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ABSTRACT

The purpose of this study was to examine the reliability and validity of a basal reading series mastery test. Subjects were 25 fourth graders, who were tested once on the SRA Reading Achievement Test, twice on the Scott-Foresman End-of-Book 9 Criterion-referenced Test (CRT), and once on the Word Reading Test. Traditional psychometric correlational analyses as well as strategies specifically designed for examining the adequacy of criterion-referenced tests were applied to the data to investigate the following dimensions of the technical adequacy of the CRT: consistency of student performance across two administrations of the CRT, criterion-related validity of the CRT scores with respect to two other measures of reading proficiency, and criterion-related validity of the CRT mastery/nonmastery decisions with respect to pre/post instructional status. Results indicated that the reliability and validity was acceptable for the total test and the scale scores, with the exception of the Literacy Understanding/Appreciation scale and, in some cases, the Word Identification scale. Implications for the development and use of criterion-referenced tests are discussed. (Author)

University of Minnesota

Research Report No. 128

THE TECHNICAL ADEQUACY OF A BASAL SERIES MASTERY TEST: THE SCOTT-FORESMAN READING PROGRAM

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Abstract

The purpose of this study was to examine the reliability and validity of a basal reading series mastery test. Subjects were 25 fourth graders, who were tested once on the SRA Reading Achievement Test, twice on the Scott-Foresman End-of-Book 9 Criterion-referenced Test (CRT), and once on the Word Reading Test. Traditional psychometric correlational analyses as well as strategies specifically designed for examining the adequacy of criterion-referenced tests were applied to the data to investigate the following dimensions of the technical adequacy of the CRT: (a) consistency of student performance across two administrations of the CRT, and (b) criterion-related validity of the CRT scores with respect to two other measures of reading proficiency and criterion-related validity of the CRT mastery/nonmastery decisions with respect to pre/post instructional status. Results indicated that the reliability and validity was acceptable for the total test and the scale scores, with the exception of the Literary Understanding/ Appreciation scale and, in some cases, the Word Identification scale. Implications for the development and use of criterion-referenced tests are discussed.

The Technical Adequacy of a Basal Series Mastery Test:

The Scott-Foresman Reading Program

Within the past decade, interest in and the use of criterion-referenced (CR) testing as a tool for evaluating the effects of instructional programs has expanded. In contrast to traditional global norm-referenced achievement tests, which typically have poor content validity with respect to classroom curricula, CR instruments are isomorphic with instructional programs and potentially useful for measuring the extent to which individuals or groups have mastered specific educational objectives.

Despite the increased focus on CR tests in the schools, there has been a lack of concomitant investigation of the reliability and validity of such instruments. Teachers who create their own CR tests rarely possess resources to conduct expensive, time-consuming reliability and validity studies. Additionally, Tindal, Shinn, Fuchs, Fuchs, Deno, and Germann (1983) documented that publishers of commercial CR instruments typically fail to address technical adequacy at all; and, when adequacy is examined, developers rely predominantly on traditional psychometric correlational analyses, which have been criticized for use with CR tests (Popham & Husek, 1969). Therefore, although CR tests may appear to be useful for evaluating the effects of instructional programs because of strong content validity, it remains unclear whether they are accurate (reliable) or meaningful (valid) for their intended purposes.

In response to this problem, researchers recently have begun the process of investigating the psychometric characteristics of commercially available basal reading series CR tests. Fuchs, Tindal,

Shinn, Fuchs, Deno, and Germann (1983) examined the test-retest reliability and criterion validity of a Ginn 720 basal mastery test and found its quality variable. In most analyses, the study skills subtests appeared inadequate, the quality of the comprehension subtests varied, and the decoding and vocabulary subtests and the total score were acceptable. Tindal et al. (1983) determined that a mastery test from the Houghton-Mifflin reading series was less than adequate; the decoding and comprehension test scales were both unreliable and invalid. These findings suggest that content and face validity are necessary but insufficient dimensions of CR test adequacy, and that test consumers must seek empirical validation of each CR test before relying on such test data for making instructional decisions.

