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ABSTRACT

Test development efforts for constructing 12 items to measure achievement of each of 30 selected language arts concepts are described. Item and total score statistics for data collected on 186 boys and 259 girls who had just begun the sixth grade are presented and discussed. (Author)

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MEASURING LANGUAGE ARTS CONCEPT ATTAINMENT: BOYS AND GIRLS

WISCONSIN RESEARCH AND DEVELOPMENT
CENTER FOR
COGNITIVE LEARNING

Technical Report No. 199

MEASURING LANGUAGE ARTS CONCEPT ATTAINMENT: BOYS AND GIRLS

by
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Report from the Project on
A Structure of Concept Attainment Abilities

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Statement of Focus

The Wisconsin Research and Development Center for Cognitive Learning focuses on contributing to a better understanding of cognitive learning by children and youth and to the improvement of related educational practices. The strategy for research and development is comprehensive. It includes basic research to generate new knowledge about the conditions and processes of learning and about the processes of instruction, and the subsequent development of research-based instructional materials, many of which are designed for use by teachers and others for use by students. These materials are tested and refined in school settings. Throughout these operations behavioral scientists, curriculum experts, academic scholars, and school people interact, insuring that the results of Center activities are based soundly on knowledge of subject matter and cognitive learning and that they are applied to the improvement of educational practice.

This Technical Report is from the Project on the Structure of Concept Attainment Abilities in Program 1 and from the Quality Verification Program. The Concept Attainment staff took primary initiative in identifying basic concepts in language arts at intermediate grade levels, while the Quality Verification Program assisted in developing tests to measure concept achievement and identifying reference tests for cognitive abilities. The tests will be used to study the relationships among cognitive abilities and learned concepts in various subject matter areas. The outcome of the Project will be a formulation of a model of structure of abilities in concept attainment in a number of subjects, including mathematics, science, and social studies, as well as language arts.

Contents

List of Tables and Figures

Abstract

Test development efforts for constructing 12 items to measure achievement of each of 30 selected language arts concepts are described. Item and total score statistics for data collected on 186 boys and 259 girls who had just begun the sixth grade are presented and discussed.

I
Introduction

The primary objective of the project entitled "A Structure of Concept Attainment Abilities" (hereafter referred to as the CAA Project) is to formulate one or more models or structures of concept attainment abilities, and to assess their consistency with actual data. The major steps for attaining this primary objective were taken to be:

1. To identify basic concepts in language arts, mathematics, science, and social studies appropriate at the fourth grade level,

2. To develop tests to measure achievement of these concepts,

3. To identify reference tests for cognitive abilities, and

4. To study the relationships among learned concepts in these four subject matter fields and the identified cognitive abilities.

This paper describes the test development efforts for measuring achievement of selected concepts in language arts; thus, it is a report of one aspect of Step 2. As such, it will include descriptive item and test statistics for the tests developed. The items can be found in "Items to Test Level of Attainment of Language Arts Concepts by Intermediate-Grade Children" (Golub, Fredrick, Nelson, & Frayer, 1971b).

Concepts may be defined in one or more of four ways: (a) structurally, in terms of perceptible or readily specifiable properties or attributes; (b) semantically, in terms of synonyms or antonyms; (c) operationally, in terms of the procedures employed to distinguish the concept from other concepts; or (d) axiomatically, in terms of logical or numerical relationships (Klausmeier, Harris, Davis, Schwenn, & Frayer, 1968). "A concept exists whenever two or more distinguishable objects or events have been grouped or classified together and set apart from objects on the basis of some common feature or property of each" (Bourne, 1966, p. 1). The concept of Bourne's definition might be called a classificatory one and seems to be the same as the structural type discussed by Klausmeier et al. (1968). This is the type of concept with which this project is concerned, and such a definition of a concept served as the basis for selection and analysis of subject matter concepts.

Many different types of performance might be taken as the critical evidence that a student does or does not understand a given concept. Thus, as a part of this project it is necessary to have a schema for measuring understanding of a concept. Such a schema was developed by Frayer, Fredrick, and Klausmeier (1969) and was used by the CAA Project to assess concept attainment. The "Schema for Testing the Level of Concept Mastery" consists of 13 types of questions, each involving a different task required of the examinee. The schema also allows for selection of an answer (multiple-choice type questions) or for production of an answer (completion type questions). It was decided to use the first 12 tasks and a multiple-choice format for this project. The 12 tasks of the schema which were used are:

1. Given the name of an attribute, select an example of the attribute.

2. Given an example of an attribute, select the name of the attribute.

3. Given the name of a concept, select an example of the concept.

4. Given the name of a concept, select

a nonexample of the concept.

5. Given an example of a concept, select the name of the concept.

6. Given the name of a concept, select the relevant attribute.

7. Given the name of a concept, select the irrelevant attribute.

8. Given the definition of a concept, select the name of the concept.

9. Given the name of a concept, select the definition of the concept.

10. Given the name of a concept, select the supraordinate concept.

11. Given the name of a concept, select the subordinate concept.

12. Given the names of two concepts, select the relationship between them.

Single- or compound-word classificatory concepts (those that are defined by attributes) in language arts subject matter at the fourth grade level were identified. This task was subdivided into four steps:

1. Identification of the major areas within the subject matter of language arts,

2. Selection of three of these major areas to be studied,

3. Identification of classificatory concepts within each of these three major areas, and

4. Random sampling of ten concepts from those identified for each of the three major selected areas.

This yielded a total of 30 language arts concepts to be studied by the project. A list is given in Table 1, by area, of the concepts identified and randomly selected for study. The areas are Words, Words in Sentences, and Connected Discourse. A description of the procedures used to identify these concepts can be found in "Selection and Analysis of Language Arts Concepts for Inclusion in Tests of Concept Attainment" (Golub, Fredrick, Nelson, & Frayer, 1971a).

The researchers of Project 101, Situational Variables and Efficiency of Concept Learning, developed a system for analyzing a concept in preparation for developing items to measure the level of attainment of that concept (Frayer, Fredrick, & Klausmeier, 1969). Since the publication of that paper they, in cooperation with the researchers of the CAA Project, have refined their thinking and advanced this system. The refinements are discussed in "A Structure of Concept Attainment Abilities: The Problem and Strategies for Attacking It" (Harris, Harris, Frayer, & Quilling, in press). Briefly, a concept may be described in many ways: in terms of its criterial, relevant, and irrelevant attributes; its examples and nonexamples; its supraordinate, coordinate, and subordinate hierarchical relationships (theoretically determined); and its lawful or other types of relationships to other concepts. Knowledge of each of these kinds of information may be tested to determine a student's level of attainment of a concept. An analysis, along these lines, of each of the 30 sampled language arts concepts which are being studied can be found in "Selection and Analysis of Language Arts Concepts for Inclusion in Tests of Concept Attainment" (Golub, Fredrick, Nelson, & Frayer, 1971a).

Thus, using the analysis of a concept as the basis for appropriate content and the 12 tasks of the schema as the basis for appropriate tasks, 12 items were developed for each of the 30 concepts. There was one item for each of the 12 tasks (except for Task 11 for five of the concepts which had no appropriate subordinate concept identified), making a total of 355 language arts items which were developed for the purpose of measuring and assessing concept attainment in language arts. The development of the items, along with item and total score statistics (for concepts and for tasks) obtained for them for beginning sixth grade boys and girls, will be discussed in the following sections.

Table 1
Language Arts Concepts Categorized by Area

Area I Words	Area II Words in Sentences	Area III Connected Discourse
*abbreviation	*adjective	body
antonym	adverb	business letter
apostrophe	capital letter	closing
*compound word	colon	*comparison
*consonant	comma	conclusion
consonant blend	command	description
*contraction	common noun	*detail
*homonym	connector	envelope
hyphen	determiner	example
long vowel	exclamation	*explanation
meaning	exclamation mark	*greeting
prefix	forms of be	*heading
rhyme	forms of have	indentation
root word	*helping verb	inside address
*short vowel	main verb	invitation
*silent letter	modifier	mailing address
specific word	negative	main idea
*suffix	noun	narration
syllable	past tense	order of ideas
*synonym	*period	*paragraph
vowel	plural noun	poetry
*word	*possessive noun	quotation
	*predicate	*return address
	preposition	signature
	*present tense	social letter
	*pronoun	story
	proper noun	supporting sentence
	question	*thank you letter
	*question mark	theme
	regular verb	*title
	request	*topic sentence
	*sentence	
	singular noun	
	statement	
	subject	
	tense	
	*verb	

* Concepts that were selected for testing.

II
Procedures

This section contains a discussion of the item development procedures used including initial item construction and revision of those items based on item analysis results. Also included is a discussion of the data collection procedures, subjects, and treatment of the data.

Test Development

One item for each of the 12 tasks was generated for each of the 30 selected concepts, with the exception of Task 11 for five of the concepts. If one looks at the tasks used to measure understanding of the concept, it is apparent that there can be more than one item generated for at least some of the tasks. For example, a Task 1 type item could be constructed to measure understanding of each of many relevant attributes for most concepts. For this project, it was decided to construct just one multiple-choice item for each task for each concept. This made it necessary to have bases for making choices when such choices were necessary. These bases consisted of principles for selecting attributes, relationships, incorrect choices, etc. A discussion of such bases may be found in "A Structure of Concept Attainment Abilities: The Problem and Strategies for Attacking It" (Harris et al., in press).

General procedures for item construction included initial item generation by a subject matter specialist item writer; critique of the items by a committee composed of the item writers from each of the four subject matters being studied (the other three are mathematics, science, and social studies), an experienced elementary school teacher specializing in reading, and a measurement specialist; and final critique by the subject matter principal investigator and a measurement specialist. Concerns in the item construction process were readability, validity, and reliability.

