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ABSTRACT

Using selected student variables, an attempt was made to predict retarded readers' true reading gains after remedial tutoring. The independent variables consisted of IQ and subtest scores obtained on the Wechsler Intelligence Scale for Children (WISC), pretutoring reading levels on the individually administered Diagnostic Reading Scales test, age, sex, grade placement, and parental socioeconomic status. The sample included 62 white subjects, 52 boys and 10 girls, between the ages of 6 years 9 months and 15 years 8 months in grades 1 through 8. Each child was tutored approximately 20 to 25 hours by an experienced tutor. Analysis of the data indicated (1) The distribution of retarded readers did not fall equally into three groups. (2) There was no significant difference in true gain means among the three groups. (3) There was no significant difference in true gain means among the four groups of subjects classified by WISC FS-IQ as having superior, bright-normal, average, or dull-normal intelligence. (4) There were five significant predictors of true reading gain: age, grade, independent reading level, potential reading level, and the difference between independent and instructional levels. Further research using true reading gains and a larger, matched sample was recommended. A bibliography is included. (CL)

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# PREDICTING TRUE READING GAINS AFTER REMEDIAL TUTORING

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One of the most crucial concerns in the field of education and in our nation is that of widespread retardation in reading skills among elementary, secondary, and college students. The incidence of reading retardation has been estimated by Marksheffel (21) to be from 2,500,000 to 5,000,000 children, so severely retarded in reading that they require immediate specialized help. Although estimates vary, it is probable that more than 10 per cent of the children of average intelligence in school are reading so inadequately that their total adjustment is impaired (25).

Reports from clinical sources reveal a disproportionate percentage of seriously retarded readers among boys as compared to girls. The range

of percentages is from approximately 65 per cent boys and 35 per cent girls to 90 per cent boys and 10 per cent girls (12). In general, research indicates that girls are better readers than boys in the primary grades but that this difference usually diminishes by the time they reach sixth grade (32).

Results of numerous studies of the relationship of reading achievement and intelligence have led to the conclusion that intelligence is a major factor in reading success at all levels. Researches by Bond (4), Bond and Fay (5), Monroe (23), and Strang (31), show that this relationship becomes increasingly more pronounced as populations are sampled at succeedingly higher grade levels. Even though intelligence is related to successful achievement in reading, as it is to all other learning, this does not necessarily guarantee reading success for the child with a high IQ. Betts (2) concluded that eight out of ten retarded readers have normal or superior intelligence.

Kottmeyer (17) states that it is not at all uncommon for bright pupils to develop reading disability, although most remedial readers will be of dull normal or normal IQ.

Since mental test performance is often considered a good predictor of reading achievement, much research has been done in the area of identification of successful and unsuccessful readers, using the Wechsler Intelligence Scale for Children IQ scores and/or subtest patterns. Results of these studies have been largely inconclusive.

The use of intelligence tests for prediction has been challenged by Harrington and Durrell (11), since reading difficulties occur among children at virtually all intellectual levels. Consideration must also be given to the question of whether or not intelligence tests measure the important perceptual aspects of reading success and failure. In addition,

IQ scores of retarded readers are often spuriously low when measured by a group intelligence test which requires reading.

Although research has been done in the area of early identification of children who are, or are likely to become, retarded readers, this identification process needs to be carried one step further to predict which retarded readers will have the greatest potential for growth. With the vast school enrollment and the shortage of trained reading personnel, it is an economic necessity to gear remedial instruction to the growth potential of the students.

There is a dearth of research studies which have attempted to predict reading improvement of retarded readers after remedial tutoring, particularly those measuring either true or residual gains, rather than crude gains.

No studies were found which used true gains as a measure of reading improvement, as does this study. This is a technique, described by Lord (19), which is appropriate when a given individual actually is a member of some natural group under consideration, such as the retarded readers in this study. Knowledge that an individual belongs to a certain group constitutes genuine information about that individual. Lord feels that an efficient method of estimation can and should make use of this information.

## Statement of the Problem

It was the purpose of this study to attempt to predict true reading gains made by retarded readers after remedial tutoring, through the use of selected student variables.

Independent variables utilized included IQ and subtest scores obtained on the Wechsler Intelligence Scale for Children (35), pre-tutoring reading levels on the individually administered Diagnostic Reading Scales test (29), age, sex, grade placement, and parental socio-economic status.

## Definitions

The definition of a "retarded reader", as used in this study, was an individual who was retarded in a number of reading skills by one year or more, if in the primary grades, or by two years or more, if older (30).