The purpose of the current study was to extend the work of Tindal et al. (1983) and Fuchs et al. (1983) by examining the reliability and validity of another basal series mastery test, that of Scott-Foresman (1981). In doing so, the present study sought to increase the data base concerning the adequacy of CR tests in order to provide relevant information not only to consumers of this specific measure but also to users of other CR instruments for which technical data are still unavailable.

Method

Subjects

Subjects were 25 students (13 M, 12 F) from one fourth grade class, located in a school district of a rural midwestern cooperative. The students' mean reading percentile rank was 65.0 (SD 31.93) as

measured on the Science Research Associates (SRA) Reading Achievement Test. Only those students for whom there were no missing data were included in any given analysis.

Measures

Three measures of reading performance were used in the study: a basal series criterion-referenced test, a global norm-referenced test, and a curriculum-based word reading test.

Criterion-referenced test. Four scales of the End-of-Book 9 Criterion-referenced Test (CRT; Johns, 1981) of the Scott-Foresman reading series were employed as measures. Each of the four scales, Word Identification, Comprehension, Study and Research, and Literary Understanding and Appreciation, is comprised of subtests. Table 1 lists the subtests constituting each scale and provides brief descriptions of tasks the examinee is required to do within each subtest. This CRT includes between 12 and 43 items per scale and cutoff scores are established at 79% and 83% correct responses. For the purpose of this study, two subtests, Fiction and Nonfiction from the Comprehension scale and Summarizing from the Study and Research scale were omitted; they are not described in Table 1. With these omissions, items per scale ranged from 12 to 41 and the mastery cutoff scores fell between 76% and 83% correct responses.

Insert Table 1 about here

Norm-referenced test. The Science Research Associates (SRA) Reading Achievement Test (Naslund, Thorpe, & Lefever, 1978) is

comprised of two subtests: vocabulary and comprehension. In the vocabulary section, examinees are required to select, from four alternatives, a synonym for an underlined word in a sentence. In the comprehension section, examinees read 200-300 word passages and answer questions in a multiple choice format. Total test score is based on a linear combination of the two subtests. Internal consistency reliability was reported at .88 (Salvia & Ysseldyke, 1981).

Curriculum-based word reading test. The Word Reading Test (Deno, Mirkin, & Chiang, 1982) requires children to read aloud passages and isolated word lists and is scored in terms of average numbers of words correct and incorrect over two alternate forms of the Isolated Word Reading and Passage Reading scales. The 200-word passages are drawn randomly from a student's grade appropriate basal reading book; the 150-word lists sample words randomly from the basals, with 60% of words drawn from the student's grade appropriate level and 40% sampled equally from all previous levels. For the passage and isolated Word Reading Test, test-retest and alternate form reliabilities were at least .90 (Fuchs, Deno, & Marston, in press; Fuchs, Wesson, Tindal, Mirkin, & Deno, 1981).

Procedure

All students were tested in groups by a school psychologist on the SRA Reading Achievement Test, and by their classroom teachers on the CRT. The Word Reading Test was administered individually by trained aides. Standardized administration procedures were adhered to on all tests. Testing time ranged from 60 to 90 minutes for the SRA Test, 60 to 90 minutes for the CRT, and five to six minutes for the

Word Reading Test. Students were tested on the following measures in the following order within a 2-week time period: the CRT, the SRA Reading Achievement Test, the Word Reading Test, and the CRT again.

Data Analysis

Consistency of performance on two administrations of the same test. Consistency of students' performance on the CRT was assessed in three ways. First, traditional test-retest reliability was determined by correlating scores from the two administrations of the CRT. The other two analysis strategies were designed specifically for criterion-referenced measures (see Millman, 1974). In the first of these, consistency of students' scale scores was determined by (a) computing individuals' percentage correct scores on each scale for each administration of the CRT, (b) calculating for each individual his/her difference score across the two administrations of each scale, and (c) determining the percentages of examinees having each possible difference score on each scale. In the second strategy, consistency of mastery-nonmastery decisions on scales was determined by dividing the difference between observed and chance proportions of agreements in decisions by the maximum value that difference could assume. (The chance proportion of agreements was computed by multiplying and then summing the marginal proportions of the same decision categories for the two administrations, as done in a chi-square test of association.)