Readability

It was intended that no student should be unable to answer an item correctly simply because of inability to read the item. In writing items, very simple language was used wherever possible. Several pilot studies concerned with the readability question were conducted, and two outside consultants expert in the testing and measurement fields were asked to look at a sample of the items from the point of view of readability for fifth graders. No significant differences were found among treatment groups studied; percentage of occurrence of subjects who could not pronounce the word and did not know its meaning when shown the concept labels, but did know its meaning when the word was pronounced, was judged to be negligible; and the two outside consultants independently advised that there was no reading problem with the items and that there should be no concern about administering them in the standard way in which the students read the items themselves. The conclusion drawn from the results of the pilot studies and the consultants' opinions was that readability of the items was not a problem and standard administration conditions would be satisfactory. For further information see Harris et al. (in press).

Validity

The content validity of each of the items was of immediate concern during item construction; aspects of construct validity were to be probed later using duplicate test construction, simplex analysis, and factor analysis of the results obtained using the content-valid items

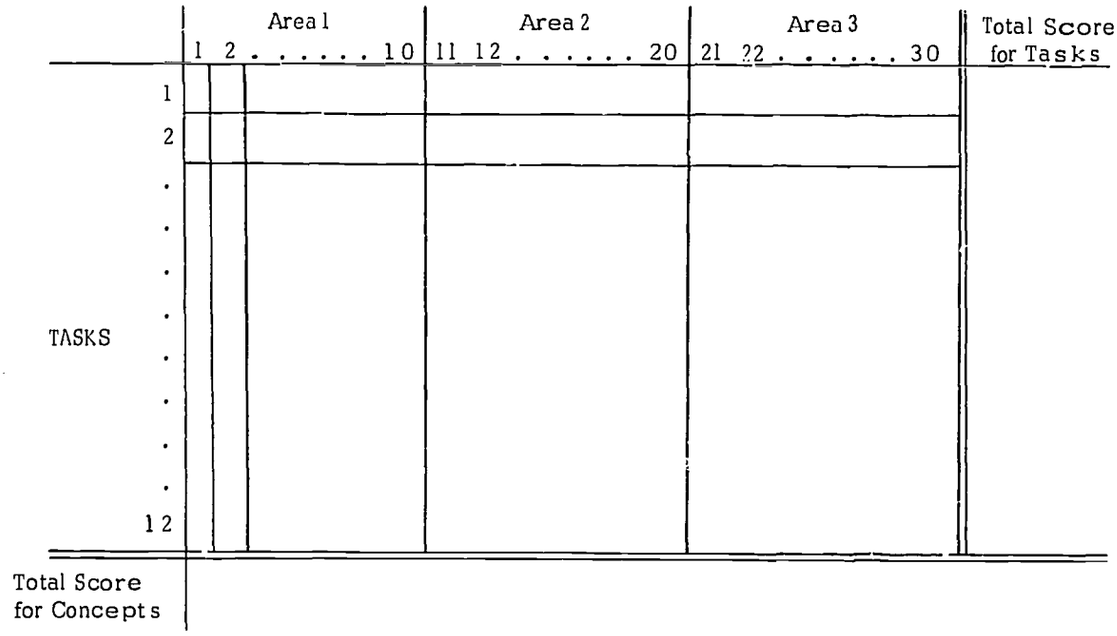

Fig. 1. Item matrix for each individual.

constructed.

Content Validity. Each item was constructed to meet the content and task specifications set for it. The task required of the student by each item was specified by the schema adopted for use in measuring concept attainment. The concept name was given by the sampling process; the attributes, examples, definition, and relationships associated with the concept name were defined by the prior analysis of the concept. The content for each item was specified in this manner. The content specifications were not as precise as the task specifications due to the necessity of choosing a single attribute to be tested for example and selecting the incorrect alternatives to be used in the multiple-choice questions. Systematic construction of alternate choices was used whenever possible; for example, for an item dealing with a type of sentence, other types of sentences (or examples of them) were used as incorrect choices, e.g. exclamation, question, statement.

To further ensure the content validity of the items, two persons who were familiar with the schema for testing concept attainment, but were not involved in the item development process, classified five random sets of 72 items (12 items for six concepts in each set) according to content and task. These two persons had the analysis of the concepts available. They were able to correctly classify all but a few of the items. Any questions they had about these few items were mutually resolved among the subject matter principal investigator, the measurement specialist, and themselves.

Reliability

Developing one item for each of the 12 tasks for each of the 30 selected concepts yields a 12 (tasks) by 30 (concepts) matrix consisting of the score for each of the 360 items, one for each cell of the matrix, for each individual to whom the items were administered. Thus, a completely crossed design exists and two types of total scores can be secured from this matrix: a total score for each of the 30 concepts (totalled across tasks) and a total score for each of the 12 tasks (totalled across concepts). Figure 1 is an illustration of such a matrix.

This design offers these alternatives: (a) use a total score of 360 items to analyze all items against; (b) use 30 total scores,

each for one concept and consisting of 12 items, to analyze the 12 task items against; and (c) use 12 total scores, each for one task and consisting of 30 items, to analyze the 30 concept items against. The first alternative was rejected since it assumes neither task nor concept variation is present. A choice was not made between the next two alternatives. Instead, both were done. An important theoretical problem of how to item analyze a completely crossed design like this remains to be solved.

Major concerns about reliability for the test development process were that internal consistency reliability estimates for task scores (total of 30 items across concepts) and concept scores (total of 12 items across tasks) be high enough to warrant further study using such scores. It was recognized that there might be some contradictions in what was attempted. The items were constructed to comply with the completely crossed design, 30 concepts by 12 tasks. One major objective of the entire project is to determine the dimensionality of the selected language arts concepts and of the tasks when using language arts content. If either or both of these are not unidimensional, then an internal consistency reliability estimate based upon items measuring aspects from the multidimensions would reflect this; the more dimensions present and the more uncorrelated they are, the lower the internal consistency estimate. Recognizing this, and not being able to study the dimensionality of the two modes (concepts and tasks) until after the items were developed, pilot studies were conducted using the items for some of the concepts for the 12 tasks. As will be pointed out later, evidence indicates that sufficiently reliable scores can be obtained for both task scores and concept scores.

Item Revision

If one looks at the 12 tasks for a single concept it becomes quite apparent that there may be a strong learning effect as one attempts to answer the items. The name of the concept appears in every item, except for the first two which deal with an attribute of the concept, either in the stem or as a possible choice. This makes a random presentation of the items desirable. Using items for six of the mathematics concepts presented on mark sense type cards, a study was conducted in which one group of subjects responded to the items arranged in the same random order (over 72 items for the six concepts) common to all subjects. The second group of subjects responded to the items arranged in a random order (over 72 items for the six concepts) which was a unique one for each subject of the group. No significant differences in test score were found between the subjects receiving a common random order and those receiving a unique random order.

Tryouts of the language arts items for item analysis and revision purposes were conducted using a single random order over the items for six concepts contained in a test booklet. This constituted a "test" of 72 items which could readily be administered in 1 hour. The tryouts were conducted during October, 1969, and January, 1970, with fifth grade students in the Madison, West Allis, and Sussex, Wisconsin school systems. Approximately 100 students (fewer for the Madison sample) responded to each "test." Madison students were given the items for six of the concepts in October; West Allis and Sussex students responded to the items for 12 concepts in January.

The tryout data were subjected to the Generalized Item Analysis Program (GITAP) (Baker, 1969), the output of which provides the proportion responding, item–criterion biserial correlation, X_{50} (point on the criterion scale corresponding to the median of the item characteristic curve), and ß (the reciprocal of the standard deviation of the item characteristic curve which is a measure of the discriminating power of the item) for each possible choice for each item as well as summary descriptive statistics for the total test. It also gives the Hoyt reliability for the total test and the standard error of measurement.

As discussed earlier, the design for these language arts achievement items is one in which the concepts and tasks are completely crossed. Since there are no item analysis procedures available for completely crossed designs, the data were analyzed in each of the two possible ways—each item as part of the appropriate concept score and as part of the appropriate task score. This raises questions as to the interpretation of such results. The main referents used for interpreting the results and as a basis for making item revisions were the results obtained from the analyses of the concept scores. The tasks were fixed and thus any arbitrary decisions were made in regard to appropriate content for incorrect choices, etc. Usual standards for item indices were not strictly adhered to, as a unique design for item analysis was being used and a major objective of the project is

to study the dimensionality of the concepts and of the tasks. If high discrimination indices were demanded, the dimensionality might have been affected by making the items more homogeneous. Also, no attempt was made to manipulate the difficulty level of the items, since another objective of the project is to determine if any differential levels of difficulty, or complexity, exist in the concepts and in the tasks. Therefore, the item analysis results were used as a very general guide to help in determining whether there were "hidden" weaknesses, clues, and/or incongruities in the items and, in an even more general sense, to show that what we were attempting to do was possible—sufficiently reliable concept and task scores could be obtained when using this completely crossed design.

The revised items can be found in "Items to Test Level of Attainment of Language Arts Concepts by Intermediate Grade Children" (Golub, Fredrick, Nelson, & Frayer, 1971b).

Subjects

Pilot studies revealed that the concepts selected were very difficult for fourth graders. Thus, the decision was made to test fifth grade students with the concepts identified as generally taught to students during the fourth grade.

The language arts items were administered to 186 boys and 259 girls who were just beginning the sixth grade during the fall of 1970 in the public school system of Madison, Wisconsin. The subjects were students who volunteered to participate as a result of a letter sent to a random selection from the population of all such boys and from the population of all such girls. Approximately 60% of those invited to participate in the testing responded affirmatively. The subjects who completed the testing program were paid $7.50.

Since the participation of all students comprising the random sample was impossible to attain, test scores and IQ data were obtained from the files of the Madison Public School System for those students for whom the information was available. Table 2 includes the summary statistics for the population of fifth grade students in the public school system of the city of Madison during the school year 1969–70, and for the boys and the girls who comprised the tested samples for the language arts items. The Lorge–Thorndike Intelligence scores were obtained in the fall of 1968 when the subjects were fourth graders, and the scores on the Iowa Tests of Basic Skills, given in grade equivalent scores, were obtained in the fall of 1969 when the subjects were fifth graders.