"True reading gains" are distinct from observed gains made between pre- and post-tutoring reading test scores in that a multiple regression equation is used to overcome chance errors of measurement and spurious gains. Thus the "regression to the mean" phenomenon, observed with raw scores, does not occur (19).

# DESIGN OF THE STUDY

The data needed to attain the purpose of this study were obtained from the files of retarded readers who had been referred to the University of Florida Reading Clinic for a diagnostic work-up and tutoring during the years 1954-1967.

## Sample

Sixty-two white subjects, fifty-two boys and ten girls, were included in the sample. They ranged in age from six years, nine months, to 15 years, eight months, and were in grades one through eight. Any student having severe visual or auditory impairments was automatically excluded from the study, as were those classified as Borderline or Mentally Defective on the Wechsler Intelligence Scale for Children.

Each subject was tutored approximately 20-25 hours by an experienced tutor during the University of Florida summer reading clinic program or by a clinic staff member for an equivalent number of hours.

## Instruments

The test used to measure intelligence was the Wechsler Intelligence Scale for Children (35).

Results of the individually administered Diagnostic Reading Scales (29) were used as the pre- and post-tutoring reading achievement scores. Sufficient selections are available in the test booklet so that unfamiliar material was used on the post-tutoring test.

Grade placement scores are given on the following three levels: Instructional (Oral Reading); Independent (Silent Reading); and Potential (Auditory Comprehension).

> The term "Instructional Level" is used to designate the child's grade level in oral reading. It implies the level and quality of reading which most teachers would find acceptable in group or classroom practice, and the grade level of basal or other reading materials to which the child should or would be exposed in the typical classroom.
>
> "Independent Level" is that grade level of supplementary instructional and recreational reading materials which the pupil can read to himself with adequate comprehension, even though he may experience some word-recognition difficulties.
>
> The "Potential Level" indicates whether a child is capable of understanding materials of even greater difficulty than those he can read orally or silently. This might be considered the level to which his reading can grow under favorable conditions. Theoretically, a pupil can progress to his Potential Level when his difficulties with mechanics or vocabulary are overcome.
>
> (29)

## Dependent Variable

True reading gains at the Instructional Level were considered the dependent variable.

The true reading gain was calculated for each subject, based on his observed gain between pre- and post-tutoring Instructional Level scores on the Diagnostic Reading Scales. An ordinary multiple regression equation was used to overcome the chance errors of measurement and spurious correlation existing between initial status on the pre-test and gain between pre-test and post-test (19).

## Independent Variables

Student characteristics considered in this study as possible predictors of true reading gain are:

Wechsler Intelligence Scale for Children:

Full Scale IQ (FS-IQ)
Verbal IQ (V-IQ)
Performance IQ (P-IQ)
Subtests: General Information (Info.)
General Comprehension (Comp.)
Arithmetic (Arith.)
Similarities (Sim.)
Vocabulary (Voc.)
Digit Span (D. S.)
Picture Completion (P. C.)
Picture Arrangement (P. A.)
Block Design (B. D.)
Object Assembly (O. A.)
Coding (Cod.)

Diagnostic Reading Scales:

Independent Level (Ind.)
Potential Level (Pot.)
Difference between Independent and Instructional Levels (Ind.-I)
Difference between Potential and Instructional Levels (Pot.-I)
Difference between Grade placement and Instructional Level (Gr.-I)

Other:

Age
Sex
Socio-Economic Status (Warner Scale Values)

## Hypotheses

Hypothesis I: The distribution of subjects will fall equally into three groups:
V = P (within 12.5 points)
P > V
V > P

Hypothesis II: There will be no significant difference in true gain means in reading improvement among the three groups of V = P, P > V, and V > P.

Hypothesis III: There will be no significant difference in true gain means in reading improvement among the WISC Full Scale IQ classifications of the subjects.
120-129--Superior
110-119--Bright Normal
90-109--Average
80- 89--Dull Normal

Hypothesis IV: There will be no significant predictors of true reading gain from among the 22 student characteristics considered.

## THE FINDINGS

Information regarding the student characteristics considered in this study, except for sex and socio-economic status, is presented in Table 1.

### Verbal IQ and Performance IQ

Distribution of Subjects.--Due to the conflicting results of research investigating the V-IQ and P-IQ characteristics of retarded readers, it was hypothesized that the subjects in this study would be distributed equally among three groups: V = P (within 12.5 points); P > V; V > P.