Criterion-related validity. The criterion-related validity of the CRT was determined in two ways. The traditional psychometric strategy of correlating scores on the measure of interest (CRT) with criterion measures was used. The SRA Reading Achievement Test and the

Word Reading Test were employed as the criterion measures. Additionally, chi-square statistical tests were applied to contingency tables wherein test mastery-nonmastery represented one dimension of each table and pre-post instructional status represented the other dimension. Percentages of misclassifications and ϕ coefficients supplemented the chi-square tests.

Results

Table 2 is a display of students' mean scores and standard deviations on each scale and for the total score of the CRT, on the subtest and total scores of the SRA Reading Achievement Test, and on the isolated word reading and passage reading scales of the Word Reading Test.

Insert Table 2 about here

Consistency of Performance on Administrations of the Same Test

Test-retest reliability correlations on scales of the CRT are displayed in Table 3. All coefficients for the test scales and total test were at least .90, with the exception of the Literary Understanding/Appreciation scale, which had a coefficient of .68.

Insert Table 3 about here

The second analysis of the consistency of performance involved calculating the percentages of examinees who had different percentage correct scores across the two administrations of the CRT. Figures 1

and 2 are graphic displays of the percentages of examinees displaying various difference scores on each scale of the CRT; Table 4 summarizes the information illustrated on the graphs. The range of difference scores on the scales fell between 0 and 42%. The percentage of examinees with 0% difference scores on two administrations ranged from 13 on the Comprehension scale to 25 on the Literary Understanding/Appreciation scale.

Insert Figures 1-2 and Table 4 about here

The third analysis of the consistency of performance addressed consistency of mastery-nonmastery decisions across the two administrations of the CRT. Table 5 is a display of the uncorrected and corrected proportions of examinees placed into the same decision category on the two administrations. On the Word Identification, Comprehension, and Study and Research scales, the corrected proportions were high, ranging from a proportion of agreement on the Study and Research scale of 84% higher than chance to a proportion of agreement on the Word Identification scale of 96% greater than chance. On the Literary Understanding/Appreciation scale, the proportion of agreement was lower, with a proportion of agreement of 57% better than chance.

Insert Table 5 about here

Criterion-related Validity

Correlational analyses were conducted between the CRT scales and two criterion measures, the SRA Reading Achievement Test and the Word Reading Test. Correlations between the CRT scales and the SRA subtest and total test scores are displayed in Table 6. They ranged from .48 to .90 when CRT scale and SRA vocabulary subtest scores were involved; from .59 to .87 when CRT scale and SRA comprehension subtest scores were employed; and from .55 to .89 when CRT scale and SRA total scores were used. For the CRT total score, correlations ranged between .92 and .95. The median correlation for the CRT Word Identification scale was .62; for the CRT Comprehension scale, .86; for the CRT Study and Research scale, .89; and for the Literary Understanding/Appreciation scale, .55.

Insert Table 6 about here

Correlations between the CRT scales and the Word Reading Test scale scores are displayed in Table 7. They ranged from .42 to .73 when isolated word reading scores and CRT scale scores were involved, and from .55 to .76 when passage reading scores and CRT scale scores were employed. For the CRT total score, correlations were .77 and .84.

Insert Table 7 about here

Criterion validity also was examined by inspecting the relation between mastery-nonmastery decisions on the CRT and actual pre-post

instructional status. Relevant chi-square values, phi coefficients, and percentages of misclassified students are displayed in Table 8. The highest percentages of misclassifications occurred with the Word Identification (48%) and Literary Understanding/Appreciation (35%) scales; lower percentages were found for the Study and Research scale and the total score (22%). The percentage of misclassified students on the Comprehension scale was 26.

Insert Table 8 about here

Discussion

The purpose of the current study was to describe the reliability and validity of a basal reading series criterion-referenced mastery test. The study examined two aspects of the technical adequacy of the Scott-Foresman End-of-Book 9 Criterion-referenced test: (a) the consistency of students' performance on two administrations of the test, and (b) the criterion validity of the test with respect to two other measures of reading proficiency that have demonstrated psychometric strength. On these indices, the total score and all scale scores, with the exception of the Literary Understanding scale and, in some cases, the Word Identification scale, seemed adequate.

