $N = 60$

Validation: Not available


University Microfilms Order No. 68-8692

Title: FINAL EXAMINATION

Factors: Achievement in diverse science topics

Format: Completion, multiple-choice and essay items. (2 forms)

Population: College non-science majors

Reliability: Not available

Norms: Not available

Validation: Not available


University Microfilms Order No. 3357
2. Secondary Level

Title: PORTLAND SCIENCE TEST

Factors: Knowledge of products of science and understanding and ability to use processes of science

Format: 60 multiple-choice items in product-process pairs

Population: Eighth grade students in Portland from a variety of backgrounds

Reliability: $r = 0.85$ (Garrett rational equivalence method) $N = 515$

Norms:
- Experimental group $N = 262$
  - Process $\bar{x} = 16.2$ S.D. = 4.65
  - Product $\bar{x} = 16.6$ S.D. = 5.50
  - Total $\bar{x} = 32.8$ S.D. = 9.59

Validation: Jury of all Portland ninth grade science teachers

University Microfilms Order No. 67-716

Title: SCIENCE SKILLS TEST

Factors: Spelling, vocabulary, reading comprehension and total achievement in science

Format: 70 to 100 multiple-choice items in each of four sub-tests

Population: Eighth grade biology students

Reliability: $r = .73$ to $.94$ (Split halves on sub-tests) $N = 166$

Norms: Not available

Validation: Not available

University Microfilms Order No. 67-6121
Title: TEACHER-MADE SUBJECT-MATTER TESTS

Factors: Content achievement in general science;
1) Living things
2) Simple machines
3) Airplanes
4) Electricity and Magnetism
5) Chemistry
6) Geology

Format: Completion, multiple-choice and true-false items; the six tests total 215 items

Population: Eighth grade students

Reliability: Method not reported

1) r = .70  4) r = .55
2) r = .76  5) r = .91  N = 56
3) r = .57  6) r = .84

Norms:
1) X = 23.59  S.D. = 5.47
2) X = 11.98  S.D. = 4.24
3) X = 19.54  S.D. = 3.22  N = 56
4) X = 21.37  S.D. = 3.70
5) X = 28.35  S.D. = 12.50
6) X = 29.07  S.D. = 8.15

Validation: Validity indices range from .74 to .95 on subtests. Method of determination not given.


Title: JUNIOR HIGH SCIENCE ACHIEVEMENT TEST

Factors: Achievement of science vocabulary

Format: 116 matching and discrimination items

Population: Ninth grade science students from suburban schools

Reliability: r = .889 (Split halves technique using Spearman-Brown formula)  N = 593

Norms:
X = 65.50  S.D. = 13.54  N = 593
Title: QUALITY CONCEPT INVENTORY OF TWENTY SELECTED SCIENCE WORDS

Factors: Level of comprehension of the twenty science words expressing concepts having various degrees of complexity

Format: Two forms, senior high school and junior high school. Both contain three true statements on each of twenty words. For each statement, respondents are asked to indicate agreement, disagreement, or indecision. (Part I) Respondents are then asked to rank each of the three statements associated with a word according to their importance. (Part II)

Population: Junior and senior high school children in Colorado schools

Reliability: Part I: $r = .83$ (junior high form) and $.80$ (senior high form) K-R 20

Part II: reliability coefficients for average rankings ranged above $.88$ except for one word on junior high form.

Norms: Not available. Given to 5,713 students.

Validation: Jury assessed validity of statement and ranked them according to complexity. Reliability coefficient for rankings ranged above $.90$ on all 20 sets of statements.


University Microfilms Order No. 64-1943

Title: PRETEST

Factors: Knowledge and understanding of the concept of equilibrium; ability to use concept as a first level cognitive "organizer".

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3. Elementary Level

Title: PICTURE TEST FOR COMPREHENSION OF SCIENCE CONCEPTS
(One test for each of three grade levels)

Factors: Achievement in science concepts

Format: Picture and word description of 15 problem situations
Student selects one of three pictures he feels represents
a correct result.

Population: Urban kindergarten, first, and second grade children
classed as non-readers

Reliability: Not available

Norms: Not available

Validation: Content validity judged by author and "experts"

Reference: Boener, Charlotte M. "An Evaluation of the Grade Place-ment
of Science Concepts in the Early Elementary Grades
of the Minneapolis Public Schools." Unpublished doctoral
University Microfilms Order No. 66-3411
Reliability: r = .73 (Split halves method using Spearman-Brown Prophecy Formula) N = 300

Norms: Not available

Validation: Four-member jury


Title: READING INVENTORY OF SCIENCE KNOWLEDGE
Factores: Achievement of science knowledge
Format: 60 multiple-choice items
Population: Fifth grade students
Reliability: r = .86 (Split halves method using Spearman-Brown Prophecy Formula) N = 360
Norms: Not available
Validation: Four-member jury

Title: PICTURE TESTS AND OBJECT IDENTIFICATION TESTS
Factors: Identification of scientific knowledge held by entering kindergarten students
Format: Picture test, interviews and object identification test used in a verbal testing situation
Population: Entering kindergarten students in Shaker Heights, Ohio
Reliability: Not available
Norms: See dissertation starting on page 88

Validation: Test based on content analysis of four elementary science textbooks

University Microfilms Order No. 64-5100

Title: 1) KNOWLEDGE 2) COMPREHENSION 3) APPLICATION

Factors: Achievement in understanding certain concepts at the knowledge, comprehension and application levels

Format: 40 multiple-choice items

Population: Second through sixth grade students

Reliability: Internal consistency reliability determined through use of Hoyt Analysis of Variance
1) .80 2) .74 3) .75 Total = .90

Norms: Listed by concept and level in dissertation

Validation: Content validity assessed by jury

University Microfilms Order No. 67-16956

Title: QUALITY CONCEPT INVENTORY OF TWENTY SELECTED SCIENCE WORDS

Factors: Levels of comprehension of twenty science words

Format: Two forms; primary for grades K-3, intermediate for grades 4-6.
Primary: Respondent identified most important of three statements associated with each word.
Intermediate: Respondent assessed the correctness of each statement and ranked them in order of importance.

Population: Children in grades K through six in Colorado schools

Reliability: Determined in pilot studies, but not reported
Norms: Not available. Given to 6,447 students

Validation: 48-member jury assessed validity of statements and ranked them according to complexity. Reliability coefficient for rankings ranged from .91 to .99 for the 20 sets of statements.


Title: (None)

Factors: Achievement in science

Format: 40 multiple-choice items

Population: Fifth and sixth grade students

Reliability: Spearman-Brown split half correlation; 6th grades = .87, 5th grades = .85, N = 2934

Norms: \( \bar{X} = 15.31 \) to 17.60, S.E. = .13 - .17, N = 2934

Validation: Six-member jury


Title: PRE-TEST, CRITERION TEST A, CRITERION TEST B

Factors: Knowledge comprehension and application of selected science concepts

Format: 35 to 40 multiple-choice items

Population: Sixth grade pupils

Reliability: Kuder-Richardson internal consistency formula used to establish reliabilities of .64 to .71. N = 186 - 190
Norms: \[ \bar{x} = 19.82 - 20.27 \quad S.E. = 2.57 - 2.83 \quad N = 186 - 190 \]

Validation: Not available


Title: SCIENCE CONCEPT TEST (PCE); Detroit Edition

Factors: Understanding of selected science concepts

Format: Seven pictorial representatives of a science concept; Each is followed by three multiple choice items

Population: Ten and eleven year old children enrolled in Detroit elementary schools

Reliability: Not available

Norms: Not available

Validation: Two groups of students were identified; those that scored well on certain concepts and those that scored poorly on the same concepts. These students were interviewed by teachers who evaluated their understanding of the same concepts. The hypothesis that no relationship existed between PCE results and teacher assessment of students understanding could be rejected.