The observed and expected frequency distribution of the subjects is shown in Table 2. The null hypothesis was tested by the Chi-Square method.

TABLE 1

MEAN, RANGE, AND STANDARD DEVIATION OF VARIABLES

| Variables | Mean | Range | Standard Deviation |
|---|---|---|---|
| Grade | 4.7 | 1-8 | 1.89 |
| Age | 11.0 | 6-9-15-8 | 2.16 |
| V-IQ | 100 | 80-131 | 11.44 |
| P-IQ | 103 | 76-125 | 11.47 |
| FS-IQ | 102 | 81-121 | 10.67 |
| Info. | 10 | 4-19 | 2.75 |
| Comp. | 11 | 5-19 | 2.82 |
| Arith. | 9 | 4-17 | 2.67 |
| Sim. | 10 | 5-17 | 3.39 |
| Voc. | 8 | 5-16 | 4.58 |
| D. S. | 6 | 4-13 | 4.55 |
| P. C. | 11.5 | 5-17 | 2.97 |
| P. A. | 9 | 7-17 | 4.93 |
| B. D. | 10.5 | 5-17 | 2.62 |
| O. A. | 8.5 | 5-15 | 4.14 |
| Cod. | 8.5 | 5-17 | 3.12 |
| Ind. | 3.5 | 1.0-6.5 | 1.84 |
| Pot. | 5.8 | 2.8-8.5 | 1.53 |
| Gr.-I | 2.4 | .9-5.4 | 1.18 |
| Pot.-I | 2.9 | .7-5.2 | 1.10 |
| Ind.-I | .7 | 0-4.0 | .82 |
| True Gain | 1.0 | .3-2.4 | .48 |

TABLE 2

OBSERVED FREQUENCY AND EXPECTED FREQUENCY IN THREE CATEGORIES ASSUMING A UNIFORM DISTRIBUTION IN THE POPULATION

| | V = P | P > V | V > P | Sum |
|---|---|---|---|---|
| Observed f | 40 | 16 | 6 | 62 |
| Expected f | (20.66) | (20.66) | (20.66) | 62 |

$$X^2 = 18.1 + 1.1 + 10.4$$

$$= 29.6$$

$P = <.01,\ 2\ df \qquad X^2 = 9.210$

Since the value of the test statistic falls in the rejection region, the null hypothesis of equal distribution must be rejected.

The WISC standardization data show that two-thirds of the sample had Verbal and Performance IQ's within the range of one standard deviation of 12.5 points. This is also true in the present study. If the 40 subjects who are in the V = P category are disregarded and the distribution of the remaining subjects is tested for equal probability in the P > V and V > P categories, the null hypothesis must again be rejected, since the test statistic falls in the rejection region.

$$X^2 = 11.5$$

$p = <.01,\ 1\ df \qquad X^2 = 6.635$

We can therefore assume that there is a significant difference in observed frequency between the two remaining categories, a significantly greater number being in the P > V group. This agrees with the results of many studies which indicate that retarded readers tend to have significantly higher P-IQ's than V-IQ's (22), (6), (24), (8), (9), (26).

Consideration must be given to the fact, however, that the child's verbal score may be limited by the same factors which limit his reading

performance (37), and that he may be compensating for failure in a verbal field by giving greater attention to self-development in the non-verbal area (30).

With only 16 and six subjects in the P > V and V > P groups, respectively, results of this study have contributed little to research conclusions in this area.

Group Differences in True Gain Means.--An analysis of variance was made on the true gain means of the three groups, V = P, P > V, and V > P, in order to determine whether or not there was a significant difference among them. The appropriate data is found in Table 3 and Table 4.

Since the F value does not exceed the critical value of F.05 = 3.15, we must retain the null hypothesis and conclude that there is no significant difference among the true gain means of the groups considered.

With only six subjects in the V > P group in this study, definite conclusions should not be drawn. The acceptance of the null hypothesis, however, does cast doubt upon the verbal/performance relationship of retarded readers. If it is true that Verbal IQ is a better predictor of reading achievement, as claimed by Hage and Stroud (10) and Barratt and Baumgarten (1), the V > P group should have improved more than the other two groups. On the other hand, Wilson (37) feels that the Performance IQ is a better indicator of reading potential for retarded readers than the Verbal IQ. Therefore, the P > V group should have made the best gains of the three groups.

Results from this study and others (20), (15), (32), indicate that research in the area of V-IQ and P-IQ characteristics of retarded readers is largely inconclusive.