Test-retest reliability coefficients indicated that, when the CRT was administered twice within a short time interval, students' performance was somewhat inconsistent on the Literary Understanding and Appreciation scale, with the correlation falling below the acceptable range for making even group decisions (Salvia & Ysseldyke,

1981). Nevertheless, for the remaining scales and the total score, correlations were high and fell into the acceptable range for individual decision making.

The pattern of results of this traditional correlational analysis of consistency of student performance across testings was corroborated by the criterion-referenced strategy of examining the proportions of examinees consistently classified into the same decision category. As with the correlational analyses, statistics were generally high. All corrected proportions fell above 84% better than chance agreement except the Literary Understanding/Appreciation scale score, for which the corrected proportion fell below 60% better than chance.

Inspection of the consistency of test scores displayed in Figure 1 and 2 and in Table 4 reveals that results of the second criterion-referenced strategy for examining test consistency also corroborated the correlational results. The average percentage of subjects obtaining the same score across all scales was 18.0. Interestingly, the percentage for the Literary Understanding/Appreciation scale was higher than the percentages for the remaining scales. Nevertheless, for this Literary Appreciation/Understanding scale, greater percentages of subjects also scored with relatively great discrepancy, and the 37% of subjects whose differences scores were between 15 and 42% across the two testings achieved scores sufficiently discrepant to result in numerous inconsistent mastery decisions.

The criterion validity of the CRT also was examined in this study. The traditional correlational analyses indicated that the criterion validity of the CRT scale scores with respect to the SRA

Reading Achievement Test was good, with 50% of correlations between the CRT scales and the SRA subtests falling above .80. With the Word Reading Test, correlations between the CRT scales and the Word Reading Test scales were generally lower, with 50% falling above .70 and no correlations above .80.

With respect to both the SRA and the Word Reading Tests, correlations based on the Word Identification and the Literary Understanding/Appreciation scales typically were relatively low. The finding that criterion validity with the SRA Test was greater than with the Word Reading Test is contrary to previous findings (Fuchs et al., 1983). Given that both the Word Reading Test and the CRT are curriculum-based, one might expect a stronger relation between these two measures, and current findings are surprising. Nevertheless, correlations among curriculum-based measures and more global indices, such as the SRA test, have been reported frequently at high levels (Fuchs et al., in press; Fuchs, Fuchs, & Deno, 1982), and correlations between the CRT and the SRA tests are comparable to those reported earlier. Further, performance on the CRT predicts concurrent performance on more global measures of reading proficiency better than other basal mastery tests that have been examined (Fuchs et al., 1983; Tindal et al., 1983).

The criterion validity of the CRT also was investigated with the criterion-referenced strategy of examining the relation between the mastery-nonmastery classification on the CRT and actual pre-post instructional status. Percentages of misclassifications ranged from 22% to 48% on the CRT scales, with 22% of students misclassified on

the total test. These figures suggest that, for classifying students into groups for instruction within the basal reader for which the CRT was designed, the Word Identification and Literary Understanding/ Appreciation scales have limited utility whereas the Comprehension and Study and Research scales as well as total test score are more valid.

Consequently, the current study suggests that the Scott-Foresman End-of-Book 9 CRT is generally of good quality. Much of the test seemed useful both for predicting global reading proficiency and for making decisions about student placement and progress within the curriculum. Specifically, in the test-retest consistency analyses the total score and the scale scores, with the exception of the Literary Understanding/Appreciation scale, appeared adequate. In the criterion validity analyses, the total and the scale scores, with the exception of the Word Identification and the Literary Understanding/Appreciation scales, demonstrated technical strength. This indicates that (a) educators should use this CRT judiciously, relying primarily on the Comprehension, Study and Research, and total scores for making decisions about student performance and mastery in the curriculum, and (b) test developers at Scott-Foresman might consider reexamining the Word Identification and Literary Understanding/Appreciation scales.