Data on fathers' occupations were collected from the students using the Master Occupational Code of the United States Bureau of the Census. These data were tabulated and are presented in Table 3.

Data Collection

The data were collected during five 2-hour testing sessions in mid-October to early November. Since a large percentage of sixth graders attended one of three middle schools, it was decided to test the selected students from those schools in their own buildings after school hours. The sixth grade students attending various elementary schools were tested on three consecutive Saturday mornings at centrally-located schools. Each 2-hour session consisted of a 72-item "test" composed of language arts items, a 72-item "test" composed of science items, and an activity break between the two. The language arts and the science items were given first on alternate days.

The language arts items were arranged in five 71-item "tests." The order of the items was assigned randomly over the potential 360 items. Two different random orders were used to collect the data: one for each type of school for both boys and girls. The items were arranged in five test booklets according to the random order. The students responded to each item by marking their chosen response directly on an answer sheet. The answer sheets were read by machine and the responses punched onto data cards. The tests were given by experienced test administrators to groups of approximately 30 subjects each.

Treatment of the Data

The treatment of the data consisted of two main procedures: reliability estimation and item analysis. The data were analyzed separately for each sex group. Hoyt analysis of variance reliability estimates were obtained for each of the 30 concept scores and each of the 12 task scores for each group studied. Means and standard deviations for each of the scores were also computed.

Item analyses using the GITAP program (Baker, 1969) were obtained for each of the items as a part of two different scores: an appropriate concept score and an appropriate task score. This program provides proportion

Table 2
Test Data for Population and Samples

Test		Population	Boys	Girls
Lorge-Thorndike Intelligence	$\bar{X}$	106.60	106.11	112.23
	s		14.82	13.37
	N	2605	161	239
Iowa Basic Skills				
Vocabulary	$\bar{X}$	5.53	5.54	5.88
	s		1.41	1.33
	N	2520	181	246
Reading Comprehension	$\bar{X}$	5.44	5.29	5.97
	s		1.51	1.35
	N	2520	181	247
Language Skills	$\bar{X}$	5.24	5.04	5.82
	s		1.44	1.34
	N	2520	181	248
Work-Study Skills	$\bar{X}$	5.46	5.41	5.86
	s		1.30	1.18
	N	2520	181	248
Arithmetic Skills	$\bar{X}$	5.05	5.08	5.35
	s		.96	1.00
	N	2520	181	247
Composite	$\bar{X}$	5.35	5.27	5.77
	s		1.17	1.11
	N	2520	181	245

responding, item-criterion biserial correlation, X_{50}, and β statistics for each choice of each item. The proportion of students who respond correctly to an item is an index of the difficulty level of that item. The greater the value of the difficulty index, the easier the item. The biserial correlation coefficient is an index of the discriminating ability of the item choice. For these analyses the criterion ability used was total concept or total task score. X_{50} is the point on the criterion scale, given in standard deviation units, corresponding to the median of the item characteristic curve. It is the point at which subjects with that score have a 50-50 chance of choosing that response. β is the reciprocal of the standard deviation of the item characteristic curve at the X_{50} point. It is an index of the discrimination power of the item.

When interpreting the data in the tables of this report, the reader should note that the Hoyt reliability coefficient is a measure of internal consistency. It indicates the extent to which a group of items measures the same trait or ability. For tests constructed in the present manner (that is, to test attainment of a concept at various levels) the Hoyt reliability may be low, thereby reflecting the various levels of concept attainment and not necessarily indicating a poor group of items. The item analysis data provide guidelines for deciding whether a particular item should be revised. The percentage of Ss correctly responding to an item is optimal as it approaches 50%. Those items that are too easy (over 90% correct responses, for example) or too hard (answered at a chance level—below 25% correct responses for a four-choice item, for example) may be improved even though they already discriminate at acceptable levels. The biserial correlation between the item response and the total score should be positive and at least as high as .30 for the correct choice. Below that level, the item is not contributing much, if anything, to the reliability of the total score, and should be changed or improved. In the same manner, the β for an

Table 3
Distribution of Fathers' Occupations

	Girls	Boys
00. Accountant	4	7
01. Architect	3	2
02. Dentist	3	1
03. Engineer	10	7
04. Lawyer, Judge	6	2
05. Clergyman	--	3
06. Doctor	12	3
07. Nurse	--	--
08. Teacher, Professor	20	15
09. Other Professional	26	15
11. Farmer	--	--
21. Owner of Business	4	2
22. Manager, Official	28	13
31. Bookkeeper	--	--
32. Receptionist	1	--
39. Other Clerical	6	4
49. Salesman	27	24
51. Craftsman, Skilled Worker	39	22
52. Foreman	--	2
53. Armed Services - Officer	--	1
54. Armed Services - Enlisted	--	1
61. Truck Driver	5	4
62. Operative in Factory	16	11
69. Other Operative	12	12
71. Fireman	2	2
72. Policeman	2	4
73. Other Protective Service Worker	3	--
74. Practical Nurse, Nurse's Aide	1	1
75. Private Household Worker	--	--
79. Other Service Workers	14	16
81. Non-Farm Laborer	3	2
82. Farm Laborer	1	--
91. Not presently in labor force	6	6
99. Not ascertained	12	10

item should be +.30 or higher. The X_{50} statistic should be small, thereby indicating that the item is functioning in the middle range of difficulty. As X_{50} becomes large (either below -2.0 or above +2.0) the item is either very easy or very difficult. For example, an X_{50} of +2.0 would indicate that the students who have an even chance of answering the item correctly score two standard deviations above the mean on the total test. Such guidelines as to reliability, difficulty, and discrimination were used to determine and correct weaknesses and incongruities in the item.

III
Results and Discussion

The means, standard deviations, Hoyt reliability estimates, and standard errors of measurement are presented in Table 4 for each of the 12 tasks which were used to test the attainment of concepts. The Hoyt reliabilities for these 30-item tests range from .72 to .89, showing that each task level has a fairly high internal consistency, even though questions within a task measure 30 different and distinct concepts. The standard error of measurement averages slightly more than two points out of a possible 30. In general, the tasks seem more difficult as one moves from Level 1 to Level 12; however, this is not an ordered progression. The correlation between the rank-order of difficulty and the task number is .85. In absolute terms, it appears that students know attributes, examples, and relationships of concepts for only half to two-thirds of the concepts taught them in the preceding years of school as measured by the language arts items developed.

Boys and girls differ in magnitude of scores at all task levels, girls scoring 2.4 to 3.7 points higher than the boys. On these items and for this type of verbal knowledge girls are approximately one-half of a standard deviation above boys.

A close examination of Table 4 indicates that although girls are approximately one-half of a standard deviation above boys for all tasks, both boys and girls find certain tasks either easy or difficult. The easiest task, for both boys and girls, is to select examples of a named attribute; the most difficult task is for them to relate logically two concepts and to conclude with a principle. The selection of a supraordinate concept is not necessarily difficult for the students; however, selecting a subordinate concept, when one is available, is the second most difficult task for students. The third most difficult task is to determine the irrelevant attributes of a concept, that is, determining what is not necessarily a distinguishing feature of a concept. Table 4 presents a reading of intermediate-grade children's levels of conceptualization in language arts.

In Table 5, similar data to those in Table 4 are presented showing the scores for each of the 30 concepts. The most difficult items (and perhaps the most difficult concepts) were written for the concepts Adjective, Helping Verb, Predicate, and Topic Sentence. The easiest items were for the concepts Question Mark, Thank You Letter, Silent Letter, and Sentence. For each concept, girls scored higher than boys by .8 to 1.8 points. As is true for the task scores, the concept scores are equally reliable measures for each of the sex groups. The reliability estimates are generally lower for these concept scores (range from .47 to .80) than for the task scores. This may result partly from the fewer items (12 as opposed to 30) in the concept scores and also partly from the nature of the 12 tasks. That is, the different tasks for a particular concept may not be as internally consistent as the knowledge of the different concepts at a particular task level. This is unlikely, however, since some Spearman-Brown estimates for tripled test lengths are:

Original	Estimated
.50	.75
.60	.82
.65	.85
.70	.88

Thus, it seems that the lower reliability estimates are a function of the number of items.

Table 5 shows that the easiest concepts for girls are not necessarily the easiest concepts for boys. There is some consistency, however, between the magnitude of scores for the boys and the girls, the average difference being about one half of a standard deviation.

Table 4
Language Arts Test Results for the 12 Tasks

Task No.	No. of Items	Boys (N = 186) Mean	S.D.	Hoyt R.	S.E.	Girls (N = 259) Mean	S.D.	Hoyt R.	S.E.
1	30	19.4	6.3	.87	2.2	23.1	5.3	.86	1.9
2	30	17.2	6.3	.86	2.3	20.7	5.7	.85	2.2
3	30	18.0	5.9	.84	2.3	21.4	5.2	.83	2.1
4	30	18.0	5.4	.80	2.4	21.0	5.3	.82	2.2
5	30	16.6	6.1	.84	2.4	19.8	5.4	.83	2.2
6	30	15.4	6.3	.85	2.4	19.0	6.3	.86	2.3
7	30	14.4	5.2	.75	2.5	16.8	5.3	.78	2.5
8	30	15.6	7.0	.88	2.4	19.3	6.8	.89	2.2
9	30	16.3	6.6	.87	2.4	19.5	6.4	.87	2.2
10	30	16.1	6.3	.85	2.4	19.4	6.0	.86	2.2
11[a]	25 (30)	11.4 (13.7)	4.3	.72	2.2	13.5 (16.2)	4.4	.75	2.2
12	30	12.3	5.2	.78	2.4	15.1	5.7	.82	2.4

Task No.	Task Description	Mean Number Correct for Boys & Girls	Rank-Order of Tasks
1	Given name of attribute, select example.	21.6	1
2	Given example of attribute, select name.	19.3	4
3	Given name of concept, select example.	20.0	2
4	Given name of concept, select nonexample.	19.8	3
5	Given example of concept, select name.	18.5	5
6	Given concept, select relevant attribute.	17.6	9
7	Given concept, select irrelevant attribute.	15.8	10
8	Given definition of concept, select name.	17.8	8
9	Given name of concept, select definition.	18.2	6
10	Given concept, select supraordinate concept.	18.1	7
11[a]	Given concept, select subordinate concept.	12.7 (15.2)	11
12	Given two concepts, select relationship.	14.0	12

[a] Five concepts did not possess appropriate subordinates. The numbers in parentheses are extrapolations based on 30 items.