Title: (None)

Factors: Achievement of the behavioral objectives of the following units: 1) Seeds, 2) Classification, 3) Temperature, 4) Time, 5) Water, 6) Energy

Format: Oral examination
Population:  
1 and 2 -----------First Graders  
3 and 4 -----------Third Graders  
5 and 6 -----------Sixth Graders  

Reliability: Not available  
Norms:  
1 and 2  N = 160  No Means, etc. given  
3 and 4  N = 192  
5 and 6  N = 190  

Validation: Not established  
ED 041 762  MF $0.65  HC $6.58  167 pp.  

Title: LESSON TESTS  
Factors: Knowledge, comprehension, application of selected science concepts  
Format: Eleven tests of 36 "yes-no items" each  
Population: Pupils from grades 2-6 of heterogeneous socioeconomic grouping  
Reliability: Range from .44 to .85  N = 100  
Norms: Not available  
Validation: Not available  
University Microfilms Order No. 67-17030
## II. ACHIEVEMENT IN PROCESSES AND SKILLS OF SCIENCE

<table>
<thead>
<tr>
<th>Title:</th>
<th>BASIC SCIENCE PROCESSES TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factors:</td>
<td>Achievement in science processes as defined by AAAS</td>
</tr>
<tr>
<td>Format:</td>
<td>Slides and correlated audio-tapes</td>
</tr>
<tr>
<td>Population:</td>
<td>First through third graders from agriculturally oriented community</td>
</tr>
<tr>
<td>Reliability:</td>
<td>$r = 0.353 - 0.711$ (Test-retest) $N = 854$</td>
</tr>
<tr>
<td>Norms:</td>
<td>Not available</td>
</tr>
<tr>
<td>Validation:</td>
<td>Not available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Title:</th>
<th>X - 35 TEST OF PROBLEM SOLVING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factors:</td>
<td>Identification of the following behaviors considered to be part of the practice of science: 1) Early formation of hypothesis; 2) Specific experimentation with relevant variables as contrasted to random guessing; 3) Introduction of control to test the validity of a hypothesis selected; 4) Specific attempts at verification of the hypothesis.</td>
</tr>
<tr>
<td>Format:</td>
<td>The instrument presents the respondent with 1) a specific problem, 2) data he might employ in solving the problems, 3) a list of possible solutions including the correct one. Responses judged on a scale of 1 to 5 with reference to the four criteria quoted above.</td>
</tr>
<tr>
<td>Population:</td>
<td>College students</td>
</tr>
<tr>
<td>Reliability:</td>
<td>Comparison of individual scores in the two problems of the instrument yielded a reliability coefficient of .54.</td>
</tr>
<tr>
<td>Norms:</td>
<td>Not available</td>
</tr>
</tbody>
</table>
Validation: Construct validity with reference to a defined model of problem solving behavior. Agreement between evaluations of investigator and judges on the three parts ranged from .62 to .87.


Title: TEST OF UNDERSTANDING OF THE ELEMENTS OF MODEL BUILDING

Factors: Level of understanding of model building

Format: 48 multiple-choice items

Population: Eighth grade science students

Reliability: $r = .31$ to $.71$ (K-R 20)  $N = 817$

Norms: $\bar{X} = 23.08$ and 19.93  $S.D. = 6.85$ and 6.25 (Post-test)

Validation: Face validity determined by 7-member jury


University Microfilms Order No. 66-14,369

Title: CONCEPT-PROCESS TEST

Factors: Understanding of scientific concepts and processes. Test designed to be used in assessing these factors in classes representing all the commonly taught secondary science curriculums.

Format: 38 multiple-choice items subdivided into concept and process subscales

Population: Science students in grades 6 through 12 in schools of central Ohio

Reliability: Total $r = 0.835$  K-R 20  $N = 1399$

Concept $r = 0.655$

Process $r = 0.802$
Title: COMBINATIONAL PROBLEM SET
Factors: Combinational skill in mathematics and general science
Format: Ten problems
Population: Sixth grade students in middle class, suburban area
Reliability: $r = .8109$ (Test-retest method using Pearson $r$ correlation)
N = 32
Norms: Not available
Validation: Eight-member jury

Title: SEVENTH GRADE MATTER SKILLS TEST
Factors: Science laboratory skills
Format: Practical
Population: Seventh grade students of a university school
Reliability: Not available
Title: (13 TESTS)

Factors: Achievement of laboratory skills in chemistry including; equipment identification, general operations, special operations, errors in technique, interpreting experiments, use of tools, designing experiments for several purposes, measurement of characteristics, ordering data, formulating hypothesis and predicting effects of actions.

Format: The 13 tests each consist of one situation with a variable number of questions requiring essay, short answer or matching responses. Situations are presented through color slides and color motion picture scenes.

Population: College chemistry students

Reliability: Not available

Norms: Not available

Variation: Not available


University Microfilms Order No. 66-1928

Title: TAB SCIENCE TEST

Factors: Inquiry behaviors of searching, data processing, verifying, discovering, assimilating and accommodating.

Format: Tab-item

Population: 4, 5, and 6 grade students from wide socioeconomic range
Reliability: Coefficients of equivalence = .420 (N = 238) and internal consistency of .497 (form A) and .532 (form B).

Norms: | Form | Max. Score | Mean | S.D. | N |
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>364</td>
<td>296</td>
<td>51.5</td>
<td>1264</td>
</tr>
<tr>
<td>B</td>
<td>346</td>
<td>260</td>
<td>58.5</td>
<td>1255</td>
</tr>
</tbody>
</table>

Validation: Concurrent validity analysis with teacher rankings (.64)


Title: RATIO TASK
Factors: Ability to apply the concept of ratio
Format: A problem and categorizations of student responses to the problem
Population: Fourth through twelfth grade
Reliability: Not available
Norms: Not available
Validation: Not available
Reference: Robert Karplus and Rita W. Peterson Science Curriculum Improvement Study Lawrence Hall of Science University of California Berkeley, California 94720

Title: GRAPH INTERPRETATION INSTRUMENT
Factors: Ability to interpret graphs
Format: 15 multiple-choice items based upon graphs
Population: Majors (juniors or seniors) in elementary education
Reliability: Not available
<table>
<thead>
<tr>
<th>Title:</th>
<th>SPECIAL EARTH SCIENCE EXAMINATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factors:</td>
<td>Level of inquiry ability</td>
</tr>
<tr>
<td>Format:</td>
<td>50 multiple-choice items</td>
</tr>
<tr>
<td>Population:</td>
<td>Ninth grade earth science students</td>
</tr>
<tr>
<td>Reliability:</td>
<td>Not available</td>
</tr>
<tr>
<td>Norms:</td>
<td>Not available</td>
</tr>
<tr>
<td>Validation:</td>
<td>Twenty-four member jury held 89% agreement on items using high versus low inquiry ability.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Title:</th>
<th>(No Title)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factors:</td>
<td>Ability to use evidence from observations aided by scientific instruments</td>
</tr>
<tr>
<td>Format:</td>
<td>Respondents asked orally to differentiate between masses or volumes of pairs of objects visually and then by use of evidence from balances and graduated cylinders. They indicate their level of confidence in each answer.</td>
</tr>
<tr>
<td>Population:</td>
<td>Pupils from grades one through six of the Ohio State University School and the public schools of Central Ohio</td>
</tr>
<tr>
<td>Reliability:</td>
<td>Not available</td>
</tr>
<tr>
<td>Norms:</td>
<td>Not available</td>
</tr>
</tbody>
</table>
Validation: Pilot testing was used to refine testing technique and materials.