In any case, the technical adequacy of the Scott-Foresman End-of-Book 9 CRT was superior to previously examined basal mastery tests (see Fuchs et al., 1983; Tindal et al., 1983). A probable explanation for this superiority is as follows: Whereas other CR tests that have been examined have teachers score and compute mastery scores on subtests as well as scale scores, the Scott-Foresman CRT

limits computation of mastery scores to the test scale and total scores. By doing so, the Scott-Foresman CRT requires educators to rely on information summarized across a relatively large sampling of student behavior. As the Spearman-Brown formula indicates, when the number of items in a test increases, the reliability and validity of test scores improve correspondingly. It appears that the author of this Scott-Foresman CRT has capitalized on this measurement phenomenon by eliminating the calculation and consideration of mastery scores based on subtests, which incorporate relatively few items.

Finally, in this study, results based on traditional and on criterion-referenced strategies for examining test adequacy were analogous. Wherever traditional correlational statistics suggested relative strengths or weaknesses in scales, the results of the alternative strategies paralleled findings. Consequently, results of the present study echo previous research (Tindal et al., 1983), which suggests that the two types of analyses corroborate, complement, and enhance each other. It appears that both strategies may be appropriate and necessary for investigating and describing the reliability and validity of criterion-referenced tests.

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Table 1

Examinees' Tasks on the Scott-Foresman End-of-Book 9 Test

Scale/Subtest	Examinees' Tasks
Word Identification	
Context and Consonants	Read a sentence containing a word from which all vowels and vowel teams have been deleted. From an array of three choices, select a complete word to substitute for the incomplete one.
Syllables, Accent	Read questions concerning the syllable division and accented syllable of a word. From two choices, select the answer to each question.
Compounds, Contractions	From an array of three choices, select either a compound word or a contraction, as directed.
Root words, Ending, Suffixes	1. Given a word and three possible roots, select the correct one. 2. Given a choice of five descriptions concerning what might happen to a root word before an ending is added and given a word with an ending, select the correct description.
Comprehension	
Unfamiliar Words	Read a paragraph containing an underlined word, and select from among three choices a synonomous word or phrase.
Idioms	Read a paragraph containing an underlined idiom. From an array of three choices, select a phrase that defines the idiom.
Analogous Relationships	Read a story and (a) select, from an array of three choices, a description of how two objects described in the paragraph are alike, and (b) select, from an array of three choices, a word or noun phrase that completes a sentence describing an analogy.

Table 1 (continued)

Scale/Subtest	Examinees' Tasks
Story Problem/Solution	Read a story and answer multiple choice questions concerning the story's content.
Main Idea/Supporting Details	Read a short article. Determine whether sentences taken from that article are main ideas, supporting details, or neither.
Study and Research	
Table of Contents	Given tables of content from two books, answer multiple choice questions concerning (a) the content of the books and (b) how to access information from them.
Index	Given a partial index from a book, use it to answer multiple choice questions concerning how to access information from the book.
Encyclopedia	Given an illustration of a 21-volume encyclopedia, answer multiple choice questions concerning how to access information from the encyclopedia.
Footnotes	Read a segment from a factual article that contains footnotes, answer multiple choice questions concerning the content and use of the footnotes.
Headnotes	Read a headnote and then answer multiple choice questions concerning the content of the headnote.
Classifying	From an array of four words, select the one that does not belong with the others.
Diagrams	Given a diagram of a ship, answer multiple choice questions concerning the layout and contents of the ship.
Literary Understanding/Appreciation	
Story Elements	Read a story and answer multiple choice questions concerning the story's content.
Elements of Style	Read a paragraph and answer yes-no questions concerning whether certain sentences in the paragraph are exaggerations.

Table 1 (continued)

Scale/Subtest	Examinees' Task
Elements of Style	Read a paragraph for which each sentence is identified with a number. Then, answer multiple choice questions concerning (a) which sentence is a flashback, (b) where personification is contained in the paragraph, and (c) the point of view with which the paragraph is written.
Types of Literature	Read a story and select from an array of three choices, the literary form of the story.