Of the thirty (30) concepts chosen for inclusion in this test, 1-10 deal with words and word-forms, 11-20 deal with words in sentences, and 21-30 deal with connected discourse. The first ten concepts, in the category of words and word-forms, are the easiest for intermediate grade children. Concepts in this area are associated with reading and spelling instruction started in the primary grades. The easiest concepts for boys are Consonants, Short Vowel, and Silent Letter, the most difficult concepts for boys being Suffix and Synonym. None of the concepts in this area was particularly difficult.

The concepts in group 11-20 are the most difficult for both boys and girls. Instruction in most of these concepts does not generally start until the fourth grade. The most difficult concepts in this group are Adjective, Helping Verb, Predicate, Possessive Noun, and Pronoun. The easiest concepts in this group are Period and Question Mark.

Table 5
Language Arts Test Results for the 30 Concepts

No.	Concept	Boys (N = 186) Mean	S.D.	Hoyt R.	S.E.	Girls (N = 259) Mean	S.D.	Hoyt R.	S.E.
1	Abbreviation	6.8	2.8	.71	1.5	8.4	2.6	.72	1.3
2	Compound Word	6.8	2.7	.69	1.5	8.5	2.5	.70	1.3
3	Consonant	7.3	2.6	.67	1.4	8.4	2.4	.68	1.3
4	Contraction	6.2	2.9	.73	1.5	7.6	3.0	.77	1.4
5	Homonym	6.8	2.7	.69	1.4	8.3	2.5	.69	1.3
6	Short Vowel	7.5	2.9	.76	1.4	8.6	2.7	.75	1.3
7	Silent Letter	7.4	2.8	.70	1.4	9.0	2.6	.74	1.3
8	Suffix	6.0	3.3	.80	1.4	7.2	3.3	.80	1.4
9	Synonym	6.1	2.8	.68	1.5	7.6	2.7	.70	1.4
10	Word	6.8	2.8	.71	1.4	8.0	2.6	.70	1.4
11	Adjective	4.6	2.6	.65	1.5	5.5	2.9	.72	1.4
12	Helping Verb	4.9	2.2	.47	1.5	5.7	2.3	.52	1.5
13	Period	7.0	2.7	.67	1.5	8.5	2.4	.68	1.3
14	Possessive Noun	5.8	2.7	.67	1.5	6.9	2.7	.69	1.4
15	Predicate	5.1	2.7	.67	1.5	6.3	3.0	.74	1.5
16	Present Tense	6.0	2.7	.68	1.5	7.1	2.7	.72	1.4
17	Pronoun	5.5	2.7	.66	1.5	6.5	2.8	.72	1.4
18	Question Mark	7.9	2.9	.76	1.3	9.6	2.5	.77	1.2
19	Sentence	6.9	2.9	.72	1.5	8.7	2.7	.75	1.3
20	Verb	6.3	2.8	.69	1.5	7.1	2.9	.75	1.4
21	Comparison	6.2	2.9	.72	1.5	7.4	2.8	.72	1.4
22	Details	6.1	2.7	.68	1.5	7.3	2.8	.73	1.4
23[a]	Explanation	6.0 (6.5)	2.7	.70	1.4	6.7 (7.3)	2.7	.72	1.4
24	Greeting	6.7	2.6	.67	1.4	8.0	2.4	.67	1.3
25[a]	Heading	4.9 (5.3)	2.3	.59	1.4	5.9 (6.4)	2.5	.69	1.3
26[a]	Paragraph	6.5 (7.1)	2.7	.71	1.4	7.7 (8.4)	2.6	.75	1.3
27[a]	Return Address	6.9 (7.5)	2.3	.64	1.3	8.1 (8.8)	2.0	.57	1.2
28[a]	Thank You Letter	7.2 (7.8)	2.7	.74	1.3	8.6 (9.4)	2.3	.73	1.1
29	Title	7.2	2.9	.73	1.4	8.7	2.4	.68	1.3
30	Topic Sentence	5.1	2.4	.58	1.5	6.4	2.7	.67	1.5

[a] Denotes concepts tested by 11 items rather than 12. These concepts did not have appropriate subordinates as required in Task 11. The numbers in parentheses are extrapolations based on 12 items.

The last group of concepts (21-30), dealing with connected discourse, represents middle-difficulty concepts. The most difficult concepts in this group are Heading and Topic Sentence, the easiest being Thank You Letter and Title. The girls average about a half of a standard deviation above the boys.

The level of attainment shown in Table 5 for concepts taught before the beginning of sixth grade indicates some areas of needed teaching and testing emphasis.

Table 6 gives a summary of the item data for the correct response to all 355 items. (Note that decimal points have been omitted in the columns of biserial R.) The items are arranged by concept, and within each concept the 12 tasks are in order from 1 through 12. Thus, Item 14 is the data for Task Level 2 for Compound Word. Six percent, or 22, of the items had a Beta score below .30, indicating that the item might need revision to improve its discriminating power. These 22 items are

Table 6
Item Indices Based on Concept and Task Criterion Scores

Item No.	Percent Correct B	Percent Correct G	Biserial R Boys C	Biserial R Boys T	Biserial R Girls C	Biserial R Girls T	X_{50} Boys Concept	X_{50} Boys Task	X_{50} Girls Concept	X_{50} Girls Task	Beta Boys Concept	Beta Boys Task	Beta Girls Concept	Beta Girls Task
Abbreviation														
1	65	87	56	59	89	81	-.66	-.64	-1.26	-1.38	.68	.72	1.97	1.39
2	61	78	76	61	77	72	-.36	-.45	-1.00	-1.08	1.16	.76	1.21	1.03
3	75	88	66	55	62	54	-1.01	-1.21	-1.94	-2.21	.88	.66	.78	.64
4	70	84	68	63	69	62	-.77	-.82	-1.43	-1.58	.92	.82	.95	.80
5	62	77	77	70	62	62	-.39	-.43	-1.21	-1.21	1.19	.99	.78	.78
6	57	68	49	38	58	51	-.36	-.47	-.82	-.93	.56	.41	.72	.60
7	52	61	54	40	57	44	-.10	-.14	-.51	-.65	.65	.44	.70	.50
8	42	48	61	59	63	57	.31	.32	.08	.09	.76	.73	.81	.69
9	49	64	73	73	84	83	.04	.04	-.43	-.44	1.06	1.07	1.58	1.46
10	61	73	66	61	72	76	-.41	-.45	-.87	-.82	.89	.77	1.02	1.16
11	55	72	73	56	75	71	-.19	-.24	-.77	-.81	1.06	.67	1.13	1.01
12[a]	30	36	32	25	50	35	1.69	2.17	.74	1.06	.34	.25	.58	.37
Compound Word														
13	79	85	57	55	59	51	-1.41	-1.47	-1.74	-2.04	.70	.66	.74	.59
14[a]	33	40	52	28	42	26	.84	1.55	.59	.95	.60	.29	.47	.27
15	54	81	73	70	82	77	-.13	-.14	-1.09	-1.16	1.08	.97	1.44	1.21
16	71	88	63	63	81	69	-.88	-.88	-1.44	-1.69	.81	.81	1.36	.94
17	70	79	60	60	72	59	-.90	-.90	-1.11	-1.35	.74	.75	1.03	.74
18	62	77	60	44	88	84	-.50	-.68	-.85	-.89	.76	.49	1.82	1.53
19	55	73	53	46	64	54	-.26	-.29	-.97	-1.15	.62	.52	.83	.65
20	68	81	67	60	67	65	-.68	-.77	-1.31	-1.35	.91	.75	.91	.86
21	51	73	66	67	75	71	-.02	-.02	-.82	-.87	.88	.91	1.13	1.00
22	44	50	48	46	61	53	.34	.35	.01	.01	.54	.52	.78	.63
23	52	58	63	61	45	32	-.09	-.09	-.44	-.63	.81	.78	.51	.34
24	46	63	68	66	70	67	.14	.14	-.45	-.48	.93	.89	.99	.90
Consonant														
25	91	92	50	55	58	59	-2.74	-2.48	-2.47	-2.40	.58	.66	.71	.74
26	74	86	59	49	71	67	-1.07	-1.28	-1.53	-1.61	.74	.57	1.00	.91
27	71	82	83	76	84	82	-.67	-.72	-1.08	-1.11	1.46	1.19	1.57	1.45
28	68	75	59	43	55	45	-.81	-1.10	-1.20	-1.45	.73	.48	.66	.51
29	73	87	72	66	82	77	-.86	-.94	-1.37	-1.45	1.03	.87	1.44	1.22
30	42	49	56	57	63	66	.36	.35	.02	.02	.68	.70	.82	.89
31	44	51	43	34	57	46	.35	.44	-.06	-.07	.47	.36	.69	.51
32	54	63	66	68	53	54	-.14	-.14	-.62	-.62	.88	.92	.63	.63
33	72	81	68	58	78	73	-.86	-1.01	-1.12	-1.21	.93	.70	1.27	1.06
34	62	77	72	62	81	72	-.44	-.51	-.91	-1.02	1.05	.81	1.37	1.02
35	48	53	52	55	55	47	.10	.10	-.13	-.15	.60	.65	.65	.54
36	27	41	54	47	63	45	1.10	1.29	.36	.51	.65	.53	.80	.51
Contraction														
37	60	74	74	64	80	79	-.35	-.40	-.81	-.82	1.11	.84	1.32	1.30
38	48	64	63	59	82	72	.09	.09	-.46	-.51	.80	.74	1.41	1.05
39	65	75	67	65	89	77	-.56	-.57	-.75	-.87	.90	.86	1.99	1.22
40	70	79	54	48	58	54	-1.00	-1.13	-1.40	-1.51	.64	.54	.71	.64
41	63	68	72	59	79	67	-.46	-.55	-.57	-.68	1.04	.74	1.31	.90
42	48	66	80	74	84	81	.05	.06	-.50	-.52	1.33	1.08	1.55	1.40
43	48	64	66	45	53	44	.08	.12	-.68	-.82	.88	.50	.62	.49
44	42	54	71	62	79	69	.29	.33	-.14	-.16	1.01	.79	1.27	.95
45	53	63	63	50	75	57	-.13	-.16	-.45	-.60	.82	.58	1.14	.69
46	52	68	63	64	63	47	-.06	-.06	-.76	-1.01	.82	.84	.80	.53

[a] Denotes Beta scores below .30. Item might need revision.