Title: FIFTH GRADE SCIENCE PROBLEM SOLVING TEST

Factors: Ability to: 1) identify hypotheses  
2) identify problems  
3) identify valid conclusions

Format: 36 multiple-choice items based on description of hypothetical situations

Population: Fifth grade students

Reliability: $r = .81$ (Test-retest method using Pearson's Product-Moment Correlation) $N = 811$

Norms: $\bar{X} = 4.89$ to 6.49 $N = 27$ (each of three groups)

Validity: Content validity purported by author, based on objectives of science education as developed by Commission on Science Education of the American Association for the Advancement of Science.


Title: THE PROBLEM-SOLVING TEST

Factors: Problem-solving skills such as forming, testing, revising and reporting of hypotheses

Format: Respondent reports all he can about the inside of a closed box, collecting data by any means except opening the box. Final test consists of 21 boxes.

Population: College students
Reliability: \[ r = .84 \text{ (Split-half method)} \] \[ N = 50 \]

Norms: Not available

Validation: Test scores and time spent on test were compared with scores on standardized instruments which purport to measure aspect of problem solving ability.


Title: HYPOTHESIS QUALITY SCALE

Factors: Quality of Scientific Hypotheses

Format: Rating scale: Values 0-5

Population: Sixth through 11th graders in science

Reliability: \[ r = .96 \text{ (interjudge technique)} \] \[ N = 50 \]

Norms: Not available

Validation: Content


Title: COMPETENCY MEASURES FOR GROUPS

Factors: Assess the 24 specific behaviors listed as behavioral expectancies for exercises A-K of Part A of Science – A Process Approach.

Format: 56 tasks

Population: Kindergarten students

Reliability: \[ r = .78 \text{ (K-R 21)} \] \[ N = 44 \]

Norms: \[ \bar{X} = 33.97 \text{ S.D.} = 6.24 \text{ (Post-test)} \] \[ N = 60 \]
Validation: Content validity by author

Reference: William C. Ritz
Staff Associate
Eastern Regional Institute for Education
635 James Street
Syracuse, N.Y. 13203

---

Title: LABORATORY PRACTICAL
Factors: Ability in; measurement, identification, interpreting and determining interrelationships
Format: 20 laboratory setups, one question related to each setup
Population: High school biology students
Reliability: Hoyt analysis of variance yielded reliability of .63. N = 390
Norms: $\bar{X} = 11.3$  S.D. = 3.2 N = 390
Validation: Not available

---

Title: LABORATORY PERFORMANCE TEST
Factors: Achievement in physics laboratory skills
Format: 6 laboratory problems
Population: College students enrolled in introductory physics courses
Reliability: $r = .596$ (K-R 20) N = 124
Norms: $\bar{X} = 14.08$ (24 points maximum) N = 124
Validation: Three-member panel
Title: PRACTICAL LABORATORY EXAMINATION
Factors: Laboratory skills (manipulative and intellective) utilized in BSCS curricula
Format: Seven problems with instructions to students and questions to be answered
Population: Twelfth-grade Israeli students
Reliability: High degree of evaluator agreement
Norms: $\bar{X} = 74.34$ (Maximum = 100) S.D. = 9.49 N = 99
Validation: Content and construct validity claimed by authors

Title: THE TEST OF SCIENCE PROCESSES
Factors: The ability to use the following processes:
  1) observing  2) comparing  3) classifying  4) quantifying
  5) measuring  6) experimenting  7) inferring  8) predicting
Format: 96 multiple-choice items
Population: Junior high school students
Reliability: $r = .90 - .91$ total (K-R 20)
  Subtest = 1) .41 - .47  2) .26 - .37  3) .58 - .71
  4) .64 - .75  5) .71 - .82  6) .43 - .54  7) .48 - .63
  8) .32 - .56
Norms: Included in dissertation
Validation: Criterion-related validity assessed through correlation of student scores with the teacher ratings of students. Correlations ranged from .115 to .477.
Title: ERIE SCIENCE PROCESSES TEST
Factors: Skills reflecting the process orientation of Science - A Process Approach curriculum
Format: 35 multiple-choice items
Population: Students in fourth and fifth grades
Reliability: $r = .72$ (K-R 20)  $N = 846$
Norms: Not available
Validation: Content validity for experimental version of the curriculum
Reference: Charles W. Wallace, Staff Associate
Eastern Regional Institute for Education
635 James Street
Syracuse, New York 13203
III. CHARACTERISTICS AND ABILITIES OF STUDENTS

Title: COGNITIVE PREFERENCE EXAMINATION: HIGH SCHOOL CHEMISTRY

Factors: Identifying the following types of cognitive preferences as related to chemical information; 1) memory of facts, 2) practical application, 3) critical questioning of information, and 4) fundamental principles.

Format: 35 items each with four possible correct responses. Responses differ in cognitive type. Respondent chooses the one he prefers.

Population: Eleventh grade chemistry pupils from an urban area

Reliability: \( r = 0.41 \) to \( 0.78 \) (Subscales using test-retest method and the Pearson-Product-Moment formula) \( N = 44 \)

Norms:
1) \( \bar{X} = 6.75 \), \( S.D. = 3.63 \)
2) \( \bar{X} = 8.33 \), \( S.D. = 3.13 \)
3) \( \bar{X} = 8.65 \), \( S.D. = 4.17 \)
4) \( \bar{X} = 10.20 \), \( S.D. = 3.54 \)

Validation: Face validity established by three-member jury


Title: COGNITIVE PREFERENCE EXAMINATION - II

Factors: Cognitive Preference; memory, application, questioning

Format: Thirty multiple-choice items each having three correct distractors reflecting the three types of cognitive style. Respondent chooses the one he prefers.