Table 2

Student Performance on Measures of Reading Achievement

Test	Number of Items	Mean	SD
End-of-Book 9 Test (N=25)			
Word Identification	36	29.8	5.6
Comprehension	25	18.3	5.3
Study and Research	41	30.8	8.5
Literary Understanding/ Appreciation	12	8.2	2.2
Total	114	86.9	19.3
SRA Reading Achievement Test (N=22)			
Vocabulary		28.5	9.1
Comprehension		34.5	11.2
Total		63.5	20.1
Word Reading Test			
Isolated Word Reading (N=22)		38.2	19.8
Passage Reading (N=26)		79.2	47.1

Table 3

Test-retest Reliabilities for Scott-Foresman End-of-Book 9 Test (N=25)

Scale	Reliability
Word Identification	.93
Comprehension	.92
Study and Research	.93
Literary Understanding/Appreciation	.68
Total	.98

Table 4

Proportion of Subjects with Varying Percentages of Difference Scores Across Two Administrations of the End-of-Book 9 Test (N=24)

Scale	N[a]	Percentage of Difference Score					
		0.0	1.0 to 7.0	8.0 to 14.0	15.0 to 24.0	25.0 to 34.0	35.0 to 44.0
Word Identification	36	17	55	28	0	0	0
Comprehension	25	13	50	29	8	0	0
Study and Research	41	17	67	4	12	0	0
Literary Understanding/ Appreciation	12	25	0	38	8	25	4

[a]Number of items on the test.

Table 5

Uncorrected and Corrected Proportions of Examinees (N=24) Placed Into the Same Decision Categories on Two Administrations of the End-of-Book 9 Test

Scale	Proportion of Examinees	
	Uncorrected	Corrected for Chance Agreement[a]
Word Identification	.96	.96
Comprehension	.92	.9
Study and Research	.83	
Literary Understanding/Appreciation	.63	.57

[a]Observed--Chance Proportions/Maxiumum Value that (Observed-Chance Proportions) Can Assume.

Table 6

Correlations Between End-of-Book 9 Test and SRA Test Scores (N=21)

Scott-Foresman Scale	SRA Vocabulary	SRA Comprehension	SRA Total
Word Identification	.57	.62	.62
Comprehension	.80	.86	.86
Study and Research	.90	.87	.89
Literary Understanding/ Appreciation	.48	.59	.55
Total Test	.92	.94	.95

Table 7

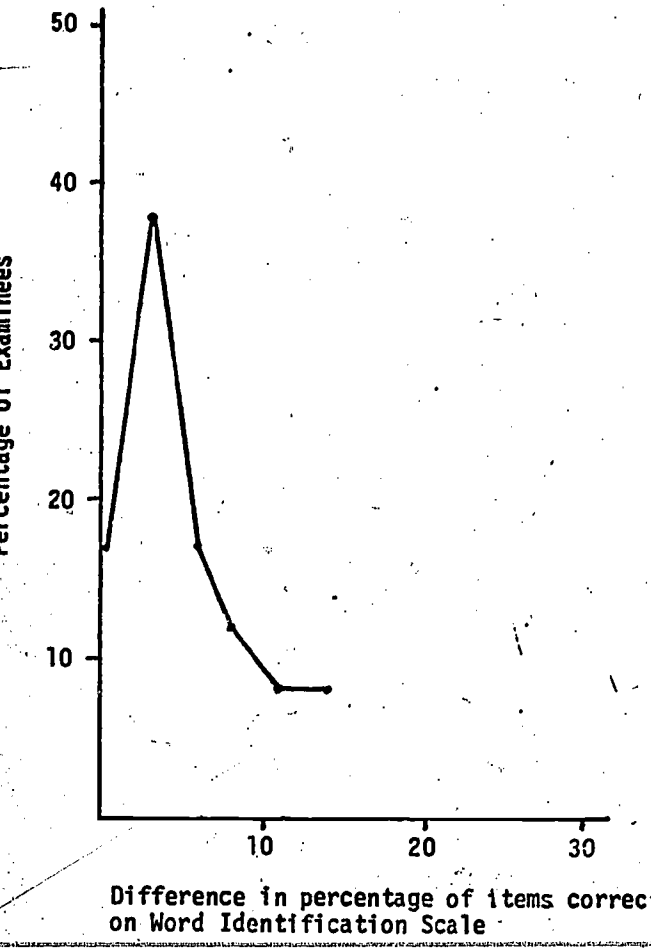
Correlations Between End-of-Book 9 Test and Word Reading Test Scores (N=21)