Table 6. (Continued)

Item No.	Percent Correct B	Percent Correct G	Biserial R Boys C	Biserial R Boys T	Biserial R Girls C	Biserial R Girls T	X_{50} Boys Concept	X_{50} Boys Task	X_{50} Girls Concept	X_{50} Girls Task	Beta Boys Concept	Beta Boys Task	Beta Girls Concept	Beta Girls Task
Contraction (continued)														
47[a]	32	29	24	13	10	01	1.00	3.54	5.74	46.25	.25	.13	.10	.01
48	40	56	59	51	76	79	.44	.51	-.21	-.20	.73	.59	1.16	1.29
Homonym														
49	67	77	73	63	52	49	-.59	-.68	-1.40	-1.49	1.05	.82	.61	.56
50	61	82	75	81	73	73	-.36	-.34	-1.24	-1.24	1.13	1.36	1.07	1.08
51	65	75	71	59	76	61	-.54	-.65	-.90	-1.12	1.02	.74	1.18	.77
52	81	88	65	50	77	67	-1.35	-1.76	-1.54	-1.78	.86	.58	1.23	.91
53	77	81	64	63	72	62	-1.14	-1.16	-1.23	-1.42	.84	.82	1.03	.79
54	47	69	63	52	71	75	.11	.13	-.71	-.67	.80	.61	1.00	1.13
55	65	80	67	59	69	39	-.56	-.63	-1.24	-2.20	.89	.73	.94	42
56	46	55	65	42	60	53	.17	.26	-.20	-.23	.86	.46	.74	.62
57	58	69	57	44	66	57	-.33	-.43	-.74	-.86	.69	.49	.88	.69
58	54	71	54	65	82	84	-.17	-.15	-.68	-.66	.65	.85	1.41	1.53
59[a]	22	32	15	-05	30	22	5.42	16.31	1.50	2.08	.15	-.05	.32	.22
60	39	54	63	49	61	58	.46	.59	-.18	-.19	.81	.56	.76	.71
Short Vowel														
61	84	91	65	82	75	75	-1.51	-1.21	-1.79	-1.81	.86	1.41	1.15	1.11
62	62	75	73	69	70	60	-.43	-.46	-.98	-1.13	1.05	.94	.97	.76
63	86	85	72	58	67	62	-1.50	-1.86	-1.54	-1.68	1.04	.71	.91	.78
64	70	84	66	53	71	70	-.79	-.98	-1.39	-1.41	.89	.63	1.01	.97
65	69	82	72	56	66	58	-.70	-.90	-1.39	-1.56	1.04	.68	.87	.72
66	49	64	66	65	81	63	.02	.02	-.43	-.55	.87	.85	1.39	.81
67	47	53	52	49	55	45	.15	.17	-.11	-.14	.62	.56	.66	.50
68	58	64	68	59	75	64	-.28	-.32	-.50	-.58	.92	.73	1.12	.84
69	51	67	75	58	79	67	-.02	-.02	-.55	-.65	1.15	.70	1.27	.89
70	60	71	69	55	79	73	-.38	-.47	-.70	-.76	.95	.66	1.30	1.08
71	60	70	85	73	75	66	-.30	-.36	-.71	-.81	1.61	1.06	1.12	.87
72	49	57	56	52	55	58	.02	.03	-.31	-.29	.67	.61	.66	.72
Silent Letter														
73	67	86	76	75	95	91	-.57	-.58	-1.12	-1.16	1.16	1.12	3.11	2.26
74	70	85	69	66	80	74	-.78	-.82	-1.32	-1.42	.96	.87	1.33	1.10
75	84	90	54	49	55	48	-1.84	-2.00	-2.29	-2.65	.65	.57	.66	.54
76	60	79	65	58	89	76	-.40	-.44	-.90	-1.05	.84	.72	1.91	1.18
77	65	85	74	66	78	67	-.50	-.57	-1.31	-1.52	1.12	.87	1.24	.90
78	51	65	58	58	65	55	-.05	-.05	-.59	-.69	.71	.71	.85	.66
79	63	70	45	38	52	43	-.74	-.87	-1.02	-1.25	.51	.41	.61	.47
80	57	74	70	62	76	67	-.25	-.28	-.85	-.96	.98	.79	1.16	.91
81	54	64	52	55	56	43	-.18	-.17	-.66	-.87	.62	.65	.68	.47
82	59	70	64	54	70	65	-.34	-.40	-.76	-.81	.83	.65	.98	.87
83	69	78	58	42	70	55	-.87	-1.21	-1.11	-1.40	.71	.46	.97	.66
84	44	56	62	60	76	74	.24	.25	-.18	-.19	.80	.75	1.23	1.09
Suffix														
85	47	70	57	64	55	61	.12	.11	-.93	-.83	.70	.84	.66	.77
86	52	62	68	61	67	56	-.08	-.09	-.45	-.53	.93	.77	.90	.68
87	52	66	80	71	79	62	-.07	-.08	-.51	-.65	1.33	1.01	1.29	.78
88	45	56	60	49	68	49	.20	.25	-.21	-.29	.74	.56	.92	.56
89	53	70	85	69	90	70	-.10	-.12	-.57	-.73	1.62	.96	2.04	.98
90	51	69	62	63	67	60	-.02	-.02	-.73	-.81	.79	.80	.90	.75
91	44	46	55	52	64	51	.30	.31	.17	.22	.66	.61	.83	.59
92	54	63	79	67	81	65	-.14	-.16	-.41	-.50	1.30	.91	1.39	.86
93	46	58	80	62	67	46	.13	.18	-.30	-.44	1.34	.78	.90	.51

Table 6. (Continued)

Item No.	Percent Correct B	Percent Correct G	Biserial R Boys C	Biserial R Boys T	Biserial R Girls C	Biserial R Girls T	X_{50} Boys Concept	X_{50} Boys Task	X_{50} Girls Concept	X_{50} Girls Task	Beta Boys Concept	Beta Boys Task	Beta Girls Concept	Beta Girls Task
Suffix (continued)														
94	67	71	70	58	86	87	-.64	-.77	-.65	-.64	.97	.70	1.66	1.74
95	46	47	73	58	66	53	.13	.16	.12	.16	1.06	.71	.88	.62
96	40	46	72	61	77	63	.34	.40	.12	.15	1.04	.77	1.19	.80
Synonym														
97	58	76	65	57	64	62	-.29	-.34	-1.08	-1.12	.85	.69	.84	.80
98	54	71	53	57	79	69	-.18	-.17	-.68	-.79	.62	.69	1.30	.95
99	37	45	52	30	62	38	.63	1.10	.20	.32	.61	.31	.79	.41
100	62	81	63	58	71	64	-.50	-.54	-1.22	-1.36	.81	.72	1.01	.82
101	41	49	71	54	71	59	.33	.43	.03	.04	1.00	.64	1.00	.73
102	59	64	56	40	52	44	-.41	-.57	-.68	-.80	.67	.44	.61	.49
103	49	65	61	45	58	49	.04	.06	-.67	-.81	.78	.50	.72	.56
104	58	78	75	70	65	68	-.25	-.27	-1.17	-1.11	1.14	.99	.85	.93
105	61	73	65	58	76	64	-.44	-.49	-.82	-.97	.85	.72	1.16	.84
106	53	66	60	67	70	67	-.11	-.10	-.59	-.62	.75	.90	.99	.90
107	27	37	37	39	41	30	1.62	1.54	.78	1.05	.40	.42	.45	.32
108	50	57	54	46	57	50	.00	.00	-.31	-.36	.64	.53	.70	.58
Word														
109	69	78	65	60	69	73	-.78	-.84	-1.14	-1.08	.86	.75	.96	1.07
110	36	45	45	40	45	39	.80	.89	.27	.31	.50	.44	.50	.42
111	67	78	75	61	55	57	-.59	-.73	-1.42	-1.37	1.14	.76	.66	.70
112	84	92	64	64	82	67	-1.57	-1.58	-1.71	-2.10	.84	.83	1.41	.90
113	35	44	53	44	53	37	.70	.84	.26	.38	.63	.49	.63	.40
114	48	51	58	46	54	41	.09	.12	-.06	-.08	.71	.51	.64	.45
115	61	70	57	45	66	51	-.51	-.64	-.80	-1.04	.69	.50	.88	.59
116	40	51	64	49	58	56	-.41	.53	-.06	-.06	.82	.56	.72	.67
117	70	80	81	62	84	81	-.64	-.85	-1.01	-1.05	1.39	.78	1.57	1.38
118	51	66	76	77	85	86	-.04	-.03	-.50	-.49	1.17	1.22	1.60	1.67
119	54	70	64	73	68	68	-.15	-.13	-.78	-.78	.83	1.05	.93	.93
120	67	76	56	54	76	67	-.80	-.82	-.93	-1.05	.67	.64	1.17	.91
Adjective														
121	49	58	67	73	68	51	.02	.02	-.28	-.37	.91	1.07	.93	.59
122	56	60	69	66	72	57	-.24	-.25	-.35	-.44	.95	.87	1.03	.69
123	33	45	53	46	65	48	.81	.94	.19	.25	.63	.51	.85	.55
124	40	55	71	68	66	67	.37	.38	-.18	-.18	1.00	.92	.89	.91
125	35	41	57	33	66	44	.68	1.18	.33	.50	.69	.35	.88	.49
126	53	61	63	65	70	58	-.13	-.12	-.40	-.48	.82	.85	.97	.70
127	37	49	52	43	62	52	.64	.76	.04	.05	.60	.48	.80	.60
128	38	47	69	48	61	48	.46	.65	.13	.17	.94	.55	.78	.55
129	33	41	69	62	81	64	.62	.69	.30	.37	.96	.80	1.37	.84
130	47	54	67	56	69	58	.12	.14	-.16	-.19	.89	.68	.95	.71
131[a]	17	20	44	27	51	29	2.15	3.52	1.68	2.96	.49	.28	.59	.30
132[a]	20	19	08	15	13	12	11.23	5.82	6.54	7.59	.08	.15	.14	.12
Helping Verb														
133[a]	30	25	31	18	41	31	1.68	2.95	1.63	2.15	.33	.18	.45	.33
134	53	66	63	59	64	72	-.11	-.11	-.67	-.60	.81	.73	.83	1.03
135	59	74	67	48	64	43	-.35	-.48	-1.01	-1.50	.90	.55	.83	.48
136	44	51	59	43	45	39	.25	.34	-.05	-.06	.73	.48	.51	.43
137	46	63	59	49	60	57	.18	.22	-.57	-.60	.74	.56	.74	.69
138	47	52	54	43	56	40	.12	.16	-.08	-.11	.65	.48	.67	.44
139	35	41	35	36	55	36	1.10	1.08	.40	.60	.37	.38	.66	.39
140	55	66	59	60	52	54	-.21	-.20	-.81	-.78	.73	.75	.62	.65