Population: Juniors and seniors enrolled in an elementary science and social studies methods course at the University of Kentucky

Reliability: Test-retest stability coefficients using Pearson-Product-Moment:
- Application: \( r = 0.77 \), \( N = 100 \)
- Memory: \( r = 0.70 \)
- Questioning: \( r = 0.74 \)
Title: RODS, SPRINGS, LEVERS
Factors: Separation of variables
Format: Practical examination with 9 Piaget-type tasks in each of the three subtests
Population: Fifth and sixth grade students
Reliability: $r = .79$ to $.88$ (subtests, using K-R 20) $N = 27$
Norms: Not available
Validation: Not available

Title: SCIENTIFIC CURIOSITY INVENTORY
Factors: Scientific curiosity
Format: Seven sets of statements; within each set respondent is asked to answer yes or no to each statement in context of two questions which are posed at the beginning of the set.
Population: Junior high school science students
Reliability: $r = .896$ (Spearman-Brown correlation of split-halves) $N = 251$
Norms: Not available
Title: SCIENTIFIC APTITUDE SURVEY

Factors: Fourteen competencies thought important in defining scientific talent

Format: 150 multiple-choice items

Population: Eighth grade students of urban California schools

Reliability:
- \( r = .93 \) (K-R 20) \( N = 240 \)

Norms:
- \( \bar{X} = 74.5 \) (Max. = 150) \( S.D. = 16.4 \) \( N = 240 \)

Validation: Correlation with final marks in science classes ranged from .68 (\( N = 69 \)) to .79 (\( N = 29 \)). Correlation with teacher assessment was .82 (\( N = 148 \))


---

Title: MULTIPLE-MEANING WORD TEST

Factors: Identification of those meanings of a group of multiple-meaning science words that are known by the respondents

Format: Two parts each containing 80 multiple-choice items

Population: Children in grades four, five and six of the Kingston, New York public schools

Reliability: Split-halves correlation; \( r = .88 \) (Pearson Product-Moment Correlation corrected by the Spearman-Brown "Prophecy Formula")

Norms:
- Girls \( \bar{X} = 107.59 \) \( S.D. = 21.52 \) \( N = 256 \)
- Boys \( \bar{X} = 104.86 \) \( S.D. = 27.32 \) \( N = 270 \)
Maximum score = 160
Validation: Established through opinions of 23 reading specialists. Item analysis by grade level indicated balanced distribution of items by difficulty.


Title: ISLANDS PUZZLE
Factors: Abstract reasoning ability
Format: A puzzle is posed. A succession of clues are given. Students are asked to write out explanations for answers to questions about the puzzle. Responses are categorized according to criteria developed by authors.
Population: Fifth grade through college
Reliability: Not available
Norms: Not available
Validation: Not available
Reference: Elizabeth F. Karplus and Robert Karplus Science Curriculum Improvement Study Lawrence Hall of Science Berkeley, California 94720

Title: ROBINSON TEST OF SCIENTIFIC CREATIVITY
Factors: Scientific Creativity; emphasis on divergent scientific thought
Format: Seven parts: Different uses of objects, Anagrams, Problem Identification and Solution, Unstructured Stimulus, Amusing Incident, Problem Identification and Solution (2), Structural Ingenuity. Short essay responses scored according to a set of criteria developed by author.
Population: Secondary school students
Reliability: Inter-scorer agreement on tests ranged from 84 to 100 per cent
Norms:

\[ \bar{X} \text{ (experimental group)} = 81.84 \quad N = 311 \]
\[ \bar{X} \text{ (comparison group)} = 68.81 \quad N = 314 \]

Validation: Test results correlated highly with performance of students in Science Fair. Science Fair participants performed better on test than did non-participants.


Developed by: Dr. Willis Robinson, California Western University (mimeographed)

University Microfilms Order No. 68-14,757

Title: COGNITIVE PREFERENCE TEST: HIGH SCHOOL CHEMISTRY

Factors: Comparison of four types of "cognitive preferences".
1) memory or recall 2) practical application
3) critical questioning 4) identification of a fundamental principle

Format: 100 four-option items; each of the four options reflecting a cognitive type. Respondent chooses the one he prefers.

Population: High school chemistry students

Reliability: Coefficients of reliability*:
1) 0.70 2) 0.50 3) 0.66 4) 0.28
N = 433 (CBA students) Method not given

Norms: Means (Maximum 25) 1) 7.61 2) 7.03 3) 4.53 4) 7.09

Validation: Content validity established by jury of chemists

Reference: R. L. Marks
Department of Chemistry
Indiana University of Pennsylvania
Indiana, Pa. 15701
Title: A TEST OF SCIENCE COMPREHENSION

Factors: Critical thinking

Format: Two parts, each containing 30 multiple-choice items based on four situations arranged approximately in order of difficulty. Respondent must analyze the situation to arrive at answers.

Population: Students in grades 4 through 6 in urban and suburban school systems of Michigan

Reliability: Method - G. J. Froelich (in Garrett)

4th grade $r = .72$ $N = 182$
5th grade $r = .79$ $N = 256$
6th grade $r = .76$ $N = 213$
(Based on post-test of the experimental groups)

Norms:
4th grade $\bar{X} = 21.68$ Variance = 47 $N = 182$
5th grade $\bar{X} = 31.08$ Variance = 64 $N = 256$
6th grade $\bar{X} = 33.05$ Variance = 58 $N = 213$
(Based on post-tests of experimental groups)

Validation: Not available


Title: PROBLEM SOLVING TEST

Factors: Problem solving ability

Format: Six problems

Population: College students enrolled in an Introductory Botany course

Reliability: $r = .30$ and $.50$ (Jackson method)

Norms: Not available

Validation: Jury of university staff members in Botany and Education

University Microfilms Order No. 58-2159
<table>
<thead>
<tr>
<th>Title:</th>
<th>PHYSICS TEST II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factors:</td>
<td>Mathematical and physics problem solving ability</td>
</tr>
<tr>
<td>Format:</td>
<td>45 multiple-choice items</td>
</tr>
<tr>
<td>Population:</td>
<td>College freshman</td>
</tr>
<tr>
<td>Reliability:</td>
<td>$r = .713$ (Split-halves technique using Spearman-Brown formula) $N = 211$</td>
</tr>
<tr>
<td>Norms:</td>
<td>Not available</td>
</tr>
<tr>
<td>Validation:</td>
<td>Content validity by jury. Concurrent validity by comparison with standardized test results and teacher grades.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Title:</th>
<th>COGNITIVE STYLES TASK (CST)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factors:</td>
<td>Extent of respondents' cognitive style in categorization behavior</td>
</tr>
<tr>
<td>Format:</td>
<td>Respondents group photographs of objects and record their reasons. Each response is placed into one of six categories (See page 64 for scoring techniques).</td>
</tr>
<tr>
<td>Population:</td>
<td>Ten and eleven year old children enrolled in Detroit elementary schools</td>
</tr>
<tr>
<td>Reliability:</td>
<td>Not available</td>
</tr>
<tr>
<td>Norms:</td>
<td>Not available</td>
</tr>
<tr>
<td>Validation:</td>
<td>Based on an Individual Styles Task instrument developed by Sigel</td>
</tr>
</tbody>
</table>
Title: SCIENCE EXPERIENCE INVENTORY

Factors: Determines which of certain experiences are a part of a child's background

Format: Contains 150 statements such as "See a dust storm." "Yes" answer indicates that student has had the experience.

Population: Fourth, fifth and sixth grade students in the Minneapolis public schools; teachers from Minneapolis and Iowa; students at State University of Iowa.

Reliability: All use K-R 20
r = .94 4th grade  N = 435
r = .93 5th grade  N = 521
r = .75 Minnesota teachers  N = 37
r = .83 Iowa teachers  N = 38

Norms: (Positive responses)
4th grade  X = 63.51  S.D. = 22.04
5th grade  X = 71.98  S.D. = 22.17
Minnesota teachers  X = 117.97  S.D. = 15.37
Iowa teachers  X = 105.24  S.D. = 18.27

Validation: Formal validity assumed as test items agree with criteria set up in advance for choosing experiences.