Scott-Foresman Scale	Word Reading Test	
	Isolated Words	Passages
Word Identification	.42	.70
Comprehension	.52	.70
Study and Research	.73	.76
Literary Understanding/Appreciation	.58	.55
Total	.77	.84

Table 8

Relation Between End-of-Book 9 Test and Criterion Classification (N=23)

Scale	χ^2	Ø	Percentage Misclassified
Word Identification	.68	.17	48
Comprehension	6.88	.55	26
Study and Research	9.79	.65	22
Literary Understanding/Appreciation	.52	.15	35
Total	9.79	.65	22



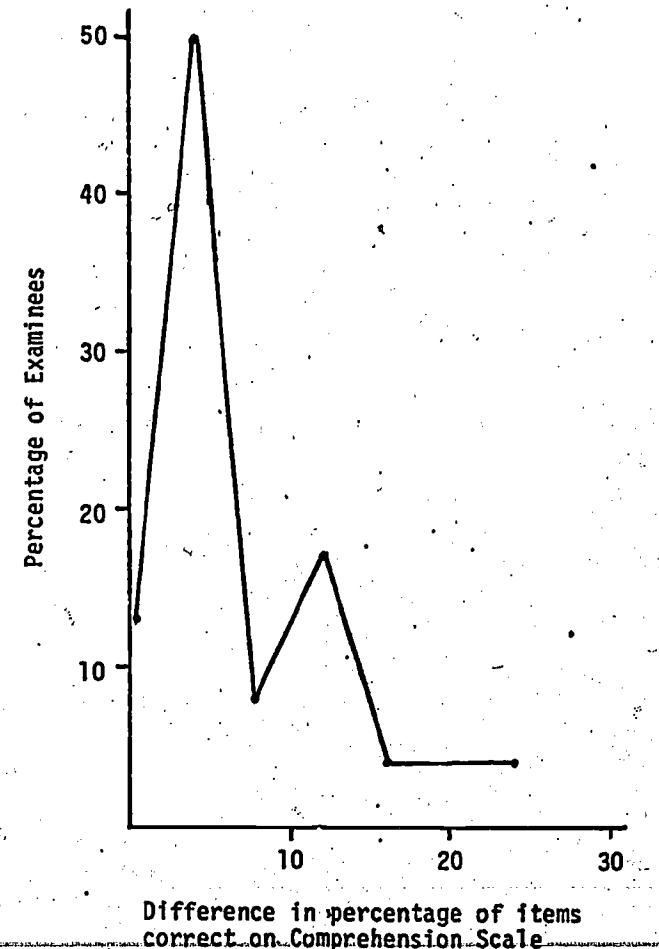
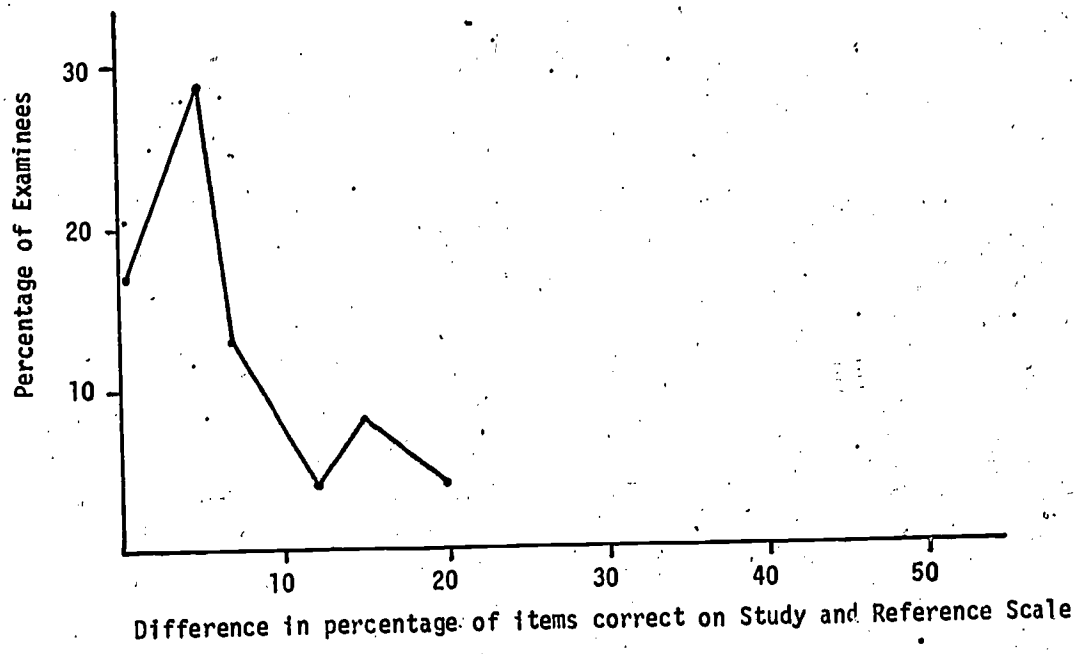