GPO 827-576-4

Table 6. (Continued)

Item No.	Percent Correct B	G	Biserial R Boys C	T	Girls C	T	X_{50} Boys Concept	Task	Girls Concept	Task	Beta Boys Concept	Task	Girls Concept	Task
Helping Verb (continued)														
141	40	41	52	31	59	49	.50	.84	.37	.45	.61	.32	.74	.56
142	30	36	57	39	50	35	.91	1.35	.75	1.05	.69	.42	.57	.38
143	31	36	40	35	54	39	1.27	1.44	.69	.94	.44	.37	.64	.43
144[a]	20	17	-09	-23	09	-05	9.60	3.70	11.18	19.28	-.09	-.23	.09	-.05
Period														
145	83	94	58	61	66	64	-1.67	-1.59	-2.37	-2.47	.71	.77	.89	.83
146	40	41	38	35	58	48	.65	.70	.40	.48	.41	.37	.70	.55
147	72	88	83	86	66	76	-.70	-.68	-1.82	-1.58	1.50	1.67	.87	1.15
148	58	71	52	39	51	48	-.37	-.49	-1.08	-1.15	.61	.42	.60	.55
149	48	64	67	63	68	69	.06	.06	-.54	-.54	.89	.80	.93	.95
150	64	79	58	50	61	53	-.62	-.72	-1.34	-1.54	.71	.57	.76	.62
151	42	45	46	36	49	39	.45	.57	.25	.31	.51	.38	.56	.43
152	48	69	67	54	77	68	.06	.08	-.63	-.73	.90	.63	1.23	.93
153	63	78	84	75	76	79	-.41	-.46	-1.00	-.96	1.52	1.12	1.18	1.29
154	74	86	63	60	82	72	-1.00	-1.05	-1.34	-1.52	.82	.75	1.44	1.05
155	42	60	57	45	73	55	.33	.42	-.34	-.45	.69	.51	1.08	.67
156	64	73	54	48	68	54	-.66	-.75	-.89	-1.11	.65	.54	.92	.65
Possessive Noun														
157	61	76	71	68	62	70	-.38	-.40	-1.15	-1.01	1.02	.93	.78	.99
158	70	76	69	66	66	71	-.77	-.82	-1.08	-1.00	.96	.87	.87	.99
159	47	58	69	46	67	48	.12	.18	-.31	-.44	.97	.52	.91	.54
160	60	72	43	46	53	39	-.60	-.58	-1.08	-1.46	.48	.50	.63	.43
161	51	61	54	41	70	48	-.02	-.03	-.39	-.56	.64	.45	.97	.55
162	46	54	67	58	63	46	.16	.19	-.18	-.24	.90	.71	.80	.52
163	47	56	52	42	56	41	.16	.20	-.29	-.39	.61	.46	.68	.45
164	57	68	71	56	63	63	-.25	-.31	-.74	-.74	1.01	.68	.80	.81
165	46	52	71	65	76	65	.15	.17	-1.95	-.08	1.01	.85	1.18	.85
166	42	61	58	72	64	64	.35	.28	-.44	-.43	.71	1.02	.82	.84
167	34	39	43	37	54	60	.96	1.14	.52	.47	.48	.39	.64	.74
168[a]	20	20	31	22	43	28	2.63	3.72	1.97	2.96	.33	.23	.47	.30
Predicate														
169	47	52	61	49	64	55	.11	.14	-.07	-.08	.76	.56	.84	.66
170	48	51	55	51	61	53	.10	.11	-.04	-.05	.65	.59	.77	.62
171[a]	41	51	45	24	51	30	.48	.89	-.03	-.05	.51	.25	.59	.31
172[a]	46	60	56	42	48	27	.17	.22	-.52	-.91	.68	.46	.55	.28
173	40	44	46	34	55	32	.54	.73	.27	.48	.51	.36	.66	.33
174	45	54	62	48	70	57	.22	.28	-.16	-.20	.79	.55	.97	.70
175	51	61	63	46	65	55	-.02	-.03	-.45	-.52	.81	.52	.85	.67
176	42	53	68	65	68	55	.30	.31	-.09	-.12	.93	.85	.93	.65
177	37	53	65	48	70	51	.50	.68	-.09	-.12	.86	.55	.98	.59
178	44	59	72	61	70	59	.21	.24	-.31	-.37	1.05	.77	.99	.73
179	37	42	57	42	69	53	.60	.82	.28	.36	.69	.46	.95	.63
180	37	54	56	53	73	64	.62	.64	-.14	-.16	.67	.63	1.06	.84
Present Tense														
181	60	75	74	66	83	79	-.33	-.37	-.81	-.85	1.10	.87	1.50	1.28
182	68	82	71	78	79	79	-.65	-.59	-1.15	-1.16	1.00	1.25	1.29	1.28
183	59	72	58	48	77	68	-.37	-.45	-.75	-.86	.72	.55	1.20	.92
184	66	76	73	64	79	64	-.55	-.63	-.91	-1.12	1.06	.83	1.28	.84
185	55	79	74	58	82	73	-.18	-.23	-.99	-1.11	1.11	.72	1.41	1.08
186	34	38	49	44	58	52	.82	.90	.51	.58	.56	.50	.72	.60

Table 6. (Continued)