Title: PHYSICAL SCIENCE CRITICAL THINKING APPRAISAL

Factors: The ability to think clearly in physical science

Format: 71 multiple-choice items

Population: College sophomores enrolled in physical science

Reliability: $r = .71$ Split-half technique using Spearman-Brown correlation

Norms: $\bar{X} = 22.60$  S.E. = 3.12  N = 362

Validation: Author selected and developed items with reference to course content. Two course instructors reviewed items for content validity, accuracy and clarity.

IV. ATTITUDES

A. Science, Scientists and Science Classes

Title: THE CALIFORNIA ELEMENTARY SCHOOL SCIENCE ATTITUDE TEST

Factors: Attitudes toward science

Format: 20 Likert-type items

Population: Fifth and eighth grade students

Reliability: $r = .73$ (Spearman-Brown)  
$N = 2901$

Norms: Not available

Validation: Correlation of .47 with science information test


University Microfilms Order No. 65-3447

Title: THE BELIEFS ABOUT AND ATTITUDES TOWARD SCIENCE AND SCIENTISTS SCALE

Factors: Beliefs about science and scientists and attitudes towards those beliefs

Format: Two parts; I - Beliefs and II - Evaluative, each consisting of about 32 multiple-choice items.

Part I scored by awarding one point for each correct answer.

Part II scoring used a complex system relating responses on Part I to responses on Part II.

Population: Developed at an eighth grade reading level. Population consisted of 9-12 graders in three different settings, urban, suburban, and rural.

Reliability: 

<table>
<thead>
<tr>
<th>Part</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part I</td>
<td>$r = 0.79$ (K-R 20)</td>
</tr>
<tr>
<td>Part II</td>
<td>$r = 0.86$ (Test-retest; Pearson Product Moment Correlation)</td>
</tr>
</tbody>
</table>

Attitude test (combination of Part I and Part II) 

$r = 0.57$ (Test-retest; Pearson Product Moment Correlation)
Norms: N = 50 students at each grade level in each setting.

Attitude scores:

By Setting:
- Urban: $\bar{X} = 66.81$, S.D. = 11.71, N = 141
- Suburban: $\bar{X} = 72.87$, S.D. = 10.42, N = 205
- Rural: $\bar{X} = 70.15$, S.D. = 10.07, N = 135

By Grade Level:
- 9th: $\bar{X} = 68.60$, S.D. = 11.22, N = 126
- 10th: $\bar{X} = 67.46$, S.D. = 12.72, N = 125
- 11th: $\bar{X} = 71.29$, S.D. = 9.03, N = 118
- 12th: $\bar{X} = 73.89$, S.D. = 9.51, N = 112

Validation: Item pool submitted to panel of seven judges for classification into belief or evaluation items. Responses were subjected to a two-way analysis of variance and yielded an intraclass (judge) correlation of 0.87. Additional assessments of content validity were made.


University Microfilms Order No. 71-7417

Title: HOW MUCH DO YOU LIKE
Factors: Attitudes toward science class
Format: 5 items each having a 7 point response scale
Population: Eighth grade students enrolled in physical science classes
Reliability: Not available
Norms: $\bar{X} = 24.7$, N = 96
Validation: Not available
University Microfilms Order No. 68-14,778
Title: INTEREST INVENTORY

Factors: Science interest level

Format: Six parts: Part One - ranking of 10 elementary school subjects in order of student preference; Part Two - nine areas students could read about in library books; Part Three - ten possible occupations; Part Four - ten games and play objects; Part Five - ten articles commonly collected by children; Part Six - Ten places students could visit. For Parts 2-6 respondents indicate degree of like-dislike on a five point scale.

Population: Sixth graders in Wichita Public Schools

Reliability: Instrument given three times to same students. Co-efficients of correlation between results were:
1st and 2nd r = .714
1st and 3rd r = .719
2nd and 3rd r = .786

Norms: Group A (6 classrooms) $\bar{X} = 59.2$ (Post-test)
Group B (6 classrooms) $\bar{X} = 59.0$

Validation: Not available


Title: ATTITUDE SCALE

Factors: Attitudes toward teaching and learning science

Format: 20 items with weighted values. Agree responses are totalled for score.

Population: Elementary education majors without science background

Reliability: $r = .93$ (test-retest method) $N = 226$

Norms: Not available

Validation: Items selected from pool of 200 through Q-sort technique using 100 respondents

Title: STUDENT QUESTIONNAIRE

Factors: Student attitudes toward teacher and learning science

Format: 34 Likert-type items

Population: Junior high school students

Reliability: Not available

Norms: Not available

Validation: Not available

Reference: Earth Science Education Project
Box 1559
Boulder, Colorado 80306

Title: STUDENT ATTITUDE TOWARD SCIENCE

Factors: Student acceptance of 1) text material, 2) course content, 3) laboratory work, 4) interest in the course, 5) involvement and 6) satisfaction of perceived needs.

Format: 72 statements using a Likert-type response scale

Population: 10th grade secondary school students taking the "General Course" science program in Manitoba schools

Reliability: Not available

Norms:

<table>
<thead>
<tr>
<th>Factor</th>
<th>Score</th>
<th>Neutral Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>39</td>
<td>$\bar{X} = 44.2$ S.D. = 9.5</td>
</tr>
<tr>
<td>2.</td>
<td>36</td>
<td>$\bar{X} = 38.5$ S.D. = 6.7</td>
</tr>
<tr>
<td>3.</td>
<td>42</td>
<td>$\bar{X} = 41.0$ S.D. = 6.2</td>
</tr>
<tr>
<td>4.</td>
<td>51</td>
<td>$\bar{X} = 54.4$ S.D. = 12.2</td>
</tr>
<tr>
<td>5.</td>
<td>33</td>
<td>$\bar{X} = 38.6$ S.D. = 4.9</td>
</tr>
<tr>
<td>6.</td>
<td>15</td>
<td>$\bar{X} = 16.0$ S.D. = 3.3</td>
</tr>
<tr>
<td>7.</td>
<td></td>
<td>$\bar{X} = 232.8$ S.D. = 32.2</td>
</tr>
</tbody>
</table>

N = 872

Validation: Not available


University Microfilms Order No. 67-1635
Title: HOW I FEEL, FORM OZ

Factors: Scale I: Attitude Toward Science Class and Science
Scale II: Anxiety About Science Class

Format: Thirty item, forced-choice instrument

Population: Second and third grade students

Reliability: Internal reliability of each scale was computed from item mean values for the total group using Cronbach's coefficient alpha. Scale I = .564  Scale II = .505  N = 75

Norms: Scale I: $\bar{X} = 23.01$  S.E. = 0.74
Scale II: $\bar{X} = 2.47$  S.E. = 0.25  N = 75

Validation: Corrected correlations with IQ scores were essentially zero. It therefore measures something which is independent of IQ.


Title: STUDENT REACTION INVENTORY

Factors: Degree of interest of students in various areas of science covered in a science survey course

Format: First part focuses on general factors of interest in science and consists of 72 questions answerable by yes-no response.
Second part consists of a series of 150 words selected from the areas of natural sciences. Respondent indicates his degree of interest in each.