Figure 1. Displays of consistency of test scores on Word Identification and Comprehension Scales of the End-of-Book 9 CRT.



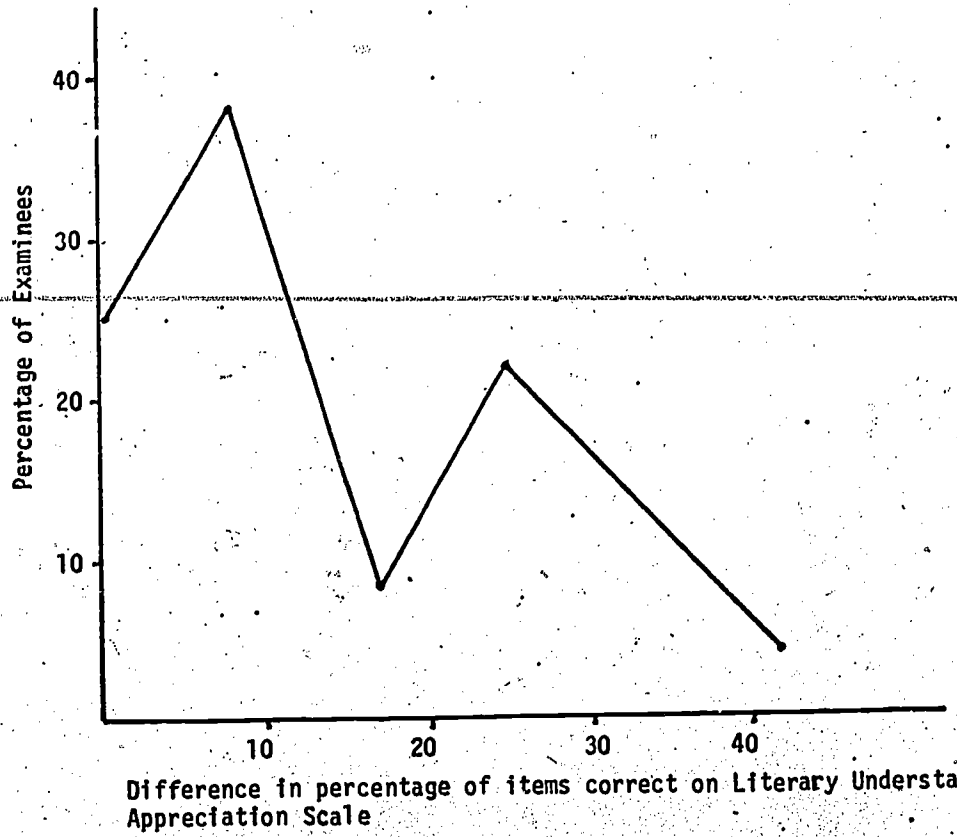


Figure 2. Displays of consistency of test scores on Study and Reference and Literary Understanding/Appreciation Scales on the End-of-Book 9 CRT.

PUBLICATIONS

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The publications listed here are only those that have been prepared since 1982. For a complete, annotated list of all IRLD publications, write to the Editor.

Wesson, C., Mirkin, P., & Deno, S. Teachers' use of self instructional materials for learning procedures for developing and monitoring progress on IEP goals (Research Report No. 63). January, 1982.

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