Item No.	Percent Correct B	Percent Correct G	Biserial R Boys C	Biserial R Boys T	Biserial R Girls C	Biserial R Girls T	X_{50} Boys Concept	X_{50} Boys Task	X_{50} Girls Concept	X_{50} Girls Task	Beta Boys Concept	Beta Boys Task	Beta Girls Concept	Beta Girls Task
Present Tense (continued)														
187	34	32	56	43	40	36	.75	.98	1.14	1.28	.67	.47	.44	.38
188	46	53	58	45	67	62	.19	.24	-.11	-.12	.71	.51	.91	.79
189	58	63	54	38	53	49	-.38	-.54	-.60	-.65	.64	.41	.63	.56
190	41	46	49	40	52	30	.45	.45	.18	.31	.56	.55	.61	.31
191	56	69	78	62	79	67	-.19	-.24	-.63	-.74	1.23	.80	1.29	.91
192[a]	25	28	19	26	46	30	3.58	2.58	1.26	1.26	.19	.27	.51	.31
Pronoun														
193	68	83	70	61	73	77	-.68	-.78	-1.29	-1.22	.98	.77	1.06	1.21
194	44	66	73	73	70	75	.22	.22	-.58	-.54	1.07	1.05	.97	1.12
195	45	51	51	37	69	54	.27	.36	-.05	-.06	.59	.40	.96	.65
196	60	70	55	53	64	60	-.47	-.49	-.79	-.84	.66	.62	.84	.76
197	40	36	40	40	45	36	.65	.65	.82	1.04	.43	.43	.50	.38
198	51	53	65	64	67	59	-.04	-.04	-.09	-.11	.86	.84	.90	.72
199	45	44	55	55	62	61	.22	.22	.23	.23	.65	.66	.80	.78
200	52	70	58	59	74	59	-.09	-.09	-.72	-.90	.72	.72	1.09	.73
201	48	62	63	54	70	49	.09	.10	-.43	-.61	.81	.64	.99	.56
202	43	44	58	49	67	63	.30	.36	.24	.25	.72	.56	.91	.82
203	30	36	52	46	51	56	1.01	1.13	.71	.65	.60	.52	.60	.67
204	29	39	65	48	59	59	.85	1.16	.49	.49	.85	.54	.73	.73
Question Mark														
205	70	81	79	65	88	75	-.66	-.80	-1.01	-1.20	1.30	.87	1.90	1.12
206	53	65	64	59	73	71	-.11	-.11	-.54	-.55	.83	.73	1.07	1.01
207	74	89	71	62	71	59	-.90	-1.01	-1.71	-2.06	.99	.80	1.02	.73
208	88	92	68	69	88	69	-1.71	-1.69	-1.59	-2.04	.92	.94	1.83	.94
209	63	86	73	65	76	70	-.45	-.51	-1.41	-1.53	1.07	.86	1.16	.97
210	64	76	75	63	95	77	-.48	-.57	-.74	-.91	1.15	.80	2.91	1.20
211	35	59	60	57	74	64	.62	.65	-.32	-.37	.75	.70	1.11	.83
212	58	74	54	57	75	65	-.38	-.36	-.85	-.97	.64	.69	1.12	.86
213	74	84	79	68	78	56	-.82	-.96	-1.29	-1.79	1.31	.92	1.24	.67
214	77	86	77	60	72	60	-.95	-1.22	-1.49	-1.79	1.21	.76	1.02	.74
215	72	86	77	55	79	60	-.74	-1.04	-1.39	-1.84	1.21	.65	1.30	.75
216	66	78	62	51	62	45	-.67	-.82	-1.26	-1.73	.79	.59	.80	.51
Sentence														
217	54	72	69	64	75	62	-.14	-.15	-.78	-.95	.95	.84	1.14	.79
218	50	76	71	67	84	76	.00	.00	-.83	-.91	1.01	.91	1.52	1.18
219	61	80	75	70	92	81	-.38	-.41	-.92	-1.05	1.12	.99	2.42	1.39
220	75	80	45	43	45	40	-1.49	-1.55	-1.90	-2.13	.50	.47	.50	.44
221	47	66	50	43	59	55	.13	.16	-.68	-.73	.58	.48	.73	.66
222	68	85	69	65	78	74	-.67	-.71	-1.33	-1.40	.96	.85	1.24	1.09
223	53	64	56	45	67	52	-.12	-.15	-.54	-.69	.68	.50	.91	.62
224	63	77	74	65	80	77	-.44	-.51	-.94	-.97	1.11	.86	1.32	1.22
225	65	75	58	59	73	61	-.65	-.63	-.93	-1.13	.70	.73	1.08	.76
226	64	79	75	68	72	63	-.47	-.53	-1.11	-1.27	1.15	.92	1.04	.81
227	41	54	38	30	53	57	.58	.73	-.17	-.16	.41	.31	.63	.69
228	52	65	77	59	76	79	-.05	-.07	-.50	-.48	1.22	.74	1.17	1.31
Verb														
229	63	77	42	44	59	53	-.78	-.75	-1.25	-1.37	.47	.49	.72	.63
230	70	80	59	57	61	62	-.91	-.94	-1.37	-1.36	.73	.70	.77	.79
231	48	58	83	73	84	57	.06	.07	-.23	-.34	1.51	1.06	1.54	.69
232	54	53	61	57	71	51	-.16	-.17	-.10	-.14	.77	.70	1.02	.60

Table 6. (Continued)

Item No.	Percent Correct B	G	Biserial R Boys C	T	Girls C	T	X_{50} Boys Concept	Task	Girls Concept	Task	Beta Boys Concept	Task	Girls Concept	Task
Verb (continued)														
233	53	55	62	48	70	50	-.11	-.14	-.17	-.24	.80	.55	.98	.58
234	38	47	50	48	66	57	.63	.66	.10	.11	.58	.55	.87	.69
235	49	52	43	41	53	44	.06	.07	-.08	-.10	.47	.45	.62	.49
236	32	38	61	50	71	59	.79	.95	.44	.52	.76	.58	1.01	.74
237	55	64	67	69	67	56	-.20	-.20	-.54	-.65	.89	.96	.90	.67
238	66	68	68	61	66	65	-.59	-.66	-.69	-.70	.92	.77	.88	.86
239	61	69	77	59	71	54	-.37	-.49	-.70	-.92	1.22	.73	1.01	.64
240	40	49	56	56	53	52	.46	.46	.05	.05	.68	.68	.63	.62
Comparison														
241	64	77	71	67	76	69	-.50	-.53	-.97	-1.06	1.02	.91	1.16	.96
242	50	61	60	48	56	47	.02	.03	-.52	-.62	.75	.55	.67	.53
243	65	76	69	51	83	79	-.56	-.76	-.85	-.90	.96	.59	1.50	1.28
244	56	59	69	64	81	79	-.23	-.25	-.27	-.28	.97	.83	1.40	1.29
245	39	51	63	41	59	45	.43	.66	-.04	-.05	.82	.46	.73	.50
246	56	74	72	67	76	67	-.23	-.24	-.84	-.95	1.03	.91	1.17	.90
247[a]	37	33	46	24	36	12	.72	1.35	1.20	3.55	.51	.25	.39	.12
248	62	81	81	76	76	81	-.39	-.41	-1.16	-1.08	1.37	1.18	1.17	1.40
249	48	61	70	59	66	60	.06	.07	-.42	-.47	.99	.74	.88	.75
250	65	75	62	65	79	62	-.60	-.58	-.85	-1.08	.79	.85	1.27	.79
251	49	53	57	59	67	55	.05	.05	-.11	-.13	.69	.74	.91	.66
252[a]	27	42	30	24	40	31	2.04	2.60	.50	.65	.32	.24	.43	.32
Detail Sentence														
253	66	78	61	52	69	62	-.66	-.78	-1.13	-1.24	.76	.61	.94	.79
254	78	81	44	43	62	57	-1.81	-1.83	-1.43	-1.58	.48	.48	.80	.68
255[a]	31	23	38	21	44	29	1.33	2.42	1.68	2.55	.41	.21	.50	.31
256	52	64	66	56	70	66	-.08	-.10	-.53	-.57	.88	.68	.98	.87
257	56	60	50	43	49	46	-.32	-.38	-.53	-.56	.58	.47	.56	.52
258	56	71	71	66	80	73	-.21	-.23	-.69	-.76	1.01	.88	1.34	1.07
259	54	64	52	49	68	58	-.18	-.19	-.55	-.65	.60	.56	.92	.70
260	48	61	66	58	80	73	.06	.07	-.36	-.40	.88	.70	1.32	1.07
261	49	68	75	65	81	77	.04	.04	-.56	-.59	1.12	.85	1.37	1.21
262	55	77	82	77	87	78	-.16	-.18	-.84	-.93	1.46	1.21	1.78	1.27
263	39	49	65	56	62	63	.44	.51	.05	.05	.86	.67	.80	.81
264	28	35	48	39	44	48	1.23	1.49	.86	.79	.54	.42	.50	.55
Explanation														
265	72	85	75	60	74	82	-.78	-.97	-1.40	-1.25	1.14	.75	1.10	1.46
266	63	72	71	57	67	58	-.49	-.60	-.86	-1.00	1.00	.69	.90	.71
267	35	49	59	41	68	65	.66	.94	.05	.05	.73	.45	.92	.85
268	63	51	60	39	59	45	-.58	-.88	-.02	-.03	.74	.42	.72	.50
269	59	61	67	65	74	67	-.32	-.33	-.36	-.40	.91	.86	1.10	.90
270	64	73	72	68	80	64	-.50	-.53	-.77	-.95	1.03	.93	1.33	.84
271	45	52	45	30	44	35	.27	.40	-.10	-.12	.50	.32	.49	.38
272	40	57	70	58	67	55	.35	.42	-.25	-.31	.99	.71	.91	.65
273[a]	48	46	46	23	51	27	.09	.17	.18	.35	.52	.24	.60	.28
274	59	67	70	60	77	66	-.31	-.36	-.58	-.67	.99	.76	1.22	.88
275														
276	48	56	69	61	79	72	.06	.07	-.20	-.22	.96	.77	1.27	1.05
Greeting														
277	60	74	70	52	72	60	-.35	-.47	-.90	-1.07	.97	.61	1.04	.76
278[a]	31	40	39	11	45	28	1.30	4.62	.56	.89	.42	.11	.50	.29
279	80	87	69	69	79	70	-1.20	-1.20	-1.44	-1.62	.95	.96	1.29	.99

Table 6. (Continued)