Population: Students at the Newark College of Rutgers University

Reliability: Second part: 50 words were identified. For each original word two corresponding words were selected. This process yielded three equivalent lists of 50 words each. Rank correlations were as follows:

First and second lists  $r = .729$  N = 101
Second and third lists $r = .725$  N = 101
First and third lists  $r = .620$

Norms: See dissertation starting on p. 49
| Validation: | List of terms used agreed on by all course instructors |

| Title: | PROJECTIVE TEST OF ATTITUDES |
| Factors: | Attitudes toward science, scientific processes and scientists |
| Format: | Word association items, sentence completion items and an apperception test |
| Population: | Fifth grade students |
| Reliability: | Not available |
| Norms: | Not available |
| Validation: | Interface validity determined between like sections of the instrument |

| Title: | SCIENTIFIC ATTITUDE INVENTORY |
| Factors: | Scientific attitudes |
| Format: | 60 Likert-type items |
| Population: | Low-ability tenth-grade biology students |
| Reliability: | \( r = .934 \) (Test-retest method of Winer) \( N = 23 \) |
| Norms: | \( \bar{X} = 106.22 - 119.16 \) \( N = 22 - 23 \) |
| Validation: | Jury |
**Title:** WHAT IS YOUR ATTITUDE TOWARD SCIENCE?

**Factors:** Attitudes toward science (intellectual)  
Attitudes about science (emotional)

**Format:** 60 Likert-type items

**Population:** Students in seventh grade through college

**Reliability:** \( r = .93 \) (Test-retest method of Winer)  
\( N = 23 \)

**Norms:** Not available

**Validation:** Construct validity determined

**Reference:** Moore, Richard W., Miami University, Oxford, Ohio.  

---

**Title:** STUDY OF ATTITUDES TOWARD SCIENTISTS AND SCIENCE

**Factors:** Attitude toward scientists and science

**Format:** Two forms consisting of items answerable on a 9 point scale from "Highest Appreciation" to "Highest Depreciation" (32 items and 44 items)

**Population:** Students enrolled in introductory college chemistry course

**Reliability:** 1) Test divided into two parts each of which had the same mean score. Split half technique using Spearman-Brown formula yielded an \( r = .63 \)  
\( N = 212 \)

2) Test-retest method yielded an \( r = .60 \)  
\( N = 119 \)

**Norms:**  
\[ \bar{X} \text{ (pretest)} = 2.60 \quad \text{S.D.} = 0.58 \quad N = 467 \]  
\[ \bar{X} \text{ (post-test)} = 2.69 \quad \text{S.D.} = 0.73 \]

**Validation:** Opinions forming the statements to be included in the instrument were rated by three groups of judges on the one to nine scale.

University Microfilms Order No. 68-8727
Title: SCIENTIFIC ATTITUDE TEST

Factors: Attitudes toward science

Format: Student indicates feelings toward 35 ideas or activities (unpleasant, pleasant, none)

Population: College students enrolled in Introductory Botany

Reliability: r = .53 (Hoyt method)

Norms: Pre-test X = 28.68 and 28.88

Validation: Jury of university staff members in Botany and Education


Title: ATTITUDES TOWARD SCIENCE AND SCIENCE TEACHING

Factors: Changes in attitude as a result of the introduction of some experimental variable: (1) Toward Science (2) Toward Teaching Science

Population: Elementary teachers, elementary education majors and college freshman

Reliability: Split-half (Spearman-Brown correction)
1) r = .88 2) r = .84  N = 154

Norms: Means: 1) 62.18 (Max. = 80) 2) 54.78 (Max. = 80)  N = 45

Validation: Internal consistency

Title: SCIENCE ATTITUDE SCALE

Factors: Attitude toward subject of science

Format: 33 Likert-type items

Population: Sixth grade students

Reliability: Reliability coefficient alpha = .90  N = 115

Norms: \( \bar{X} = 114.40 \quad S.E. = 1.78 \quad N = 115 \)

Validation: Jury of four


Title: BIOLOGY STUDENT BEHAVIOR INVENTORY

Factors: Science attitudes, interests: 1) curiosity, 2) openness, 3) satisfaction, 4) responsibility

Format: Several types of items are used including:
1) Situations are explained and students asked to indicate what they might do in the given situation.
2) Students are asked the extent to which they agree with a stated opinion.

Population: Tenth grade biology students

Reliability: Split-half corrected  N = 1,153
1) .67  2) .68  3) .71  4) .37

Norms: Not available

Validation: Content validity by panel of judges, item validity through internal consistency, and concurrent validity by three different methods.

Reference: H. Edwin Steiner, Jr.
305B Chemistry Building
University of South Florida
Tampa, Florida 33620
INVENTORY OF SCIENCE ATTITUDES, INTEREST AND APPRECIATIONS

Factors: Affective outcomes of science teaching

Format:
- Part I - 50 statements reflecting attitudes about science
- Part II - 21 statements concerning possible experience of respondent
Possble responses: Agree, disagree, no opinion

Population: Sixth grade students

Reliability: Not available

Norms: $\bar{X} = 41.93$  $\text{S.D.} = 9.1$  $N = 1518$

Validation: Not available

University Microfilms Order No. 65-12980

-------------------------------------------------------------------------------------------------------------------

ATTITUDE SCALE

Factors: Generalized attitude toward science

Format: 80 items using 7 point Likert-type scale

Population: 9th and 10th graders

Reliability: $r = 0.87$ (K-R 20)  $N = 350$

Norms: Not available

Validation: Criteria derived from literature provided bases for development of items.


-------------------------------------------------------------------------------------------------------------------

70
Title: SEMANTIC DIFFERENTIAL TEST

Factors:
1) Me Teaching Science
2) Doing Experiments
3) Science

Format: Semantic differential

Population: College students enrolled in Introductory Physical Science

Reliability:
1. Five clusters varied from .68 to .84
2. Five clusters varied from .49 to .82
3. Cluster reliabilities too low to be used

Method: Stepped-up Y ii

Norms:
Post-test, experimental group
1. \( \bar{X} = 3.23 - 5.98 \) S.D. 1.00 - 1.35
2. \( \bar{X} = 3.66 - 5.87 \) S.D. .67 - 1.18 N = 301

Validation:
Three hypothesized clusters were found to exist, although reliabilities on one were too low for it to be included.

Reference:
Wayne Welch
University of Minnesota
Minneapolis, Minn. 55455

B. Toward Conservation and Environment

Title: ATTITUDE TOWARD CONSERVATION

Factors: Attitudes about conservation of natural resources

Format: 64 Likert-type items

Population: High school, college, and adult groups

Reliability: Not available

Norms:
High school \( \bar{X} = 184.08 \) N = 585
College \( \bar{X} = 191.32 \) N = 462
Adult \( \bar{X} = 196.93 \) N = 571

Validation: Not available

Reference:
Title: AN ATTITUDE INVENTORY

Factors: Attitudes toward conservation

Format: 32 Likert-type items

Population: College juniors and seniors

Reliability: Not available

Norms: Not available

Validation: Not available


Title: (None)

Factors: Attitudes toward conservation

Format: 116 Likert-type items

Population: College juniors and seniors

Reliability: A cluster analysis of items yielded 16 clusters with K-R 20 reliabilities ranging from .40 to .93.

Norms: Not available

Validation: Not available


Title: INVENTORY OF SOCIETAL ISSUES

Factors: Seven interpretable factors were found relating to environmental issues and society's and the individual's role in these issues.