TABLE 3

SIZE, TRUE GAIN MEAN, AND STANDARD DEVIATION OF V-P GROUPS

| Group | Size | Mean | Standard Deviation |
|---|---|---|---|
| V = P | 40 | 1.1 | .47 |
| P > V | 16 | .9 | .53 |
| V > P | 6 | .8 | .39 |

TABLE 4

ANOVA TABLE FOR COMPARISON OF TRUE GAIN MEANS AMONG V-P GROUPS

| Source of Variation | SS | df | MS | F[x] |
|---|---|---|---|---|
| Between Groups | .46 | 2 | .23 | 1.01 |
| Within Groups | 13.53 | 59 | .23 | |
| Total | 13.99 | 61 | | |

[x] No significant difference at .05 level.

Full-Scale IQ Groups

Research tells us that retarded readers are found at all levels of intelligence. Therefore, it should be helpful to determine if there is a significant difference in reading gains made at the various levels.

In an attempt to do so, the subjects in this study were grouped according to the Wechsler Full-Scale classifications, as listed in Table 5. Results of an analysis of variance to test the null hypothesis of equal true gain means among the groups are given in Table 6.

TABLE 5

SIZE, TRUE GAIN MEAN, AND STANDARD DEVIATION OF FS-IQ GROUPS

| Groups | Size | Mean | Standard Deviation |
|---|---|---|---|
| Superior | 3 | 1.2 | .40 |
| Bright Normal | 16 | .9 | .37 |
| Average | 33 | 1.1 | .53 |
| Dull Normal | 10 | 1.0 | .48 |

TABLE 6

ANOVA TABLE FOR COMPARISON OF TRUE GAIN MEANS AMONG FS-IQ GROUPS

| Source of Variation | SS | df | MS | F[x] |
|---|---|---|---|---|
| Between Groups | .49 | 3 | .16 | .7036 |
| Within Groups | 13.50 | 58 | .23 | |
| Total | 13.99 | 61 | | |

[x] No significant difference at .05 level.

The calculated F value is far less than the critical value of 2.77 at the .05 level of significance; therefore, the null hypothesis must be retained. It must be concluded that there is no significant difference in true gain means among the four FS-IQ groups considered in this study.

It would appear from these results that as long as retarded readers are of dull normal intelligence, or above, their intelligence classification should not preclude nor restrict their reading improvement after tutoring.

Correlation Matrix of Student Characteristics

The null hypothesis that there would be no significant predictors of true reading gain was tested by research data computations made at the University of Florida Computer Center.

A stepwise regression program was selected because it would give the desired correlation matrix of student characteristics considered in this study (Table 7), and a multiple linear regression analysis and summary table (Table 11).

In examining Table 7, the correlation matrix, four independent variables are found to be positively and significantly correlated with true reading gain at the .01 level of significance. They are grade ($r = .75$), age ($r = .68$), Independent reading level ($r = .83$), and Potential reading level ($r = .66$). The difference between Independent and Instructional reading levels (Ind.-I) is significantly correlated with true reading gain at the .05 level of significance ($r = .26$).

The null hypothesis must, therefore, be rejected.

Further examination of the matrix indicates the high intercorrelation among these five variables and true gain. Table 8 shows these significant relationships.

The variables of grade and age can almost be considered synonymous ($r = .96$). Since the Instructional, Independent, and Potential reading levels are measured in grade levels, many of the same factors as in grade and age play a significant role in their high intercorrelation.

The highly significant correlation of grade and age with true reading gain has important implications for education. Results of this study indicate that we should concentrate our clinical remedial reading efforts on children beyond the primary grades. Kottmeyer (17) concurs