Item No.	Percent Correct B	Percent Correct G	Biserial R Boys C	Biserial R Boys T	Biserial R Girls C	Biserial R Girls T	X_{50} Boys Concept	X_{50} Boys Task	X_{50} Girls Concept	X_{50} Girls Task	Beta Boys Concept	Beta Boys Task	Beta Girls Concept	Beta Girls Task
Greeting (continued)														
280	65	75	78	59	77	81	-.48	-.63	-.89	-.84	1.25	.74	1.20	1.38
281	68	76	66	67	61	52	-.69	-.69	-1.16	-1.37	.89	.89	.77	.60
282[a]	24	31	18	-04	26	10	3.96	19.97	1.94	4.87	.18	.04	.27	.11
283	37	44	37	41	51	30	.88	.79	.30	.50	.40	.46	.59	.32
284	65	80	65	64	74	74	-.57	-.58	-1.12	-1.12	.87	.83	1.10	1.10
285	63	73	79	74	81	72	-.44	-.46	-.74	-.83	1.27	1.11	1.37	1.04
286	58	74	77	62	81	69	-.27	-.33	-.80	-.94	1.19	.79	1.37	.95
287	82	91	71	60	79	61	-1.27	-1.50	-1.68	-2.16	1.02	.75	1.27	.77
288	38	52	58	57	63	55	.54	.56	-.07	-.08	.71	.69	.81	.65
Heading														
289	72	87	62	71	57	85	-.94	-.83	-1.99	-1.34	.80	1.00	.70	1.60
290	76	90	62	66	56	60	-1.14	-1.06	-2.31	-2.17	.78	.88	.68	.75
291	43	45	63	29	67	38	.28	.61	.18	.32	.81	.30	.90	.40
292[a]	34	45	48	13	78	37	.87	3.11	.17	.36	.54	.14	1.23	.40
293	24	25	41	30	72	39	1.75	2.36	.95	1.73	.45	.32	1.04	.43
294	48	58	57	32	58	36	.10	.17	-.36	-.58	.69	.34	.71	.39
295	46	58	61	50	61	65	.15	.19	-.31	-.29	.78	.58	.78	.86
296	40	51	68	49	72	55	.36	.50	-.02	-.03	.92	.57	1.04	.66
297	42	47	65	50	72	55	.31	.41	.09	.11	.85	.58	1.03	.66
298[a]	34	39	42	15	52	29	.99	2.77	.56	1.00	.46	.15	.61	.30
299														
300	34	42	57	49	63	46	.74	.85	.33	.46	.69	.56	.82	.51
Paragraph														
301	55	73	72	70	80	70	-.19	-.19	-.77	-.87	1.03	.98	1.31	.98
302	45	64	66	60	71	66	.19	.20	-.51	-.55	.87	.76	.99	.87
303	74	88	76	78	81	84	-.86	-.83	-1.46	-1.39	1.16	1.27	1.36	1.57
304	61	68	54	40	65	62	-.50	-.68	-.71	-.75	.65	.44	.83	.80
305	56	78	76	66	71	63	-.20	-.23	-1.08	-1.23	1.15	.87	1.02	.80
306	71	77	59	46	73	54	-.93	-1.19	-1.01	-1.36	.74	.52	1.06	.64
307	58	64	63	53	70	71	-.30	-.36	-.53	-.52	.80	.62	.98	1.01
308	60	64	78	67	92	87	-.33	-.39	-.38	-.40	1.25	.91	2.28	1.74
309	66	65	70	62	71	58	-.59	-.67	-.55	-.68	.98	.80	1.02	.71
310	47	60	33	31	52	38	.20	.22	-.48	-.66	.35	.33	.60	.41
311														
312	59	74	67	65	66	58	-.34	-.36	-.97	-1.09	.91	.85	.87	.71
Return Address														
313	90	97	63	64	39	45	-2.02	-1.97	-4.80	-4.17	.81	.84	.42	.50
314	89	95	53	64	79	42	-2.34	-1.95	-2.03	-3.82	.63	.83	1.30	.46
315	78	89	77	66	79	65	-1.02	-1.19	-1.54	-1.86	1.22	.89	1.30	.87
316[a]	46	52	32	13	54	33	.33	.81	-.10	-.16	.34	.13	.65	.34
317	59	71	69	57	61	41	-.32	-.38	-.93	-1.39	.94	.70	.77	.45
318	52	64	71	58	65	55	-.08	-.09	-.56	-.65	1.02	.70	.84	.67
319	58	66	56	46	55	51	-.34	-.41	-.77	-.82	.67	.52	.66	.60
320	67	80	73	62	69	46	-.59	-.70	-1.20	-1.79	1.08	.78	.95	.52
321	69	80	64	54	60	53	-.77	-.90	-1.40	-1.57	.83	.65	.75	.63
322	40	58	61	56	53	38	.43	.46	-.36	-.50	.77	.67	.63	.41
323														
324	47	60	68	67	70	55	.10	.10	-.37	-.48	.92	.91	.99	.65
Thank You Letter														
325	63	79	74	67	83	75	-.44	-.49	-.98	-1.08	1.10	.90	1.48	1.13
326	68	80	79	63	82	68	-.60	-.75	-1.01	-1.22	1.30	.82	1.42	.92

Table 6. (Continued)

Item No.	Percent Correct B	Percent Correct G	Biserial R Boys C	Biserial R Boys T	Biserial R Girls C	Biserial R Girls T	X_{50} Boys Concept	X_{50} Boys Task	X_{50} Girls Concept	X_{50} Girls Task	Beta Boys Concept	Beta Boys Task	Beta Girls Concept	Beta Girls Task
Thank You Letter (continued)														
327	82	91	72	64	68	74	-1.26	-1.42	-1.96	-1.78	1.04	.82	.92	1.11
328	53	76	60	45	64	62	-.13	-.18	-1.12	-1.16	.75	.50	.84	.79
329	75	90	76	69	69	59	-.90	-.98	-1.83	-2.15	1.16	.96	.94	.72
330	50	72	73	64	83	72	.00	.00	-.71	-.82	1.07	.82	1.48	1.03
331	62	54	53	46	51	43	-.56	-.65	-.18	-.21	.63	.52	.60	.47
332	65	84	83	71	96	72	-.45	-.52	-1.05	-1.40	1.49	1.02	3.24	1.03
333	62	81	70	66	89	79	-.45	-.48	-.97	-1.10	.99	.89	1.95	1.28
334	83	89	72	60	80	56	-1.31	-1.57	-1.54	-2.22	1.04	.76	1.34	.67
335														
336	57	68	51	56	71	59	-.34	-.32	-.65	-.80	.60	.67	1.02	.72
Title														
337	80	90	54	56	65	60	-1.53	-1.48	-1.92	-2.11	.64	.68	.87	.74
338	68	89	78	77	74	78	-.59	-.60	-1.64	-1.57	1.25	1.21	1.11	1.23
339	73	89	67	60	72	67	-.90	-.99	-1.70	-1.80	.89	.76	1.03	.91
340	66	81	60	45	50	46	-.67	-.89	-1.76	-1.93	.75	.51	.58	.51
341	69	76	61	68	57	55	-.80	-.73	-1.24	-1.29	.77	.92	.69	.66
342	54	70	76	64	76	75	-.12	-.15	-.70	-.71	1.16	.84	1.17	1.15
343	45	47	47	40	41	30	.26	.31	.18	.24	.53	.43	.46	.31
344	47	57	82	75	79	69	.10	.11	-.23	-.26	1.42	1.12	1.29	.94
345	57	70	65	61	79	62	-.27	-.29	-.66	-.84	.85	.77	1.31	.79
346	59	77	67	56	76	51	-.32	-.39	-.97	-1.43	.90	.68	1.15	.60
347	53	62	55	44	54	49	-.15	-.18	-.57	-.63	.65	.49	.65	.56
348	47	59	58	42	62	50	.14	.19	-.35	-.44	.71	.46	.79	.57
Topic Sentence														
349	50	65	50	44	60	54	.00	.00	-.66	-.72	.57	.49	.75	.64
350	50	48	39	30	52	38	.00	.00	.10	.14	.42	.31	.61	.41
351	44	69	65	57	60	52	.23	.26	-.82	-.94	.86	.69	.74	.61
352	36	47	57	55	64	50	.63	.65	.13	.16	.69	.65	.83	.58
353	65	75	65	56	64	59	-.59	-.69	-1.05	-1.14	.86	.68	.83	.72
354	42	63	72	62	76	70	.28	.33	-.44	-.47	1.03	.80	1.16	.98
355	42	54	44	46	69	57	.47	.45	-.15	-.18	.48	.51	.95	.70
356	53	70	75	70	78	79	-.11	-.12	-.66	-.66	1.13	.98	1.26	1.29
357	41	57	66	60	78	79	.35	.39	-.22	-.22	.88	.74	1.24	1.29
358[a]	18	19	00	-07	26	18	677.95	13.44	3.35	4.77	.00	-.07	.27	.18
359	31	38	41	34	42	37	1.19	1.43	.74	.85	.45	.36	.46	.39
360	37	40	58	45	47	42	.59	.76	.54	.59	.71	.51	.53	.46

footnoted in Table 6. Of these 22 items, 16 were too difficult as indicated by an X_{50} value greater than 2.0. However, for most of these 16 items, the Betas are essentially zero which causes the X_{50} to become meaningless. Seventeen other items were very easy (X_{50} value less than -2.00) but nevertheless were contributing to overall reliability. Generally, the items are distributed adequately across a range of difficulty. The fact that 94% of the items displayed no obvious weaknesses implies that the test data resulting from the items can be used in the planned factor analytic studies. The Hoyt reliability estimate for each of the concept and task scores is also encouraging. Thus, considering the magnitude of the reliability estimates, the acceptable levels of difficulty generally achieved, and the gener-

ally high discrimination indices of the items, it seems possible to proceed with attempts to determine the factors embedded in the test items constructed and to attempt to delineate the particular cognitive abilities responsible for concept attainment.

IV
Summary and Conclusions

The primary objective of the project entitled "A Structure of Concept Attainment Abilities" is to formulate one or more models or structures of concept attainment abilities, and to assess their consistency with actual data. One of the major steps for attaining this primary objective was taken to be the development of tests to measure achievement of selected language arts, mathematics, science, and social studies concepts appropriate at the fourth grade level. This paper describes the test development efforts and presents the item and total score statistics obtained using the revised items developed for measuring achievement of selected concepts in language arts.

Subject matter specialists identified single or compound word classificatory concepts for three major areas, and randomly selected ten from each area to be studied. These 30 selected concepts were then analyzed. Twelve items for each concept were developed; one for each of the first 12 tasks of "A Schema for Testing the Level of Concept Mastery" (Frayer, Fredrick, & Klausmeier, 1969).

The items that were developed were administered to 186 boys and 259 girls who had just begun the sixth grade during the fall of 1970. These data were item analyzed, separately for boys and for girls, using the GITAP program (Baker, 1969).

The means, standard deviations, Hoyt reliability estimates, and standard errors of measurement are presented and discussed for total concept and total task scores. Four different item indices—percent correct, item-criterion biserial correlation, X_{50}, and β—obtained for each item based on each of two criterion scores, appropriate total concep score and appropriate total task score, are presented and discussed.

Conclusions

The major conclusions drawn are:

1. The reliability estimates obtained for both total concept scores and total task scores are sufficiently high to warrant study of the dimensionality of these selected language arts concepts and the dimensionality of the tasks when using language arts content.

2. The difficulty item indices obtained indicate that these items are of appropriate difficulty levels for these subjects.

3. Almost all of the items have desirable levels of discrimination indices when the item is both a part of a concept criterion score and a task criterion score.

Recommendation

The completely crossed design used to construct these achievement tests is a very interesting one. This type of design might well be used more often in the future. It would be highly desirable to have available item analysis procedures that are appropriate for analyzing such crossed designs. At the present such a methodology is not known.

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