Format: 60 Likert-type items

Population: A representative sample of seniors in the public high schools of Oregon
Reliability:
Total Instrument - Cronbach alpha $r = 0.647$
Spearman-Brown Prophecy formula $r = 0.768$
Pearson-Product-Moment Correlation $r = 0.624$
Reliabilities of factor scales ranged from 0.48 - 0.85 using Spearman-Brown Prophecy formula.

Norms:
See pages 107-121 of dissertation

Validation:
A pool of items was generated following certain established ground rules. From a series of administrations of the pool items and their analysis a pool of 100 items were selected. These were evaluated by professors from sciences, humanities, and social sciences. Factor analysis resulted in selection of 60 items for final version.

Reference:
University Microfilms Order No. 71-19,912

Title: LAUG TEST OF ATTITUDES TOWARD CONSERVATION
Factors: Attitudes toward conservation
Format: 66 Likert-type items
Population: College freshman
Reliability: $r = .94$ (Spearman-Brown)
Norms: Not available
Validation: Not available

University Microfilms Order No. 65-14,289

Instrument developed by George M. Laug, New York State University, College of Buffalo.
University Microfilms Order No. 60-2609

73
Title: KNOWLEDGE OF THE NATURE OF SCIENCE

IOWA SCIENCE AND CULTURE STUDY ACHIEVEMENT TEST

Factors: Understanding of science as related to culture

Format: 50 multiple-choice items

Population: 13th and 12th grade students

Reliability: \( r = 0.63 \) (Pre and post test correlation using Pearson-
Product-Moment) \( N = 21 \)

Norms: Not available

Validation: Correlation of scores with published instruments which were also used in study

University Microfilms Order No. 68-913

Title: TEST OF SOCIAL ASPECTS OF SCIENCE

Factors: Understanding of the interaction of science and society

Format: 52 Likert-type items

Population: High school sophomores

Reliability: \( r = 0.71 \) (K-R 20 with agree responses scored as correct) \( N = 140 \)

Norms: \( \bar{X} = 33.26 \quad S.D. = 6.29 \quad N = 155 \)

Validation: Twelve-member jury

University Microfilms Order No. 68-15069
### TEST ON THE METHODOLOGY OF SCIENCE

**Factors:** Understanding of the methodology of science  
**Format:** 55 multiple-choice items (final versions)  
**Population:** In-service science teachers  
**Reliability:** \( r = .63 \) (K-R 20)  
**Norms:** \( \bar{X} = 24.98 \)  
**Validation:** Jury comprised of 10 authorities on the philosophy of science  

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### WISCONSIN INVENTORY OF SCIENCE PROCESSES

**Factors:** Knowledge of the scientific enterprise  
**Format:** 93 statements; respondent asked to judge whether each is an accurate or inaccurate statement.  
**Population:** Twelfth grade students and teachers  
**Reliability:** \( r = 0.82 \)  
**Norms:**  
- Students \( \bar{X} = 54.2 \)  
- Teachers \( \bar{X} = 66.9 \)  
**Validation:** Not available  
**Reference:** Dr. Milton O. Pella  
The Scientific Literacy Research Center  
The University of Wisconsin  
Madison, Wisconsin
Title: IUF ABRIDGED SCIENTIFIC LITERACY INSTRUMENT

Factors: Attitudes toward science and understanding of interrelationships in science

Format: 34 situation-establishing items with seven-point scale for response

Population: High school graduates enrolled as college freshmen

Reliability: Not available

Norms: Not available N = 358

Validation: 36-member jury participated in selection of items for final version of instrument


Title: WELCH SCIENCE PROCESS INVENTORY, FORM D

(Earlier form, C, also available)

Factors: Achievement of science process goals

Format: Respondent asked whether he agrees or disagrees with each of 135 items

Population: High school students and adults

Reliability: r = .86 (K-R 20) N = 171

Norms: $X = 103.78$ S.D. = 13.10 Range 33-132 N = 1058

Validation: Content validity established by opinion of experts

Reference: Pr. Wayne W. Welch 330 Burton Hall University of Minnesota Minneapolis, Minn. 55455
Title: THE METHODS AND PROCEDURES OF SCIENCE: AN EXAMINATION

Factors: Assesses student understanding of aspects of the methods and procedures reflected in a scientist's attack on a problem.

Format: Instrument consists of 50 statements. Respondent chooses from among five words or phrases the one that best characterizes the information in each statement.

Population: Students in grades 9 through 12

Reliability: \( r = .80 \) (K-R 20) \( N = 476 \)

Norms: \( \bar{X} = 18.9 \) \( S.E. = 0.3 \) \( N = 476 \)

Validation: Instrument critiqued by approximately 20 science educators

Reference: John H. Woodburn, Ph.D.
9208 Le Velle Drive
Chevy Chase, Maryland 20015
VI. PROFESSIONAL PRACTICES

A. Instructional Activities

Title: BIOLOGY LABORATORY ACTIVITY CHECKLIST

Factors: Nature and extent of laboratory instruction in biology classes; 1) Pre-Laboratory activities; 2) Laboratory activities; 3) Post-Laboratory activities; and 4) General reaction to the laboratory

Format: 60 true-false items each referring to a laboratory practice. Students respond according to their perceptions of whether the teacher uses that practice.

Population: Tenth grade biology students

Reliability: Two classes for each of five high school biology teachers were used. A t-test was computed for the two classes of each teacher. In each of the five cases the t was not significant.

Norms: Groups include one class for each of 21 teachers

- Group EB (Experienced BSCS Teachers) \( \bar{X} = 39.25 \)
- Group BB (Inexperienced BSCS Teachers) \( \bar{X} = 33.46 \)
- Group NB (Traditional Biology Teachers) \( \bar{X} = 28.87 \)

Maximum Score = 60

Validation: 1) Each item was based upon statements by individuals who participated in the development of the BSCS program.

2) Each item was verified by a panel of judges who were familiar with the BSCS program.


Title: INSERVICE INSTITUTE QUESTIONNAIRE

Factors: Assess the impact of an inservice institute upon teachers' classroom practices

Format: 50 items

Population: Junior high school teachers

Reliability: Not available

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Title: QUESTIONNAIRE FOR PRINCIPAL, SUPERVISOR, CURRICULUM COORDINATOR, ETC.

Factors: Evaluation of impact of inservice institute upon teachers and teachers' classes

Format: Respondent asked to indicate relative agreement with each of 25 statements.

Population: Junior high school administrators and supervisors

Reliability: Not available

Norms: Not available

Validation: Not available

Reference: Earth Science Education Project
Box 1559
Boulder, Colorado 80306

Title: BIOLOGY CLASSROOM ACTIVITY CHECKLIST

Factors: The identification of actual classroom practices as they relate to the philosophy and rationale of the BSCS program; A - The role of the teacher in the classroom; B - Student classroom participation; C - Use of textbook and reference materials; D - Design and use of tests; E - Laboratory Preparation; F - Type of laboratory activities; G - Laboratory follow-up activities.

Norms: 53 true-false statements each referring to a classroom practice. Students respond according to whether they perceive the practice as being used by their teacher.