TABLE 7

CORRELATION MATRIX AMONG TWENTY-TWO STUDENT CHARACTERISTICS AND TRUE READING GAIN

| | Gr. | Sex | Age | V-IQ | P-IQ | FS-IQ | Info. | Comp. | Arith. | Sim. | Voc. | D.S. | P.C. | P.A. | B.D. | O.A. | Cod. | Ind. | Pot. | GR-I | Pot-I | Ind-I | True Gain |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gr. | 1.00 | -.20 | .96 | -.16 | -.11 | -.17 | -.30 | -.00 | -.01 | 0.13 | -.15 | .05 | -.10 | -.08 | -.04 | .02 | -.15 | .77 | .73 | .71 | .10 | .42 | .75$^{x}$ |
| Sex | | 1.00 | -.30 | -.02 | -.02 | -.02 | -.11 | -.10 | -.00 | .10 | .23 | -.09 | -.17 | .14 | -.12 | -.27 | .34 | -.21 | -.35 | -.21 | -.36 | -.22 | -.10 |
| Age | | | 1.00 | -.17 | -.09 | -.16 | -.27 | .00 | -.06 | .09 | -.20 | .06 | -.06 | -.11 | .04 | .09 | -.15 | .78 | .76 | .71 | .21 | .46 | .69$^{xx}$ |
| V-IQ | | | | 1.00 | .44 | .87 | .72 | .65 | .57 | .58 | .30 | -.06 | .24 | .18 | .36 | -.07 | .12 | .04 | -.05 | -.24 | -.04 | .03 | -.05 |
| P-IQ | | | | | 1.00 | .83 | .44 | .28 | .14 | .41 | .11 | -.14 | .60 | .40 | .76 | .17 | .16 | -.04 | -.10 | -.14 | -.07 | -.09 | -.01 |
| FS-IQ | | | | | | 1.00 | .70 | .56 | .44 | .58 | .25 | -.11 | .48 | .33 | .65 | .06 | .16 | -.00 | -.09 | -.23 | -.06 | -.04 | -.04 |
| Info. | | | | | | | 1.00 | .27 | .35 | .32 | .10 | -.02 | .32 | .27 | .33 | -.04 | -.11 | -.05 | -.13 | -.35 | -.05 | -.00 | -.12 |
| Comp. | | | | | | | | 1.00 | .26 | .34 | .20 | -.19 | .27 | .13 | .16 | -.03 | .08 | .05 | -.01 | .01 | .04 | .13 | -.07 |
| Arith. | | | | | | | | | 1.00 | .39 | .15 | -.07 | .10 | .06 | .14 | -.11 | .12 | .09 | -.05 | -.03 | -.09 | .14 | .01 |
| Sim. | | | | | | | | | | 1.00 | .15 | -.04 | .28 | .09 | .35 | -.00 | -.14 | .08 | .13 | .05 | .05 | -.03 | .13 |
| Voc. | | | | | | | | | | | 1.00 | -.00 | -.01 | .60 | .10 | .01 | .04 | -.02 | -.13 | -.21 | -.11 | -.05 | -.07 |
| D. S. | | | | | | | | | | | | 1.00 | -.17 | -.13 | -.04 | .25 | .03 | .15 | .03 | .03 | -.00 | .18 | .03 |
| P. C. | | | | | | | | | | | | | 1.00 | .19 | .34 | .01 | -.09 | -.04 | -.02 | -.06 | .05 | .00 | -.06 |
| P. A. | | | | | | | | | | | | | | 1.00 | .28 | -.10 | -.10 | .02 | -.06 | -.12 | -.05 | -.02 | -.01 |
| B. D. | | | | | | | | | | | | | | | 1.00 | .15 | .01 | -.03 | .01 | .04 | .16 | .00 | -.10 |
| O. A. | | | | | | | | | | | | | | | | 1.00 | -.10 | -.04 | -.09 | .11 | -.03 | .06 | -.06 |
| Cod. | | | | | | | | | | | | | | | | | 1.00 | -.02 | -.20 | -.23 | -.25 | -.05 | -.02 |
| Ind. | | | | | | | | | | | | | | | | | | 1.00 | .73 | .25 | -.01 | .71 | .03$^{x}$ |
| Pot. | | | | | | | | | | | | | | | | | | | 1.00 | .38 | .56 | .42 | .66$^{x}$ |
| GR-I | | | | | | | | | | | | | | | | | | | | 1.00 | .38 | .32 | .10 |
| Pot-I | | | | | | | | | | | | | | | | | | | | | 1.00 | .21 | -.24$^{x}$ |
| Ind-I | | | | | | | | | | | | | | | | | | | | | | 1.00 | .26$^{x}$ |
| True Gain | | | | | | | | | | | | | | | | | | | | | | | 1.00 |

$^{xx}$Significant at the .01 level.

$^{x}$Significant at the .05 level.

in this opinion. In the primary grades, children are in the "learning to read" stage and are gradually building a sight vocabulary, learning word attack skills, and building concepts. Since most classwork is oral, their Independent level (silent reading) is often no higher than their Instructional level (oral reading). Therefore, reading readiness or beginning reading activities should be geared to their needs to strengthen any areas of weakness, rather than remediation. In the grades above primary level, the "reading to learn" stage of development, the emphasis changes from oral reading to silent reading. The student now needs to learn to read and to analyze words independently and, hopefully, strives to develop this skill. His experiential and conceptual backgrounds are widening, as are his sight and meaningful vocabularies. He is used to going to school and should have developed a longer span of attention than the primary child. Add to this the maturity to see the need for becoming a good reader in studying in the content areas and evidence mounts as to why he is a better candidate for remedial reading instruction than the very young child, should he encounter difficulty. He may have some word recognition difficulties but is able to get enough clues for good comprehension.

TABLE 8

CORRELATION MATRIX OF FIVE SIGNIFICANT VARIABLES AND TRUE GAIN

| | Grade | Age | Ind. | Pot. | Ind.-I | True Gain |
|---|---|---|---|---|---|---|
| Grade | 1.00 | .96 | .77 | .73 | .42 | .75 |
| Age | | 1.00 | .74 | .76 | .46 | .68 |
| Ind. | | | 1.00 | .73 | .71 | .83 |
| Pot. | | | | 1.00 | .42 | .66 |
| Ind.-I | | | | | 1.00 | .26 |
| True Gain | | | | | | 1.00 |

Age, Grade and Sex Differences.--With grade level having such a high correlation (r = .75) with true reading gain, it was of interest to compute true mean gains and to consider sex differences at each grade level. This has been done in Table 9.

Sex was not found to correlate significantly with true reading gains in the matrix. This may be partly due to the small number of girls in the sample. In order to determine whether or not there was a significant difference between the true reading gain means of boys (1.03) and girls (.91), as given in Table 9, the Student's t-test was administered. No significant difference between means was found at the .05 level. Similar results were obtained in the studies by Bluestein (3), Sinks and Powell (28), and Holowinsky (14).

TABLE 9

FREQUENCY AND TRUE READING GAIN MEANS OF SUBJECTS GROUPED ACCORDING TO GRADE LEVEL AND SEX

| | Number | | | True Reading Gain Means (year) | | |
|---|---|---|---|---|---|---|
| Grade | Boys | Girls | Total | Boys | Girls | Combined Scores |
| 1 | 2 | 0 | 2 | .3 | -- | .3 |
| 2 | 6 | 3 | 9 | .5 | .5 | .5 |
| 3 | 5 | 3 | 8 | .8 | .9 | .9 |
| 4 | 7 | 0 | 7 | .8 | -- | .9 |
| 5 | 12 | 1 | 13 | 1.2 | 1.0 | 1.2 |
| 6 | 10 | 3 | 13 | 1.0 | 1.3 | 1.1 |
| 7 | 6 | 0 | 6 | 1.5 | -- | 1.5 |
| 8 | 4 | 0 | 4 | 2.0 | -- | 2.0 |
| Total | 52 | 10 | 62 | 1.03[x] | .91[x] | 1.0 |

[x] No significant difference at .05 level.

Results of an analysis of variance of true gain among the eight grade levels is shown in Table 10.

It can be concluded that there is a significant difference at the .01 level of significance, among true reading gains at the grade levels considered in this study.

TABLE 10

ANOVA TABLE FOR COMPARISON OF TRUE GAIN MEANS AMONG GRADE LEVELS

| Source of Variation | SS | df | MS | F |
|---|---|---|---|---|
| Between Groups | 9.19 | 7 | 1.31 | 14.56[x] |
| Within Groups | 4.80 | 54 | .09 | |
| TOTAL | 13.99 | 61 | | |

[x] Significant at .01 level.

WISC Scores.--Rather surprisingly, none of the WISC scale or subtest scores showed a significant correlation with true reading gain. In fact, all of them were either negatively correlated with true reading gain or had very small positive correlations. This is in contrast to Krippner's (18) study in which both the WISC FS-IQ and V-IQ were significantly correlated with reading gain. Bluestein (3), too, found IQ to be significant in his study. Both of these studies used raw score gains in reading improvement and this may have resulted in the contradictory findings.

Reading Levels.--As noted previously, the Independent reading level (silent reading) and the Potential level (auditory comprehension) are significantly correlated with true reading gain at the .01 level, with ($r = .83$) and ($r = .66$) respectively.

The difference between Independent and Instructional levels (Ind.-I.) is significantly correlated with true reading gain at the .05 level of significance.