Population: Tenth grade biology students in eleven different states

Title: SURVEY OF STUDENT PERCEPTION OF COURSE AND COLLEGE

Factors: Student perceptions of college environment (part I)
and of instructor and general biology class (part II)

Format: Part I: 50 Likert-type items
Part II: 15 multiple-choice items

Population: General biology students in Jamestown Community College
and in the State University of New York at Buffalo

Reliability: Not available

Norms: Not available


Reference: Kochenderfer, Robert C. "A Comparison of Achievement of General Biology Students in a Community College with Similar Students in a University as Related to Their Backgrounds." Unpublished doctoral dissertation, State University of New York at Buffalo, 1965, p. 120. University Microfilms Order No. 65-8896

Norms: N = 1231 from 64 different classrooms

Group 1, Experienced BSCS Teachers: X = 65.70 S.D. = 8.14
Group 2, Inexperienced BSCS Teachers: X = 57.34 S.D. = 6.37
Group 3, Teachers not teaching BSCS: X = 50.90 S.D. = 5.90

Validation: Items based on published statements of BSCS rationale. Five judges were asked to decide the degree to which each classroom practice contributed to BSCS objectives. There was a correlation of .64 among the judges decisions.

Title: LEVEL OF ADOPTION SCALE FOR SCIENCE TEACHING INNOVATIONS
Factors: Identifies the level at which innovative investigations have been adopted; awareness, interest, evaluation, trial, adoption.
Format: Ten investigations are described. Teachers indicate which one of seven statements best reflects his level of awareness or utilization of the investigation.
Population: Elementary school teachers K - 6
Reliability: \( r = .65 \) (Test -- retest correlation) \( N = 94 \)
Norms: Not available
Validation: Content validity established by comparing instrument items with experiences included in an inservice program.
Reference: Kenneth R. Mechling, Clarion State College, Clarion, Pa. 16214

Title: SCIENCE CLASSROOM ACTIVITY CHECKLIST
Factors: 1) Nature of classroom activities which teachers feel should be used for secondary school science instruction.
2) Nature of activities which teachers do use as perceived by their students.
Format: 60 statements of activities with yes–no responses possible. (Based on instrument developed by Leonard Kochendorfer and Addison E. Lee, Research and Curriculum Development in Science Education, Science Education Center, The University of Texas, Austin, Texas, October, 1962.)
Population: Junior and senior high school science teachers in central Ohio
Reliability: 1) \( r = .841 \) (K-R 20)
2) \( r = .770 \) (K-R 20)
Norms: Not available
Validation: Authoritative validity established as a result of a 100% agreement in responses between 4 science educators and author to items on checklist when asked to respond so that their answers would reflect those classroom practices which they felt contributed positively to contemporary science education objectives.


Title: A DICHOTOMOUS KEY FOR IDENTIFYING A RESEARCH-ORIENTED CLASS AS OPPOSED TO A CONVENTIONAL CLASS IN ADVANCED BIOLOGY

Factors: Classroom behavior of teachers and students

Format: Seven dichotomous items

Population: 11th and 12th grade biology classes

Reliability: r = .34 - .98 (Inter-observer agreement) N = 102

Norms: Not available

Validation: Panel of judges critiqued items

Reference: Alva N. Smith
7 North Jay Street
Lock Haven, Pa. 17745

Title: SCIENCE TEACHING INFORMATION QUESTIONNAIRE

Factors: Organization of science program
Organization of instruction
Science teacher personal and biographical data

Format: Six pages of statements in multiple response format

Population: Sixth grade teachers

Reliability: Not available
STUDENT CHECKLIST

Factors: Degree of inductive-indirect or expository-direct strategy used in a laboratory teaching situation.

Format: 42 items describing characteristic teaching activities. Respondents indicate by yes-no answer whether each is being carried on in their classroom. Two scores are obtained representing the two teaching strategies.

Population: Students in 7-12 grade science classes of the Boulder Valley Schools, Boulder, Colorado

Reliability: Expository-direct scale $r = .505$
Inductive-indirect scale $r = .669$  
N = 1446
Using Hoyt's ANOVA method (Hoyt, C. "Test Reliability Established by Analysis of Variance." Psychometrika 6:103-60, 1941)

Norms: Expository-direct $\bar{X} = 7.27$ S.D. = 1.89  20 items
Inductive-indirect $\bar{X} = 11.01$ S.D. = 1.80  22 items
N = 1446

Validation: Judges rated items with reference to the type of teaching strategy represented by the described activity.

Reference: Dr. Arthur L. White
Center for Science and Mathematics Education
The Ohio State University
1945 North High Street
Columbus, Ohio 43210
### B. Beliefs and Attitudes

**Title:** STUDY OF TEACHER REACTIONS TO BSCS PROGRAM; ATTITUDE INVENTORY

**Factors:** Teacher attitudes towards the BSCS Biology Program

**Format:** Respondent checks those statements with which he agrees from a list of 46. Half of the statements reflect attitudes favorable to BSCS biology and the remainder, traditional biology.

**Population:** Biology teachers enrolled in a Summer Institute

**Reliability:** Not available

**Norms:** Not available

**Validation:** Attitude inventory agreed with peer ratings and results of a follow-up questionnaire when each was used in classifying teachers attitudes toward BSCS biology.


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**Title:** ELEMENTARY SCIENCE "BELIEFS"

**Factors:** Beliefs about the nature of elementary school science, children and teaching

**Format:** 30 Likert-type items

**Population:** Prospective or in-service elementary school teachers

**Reliability:** Not available

**Norms:** F ratios for pretest vs post-test, means determined for each item.

**Validation:** Not available

Title: (None)

Factors: Knowledge of program characteristics of AAAS Science -- A Process Approach and Science Curriculum Improvement Study.

Format: 57 multiple-choice items

Population: College teachers of elementary science and curriculum coordinators of science

Reliability: $r = .6770$ (K-R 20)  

Norms: $\bar{X} = 34.89$  
$S.D. = 5.55$  
$S.E. = 3.08$

Validation: Panel of science educators

Reference: Dr. Dale G. Merkle  
Shippensburg State College  
Shippensburg, Pa. 17257

Title: ATTITUDE SURVEY

Factors: Respondent assesses the developmental potential of a particular academic or social skill through a given content area; Arithmetic, Language Arts, Reading, Science, Social Studies.

Format: 75 questions with response indicated on a 7 point scale

Population: 1) Undergraduates in elementary education  
2) Experienced teachers

Reliability: Two way analysis of variance reported on p. 53 of reference. Reliabilities with one exception are in excess of .70.

Norms: Not available

Validation: Construct validity established through use of expert opinion

University Microfilms Order No. 69-10,807.
Attributes of individuals engaged in training science teachers

100 statements of major issues in science education; Respondent is asked to indicate agreement or disagreement with each.

Science teacher trainees at colleges and universities

Not available

Not available

Not available


C. Supervisory Practices

Supervisory practices of science supervisors

Ten case studies of supervisory problems are presented with five possible solutions to each. Solutions are paired with each other. Best of each pair is selected. (Paired comparison)

Secondary school science supervisors

Not available

Not available

Jury selected from membership of NSSA (23) and science educators (18)

D. Teacher Expectations of Students

Title: EXPECTATIONS INVENTORY

Factors: Teacher expectation of students

Format: Respondents asked to indicate proportion of their students that could do each of 24 activities. Instrument assesses the degree to which class can function in an open learning environment.

Population: Junior high school students

Reliability: Not available

Norms: Not available

Validation: Not available

Reference: Earth Science Education Project
Box 1559
Boulder, Colorado 80306