Interestingly, the degree of retardation, measured by the difference between grade placement and Instructional level (Gr.-I.), was not significantly correlated with true reading gain in this study. Other studies, such as Bluestein's (3) have found it a significant predictor of raw score reading gains. The phenomenon of regression to the mean on post-test scores has led many to believe that remediation efforts should be spent on those most retarded in reading since they apparently make the greatest gain after tutoring. Results of this study indicate that this is not true. The unique feature of this research is that true reading gains are used, rather than crude score gains. In the process of computing true gains, the multiple regression equation used overcomes chance errors of measurement and spurious correlations existing between initial status on the pre-test and gain between pre-test and post-test. Therefore, the apparent "regression to the mean" phenomenon never occurs and there is strong evidence that it is really just a statistical artifact.

Summary Table of Stepwise Multiple Regression Analysis

In addition to the correlation matrix (Table 7) already discussed, the program selected computes a sequence of multiple linear regression equations in a stepwise manner. At each step, one variable is added to the regression equation. The variable added is the one which makes the greatest reduction in the error sum of squares and which, if it were added, would have the highest F value.

SUMMARY TABLE OF STEPWISE MULTIPLE REGRESSION ANALYSIS

| Step Number | Variable Entered | Multiple r | Multiple $r^2$ | Increase in $r^2$ | F Value |
|---|---|---|---|---|---|
| 1 | Ind. | 0.8258 | 0.6819 | 0.6819 | 128.6302[x] |
| 2 | Ind.-I. | 0.9448 | 0.8926 | 0.2107 | 115.7195[x] |
| 3 | Pot.-I. | 0.9501 | 0.9027 | 0.0102 | 6.0539[x] |
| 4 | Pot. | 0.9884 | 0.9770 | 0.0743 | 184.3102[x] |
| 5 | P-IQ | 0.9893 | 0.9788 | 0.0018 | 4.6860[x] |
| 6 | FS-IQ | 0.9899 | 0.9800 | 0.0012 | 3.2768[x] |
| 7 | Sim. | 0.9901 | 0.9803 | 0.0003 | 0.7878 |
| 8 | P.C. | 0.9902 | 0.9806 | 0.0003 | 0.7447 |
| 9 | Voc. | 0.9904 | 0.9808 | 0.0003 | 0.7599 |
| 10 | P.A. | 0.9906 | 0.9812 | 0.0004 | 1.0676 |
| 11 | Age | 0.9907 | 0.9815 | 0.0003 | 0.8757 |
| 12 | Gr.-I. | 0.9910 | 0.9821 | 0.0005 | 1.4809 |
| 13 | Info. | 0.9911 | 0.9823 | 0.0002 | 0.6432 |
| 14 | Sex | 0.9912 | 0.9825 | 0.0002 | 0.5347 |
| 15 | B.D. | 0.9913 | 0.9827 | 0.0002 | 0.4371 |
| 16 | Arith. | 0.9914 | 0.9828 | 0.0001 | 0.2582 |
| 17 | Grade | 0.9914 | 0.9829 | 0.0001 | 0.2279 |
| 18 | D.S. | 0.9914 | 0.9829 | 0.0001 | 0.1808 |
| 19 | O.A. | 0.9915 | 0.9830 | 0.0000 | 0.1044 |
| 20 | Cod. | 0.9915 | 0.9830 | 0.0000 | 0.0474 |
| 21 | Comp. | 0.9915 | 0.9830 | 0.0000 | 0.0317 |
| 22 | V-IQ | 0.9915 | 0.9830 | 0.0000 | 0.0033 |

[x] Significant at the .01 level of significance.

It is apparent from this summary table that the two most important factors accounting for variance in the true reading gain are the Independent reading level and the difference between Independent and Instructional levels (Ind.-I.), accounting for 68 per cent and 21 per cent, respectively. The Potential level contributes an additional 7 per cent to the variance. All three variables have F values significant at the .01 level.

Although the difference between Potential and Instructional levels (Pot.-I), P-IQ, and FS-IQ have significant F values at the .01 level also, it can be seen that their role in accounting for true gain variance is very minute, as is that of all remaining variables. Surprisingly, V-IQ contributes nothing at all to the true reading gain variance.

Using the two variables which contribute 89 per cent of the variance, Independent level and Independent-Instructional, it is possible to derive a predictive equation from the computer data which might be used to predict approximate true reading gains of retarded readers, after remedial tutoring. It must be noted, however, that this equation would be appropriate only for use with retarded readers as defined in this study, under similar tutoring conditions, with reading levels and true gain being determined from Diagnostic Reading Scales results.

True gainability prediction equation:

$$\hat{G} = .08 + .33 \text{ (Ind.)} - .38 \text{ (Ind.-I.)}$$

Results of this prediction equation for true gainability in reading have been found to be reasonably accurate when compared to the actual true reading gains of the subjects in this study. In most cases, the predicted and actual true reading gain vary within a range of one month.

## Additional Findings

Socio-economic status, as determined by parental occupation classification on the Warner Revised Scale of Occupations (34), originally had been intended as an independent variable in this study. Unfortunately, files of eight of the subjects were incomplete and parental occupations were consequently unknown. It was difficult to assign reliable classifications in other cases because the self-described positions were often of vague nature. With incomplete data such as this, it was deemed advisable to leave it out of the matrix.

In order to investigate any differences in true gain means among the subjects from the various occupational groups, as classified, a frequency distribution table was compiled (Table 12) and an analysis of variance performed (Table 13).

It must, therefore, be concluded that there is no significant difference among true reading gain means of children of different socio-economic status considered in this study. Concurring in this opinion are Keshian (16), Reid (26), and Dukes (7). Quite the opposite results were obtained by Sheldon and Carrillo (27), Wilson (36), and Hill and Giammateo (13). It must be remembered that schools reflect the socio-economic level which they represent. This includes the learning environment of school facilities, curriculum, materials, teacher preparation, and teacher effectiveness. Unless this environment were matched for subjects from different socio-economic groups, no realistic comparisons could be made. Even then, the experiential backgrounds of the children would vary so widely that results would still be inconclusive.

Results of this study have contributed little to forming a conclusion in the area of socio-economic influence on reading improvement, for the parental occupations were unknown for one-eighth of the subjects and many others were vaguely described.

TABLE 12

FREQUENCY AND TRUE READING GAIN MEANS OF SUBJECTS GROUPED ACCORDING TO PARENTAL OCCUPATIONS (WARNER SCALE)

| | Prof. | Prop. & Mgrs. | Bus. Men | Clerks, Kin-dred | Man. Work-ers | Prot. & Serv. | Farm-ers | Un-Known |
|---|---|---|---|---|---|---|---|---|
| Fre-quency | 16 | 7 | 3 | 9 | 13 | 0 | 6 | 8 |
| True gain Mean | 1.0 | .9 | 1.0 | 1.3 | .9 | 0 | 1.2 | 1.0 |

TABLE 13

ANOVA TABLE OF TRUE READING GAIN MEANS OF SUBJECTS GROUPED ACCORDING TO PARENTAL OCCUPATION (WARNER SCALE)

| Source of Variation | SS | df | MS | F[x] |
|---|---|---|---|---|
| Between Groups | 1.14 | 6 | .19 | .81 |
| Within Groups | 12.85 | 55 | .234 | |
| Total | 13.99 | 61 | | |

[x] Not significant at the .05 level.

## Summary

In summary, analysis of the data in this study has indicated:

1. Retarded readers are not distributed equally among V = P (within 12.5 points), P > V, and V > P groups.

2. There is no significant difference in true gain means among the three groups of subjects in V = P, P > V, and V > P.

3. There is no significant difference in true gain means among the four groups of subjects classified by WISC FS-IQ as having superior, bright normal, average, or dull normal intelligence.

4. There are five significant predictors of true reading gain, including grade, age, Independent reading level, Potential reading level, and the difference between Independent and Instructional levels.

## Implications for Education

Assuming that definitions and conditions are similar to those in this study, the following implications might be made:

1. The student who appears to make the best true gain in reading after remedial tutoring is the older one, above primary grades, who has

developed his Independent reading level well above his Instructional level and whose Potential level is also above his Instructional level.

2. True gains should be considered in measuring reading improvement, rather than crude gains, which may mistakenly lead one to believe that the most retarded readers make the best gains, due to the "regression to the mean" phenomenon. The use of a multiple regression equation in computing true gains overcomes chance errors of measurement and spurious correlation existing between initial status on the pre-test and post-test.

3. As long as retarded readers are of dull normal intelligence, or above, their intelligence classification should not preclude nor restrict their reading improvement after tutoring.

## Implications for Research

1. More studies need to be done using true reading gains as the dependent variable, rather than crude score gains. This would help to clarify the role of "degree of retardation" as a predictor of reading improvement.

2. This study could be replicated using larger groups, matched as to number of boys and girls and/or as to V = P, P > V, V > P groups.

3. The true reading gainability prediction equation should be tested on other retarded readers.

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