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AUTHOR Marston, Doug; Deno, Stanley L.
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ABSTRACT

A continuous pupil progress monitoring system was implemented in two elementary schools; 552 students and 38 educational personnel were involved. The monitoring system employed was initially designed to evaluate students receiving special services and their progress toward individual education plan reading goals. The model emphasized direct assessment in the students' grade level basal reader (Ginn Reading Series) and repeated measurement of the number of words read correctly in students' 1-minute readings for 16 weeks. The number of words read correctly by the student was tabulated and the information entered into a microcomputer program. A computer printout displayed a graph of each student's performance and a summary of descriptive statistics (baseline level, current level, average weekly gain or loss, and amount of variability in reading scores). Actual time for administration and scoring was approximately 3 minutes per student. Teachers generally felt that the information collected was instructionally relevant. The extent to which student performance data were valid indices of student achievement, were sensitive to pupil growth, and could be used to judge the efficacy of program placement and student progress in the program also were examined. Results suggest that the system can be implemented successfully on a wide-scale basis in schools. (Author/PN)

University of Minnesota

Research Report No. 106

IMPLEMENTATION OF DIRECT AND REPEATED MEASUREMENT IN THE SCHOOL SETTING

Doug Marston and Stanley L. Deno

Institute for Research on Learning Disabilities

IRLD

Director: James E. Ysseldyke

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December, 1982

Abstract

A continuous pupil progress monitoring system was implemented in two elementary schools; 552 students and 38 educational personnel were involved. The educational personnel provided input on the feasibility and cost effectiveness of the system and their reactions to the system. The extent to which student performance data were valid indices of student achievement, were sensitive to pupil growth, and could be used to judge the efficacy of program placement and student progress in the program also were examined. All results suggested that the system can be implemented successfully on a wide-scale basis in schools. The need for commitment on the part of the school administration is discussed.

Implementation of Direct and Repeated Measurement in the School Setting

In an era of declining enrollments, cuts in state and federal aids, and a resurgence in private education, the public schools are in a position where they must justify their appropriations. Minneapolis Public Schools has responded to this challenge by developing and implementing a Five Year Plan that outlines how the district will meet the present and future needs of their students in our changing society. Essential to this plan is the ability to document the district's effectiveness.

A significant goal identified in the long-range plan involves the need to monitor student progress.

> Accountability for student achievement of basic skills requires development of a system-wide data-based management system for monitoring student progress. The district will design and implement a student achievement data system. (Minneapolis Public Schools, p. 14)

In an effort to achieve this stated objective, the Minneapolis Public Schools and the Institute for Research on Learning Disabilities (IRLD) cooperated on a pilot project in which pupil progress in reading was monitored frequently.

The monitoring system employed was designed initially to evaluate students receiving special services and their reading progress toward Individual Educational Plan (IEP) goals (Deno & Mirkin, 1977; Jenkins, Deno, & Mirkin, 1979). The proposed model emphasized direct assessment in the students' curriculum and repeated measurement. IRLD investigators conducted a search for measures of reading that could be used in a classroom progress measurement system. To be considered for inclusion in the system, the reading measure had to have the following

characteristics:

(1) Valid with respect to widely used measures of achievement in reading

(2) Immediately sensitive to the effects of relatively small adjustments in instructional interventions

(3) Reliable

(4) Easy to administer by teachers, parents, and students

(5) Have many parallel forms that are frequently administrable to the same student

(6) Time efficient

(7) Inexpensive to produce

(8) Unobtrusive with respect to routine instruction

(9) Simple to teach to teachers, parents, and children

On the basis of several research study results, it was concluded that the best measure of reading for the direct, repeated measurement system was the number of words read correctly by a pupil in one minute from his/her basal reader (Deno, Marston, Mirkin, Lowry, Sindelar, & Jenkins, 1982; Deno, Mirkin, & Chiang, 1982; Fuchs & Deno, 1981).

Using the research base established at the IRLD, an attempt was made to develop a similar pupil progress monitoring system in two elementary schools. During the implementation of the pilot project, five specific questions were addressed:

(1) What is the feasibility and cost effectiveness of designing and maintaining a large scale student monitoring system in an elementary school?

(2) What are the attitudes of teachers and administrators toward such a system after its implementation?

(3) Do student performance data validly index student achievement in this academic area?

(4) Are student performance data sensitive to pupil growth?

(5) Can the student performance data be used to judge the efficacy of program placement and student progress in those programs?

These five questions were the focus of the present research.

Method

Subjects

The continuous pupil progress monitoring system was instituted for half a year in two elementary schools and involved 552 students and 38 educational personnel. School A was a K-3 elementary school; all 325 pupils in grades 1 through 3 participated in the project. In School B, a K-6 elementary school, 227 students participated; these were students of teachers who volunteered to participate in the pilot project.

Procedure

Pupil evaluation in reading began in late January 1982 and continued for 16 weeks. Each week the students would read individually to a teacher, tutor, or aide from their grade level basal reader for one minute. All students read from the Ginn Reading Series (Clymer & Fenn, 1979). First graders read passages from Level 5, second graders read passages from Level 7, and third grade pupils read from Level 9.

To reduce error in measurement, all passages were screened to ensure equivalence of passages within levels. The Fry Readability Index (1975) was used to assess reading levels of the passages. Any passage rated over one year above or below grade level was not used in the study. Average readability for Ginn 5 passages was 1.1; for Ginn 7 the average readability was 2.6, and for Ginn 9 it was 3.3.

At the end of the timing, the number of words read correctly by the student was tabulated and the information entered into a micro-computer program. Figure 1 illustrates a sample reading sheet scored for correct words. Teachers then were supplied with a computer printout displaying a graph of each student's performance. Also included was a summary of the following descriptive statistics: baseline level, current level, average weekly gain (or loss), and amount of variability in reading scores. At the end of the four-month period the mean and slope of words read correctly was calculated for each student.

Insert Figure 1 about here

Results

Feasibility and Cost Effectiveness

A total of 38 educational personnel were involved in the weekly measurement of the 552 pupils. Those working with the students included teachers, tutors, aides, a school psychologist, and a principal. A frequency analysis of the participants by job description is shown in Table 1.

Insert Table 1 about here

All 38 participants were asked to complete a questionnaire surveying their attitudes toward the project; included on the questionnaire was an item asking them to estimate the amount of time

they spent administering and scoring the reading procedures. A copy of the Teacher Evaluation Questionnaire is found in Appendix A. Twenty-five of the participants responded to the survey. The average number of students tested by the respondents was 15.5. The average amount of time needed to test and score the reading samples was 47.75 minutes, or approximately 3.0 minutes per student.

Not included in this efficiency analysis is the amount of time required for developing measurement materials, training teachers, and monitoring the data collection process. Both pilot schools were serviced by a school psychologist who fulfilled these responsibilities with about 40% of full time effort. In addition, it was estimated that 10 hours/week of clerk time was required for entering data into the micro-computer.

Teacher and Administrator Attitudes

The Teacher Questionnaire also solicited the opinions of the participants about the data monitoring system. An analysis of how the participants used the data is presented in Table 2. The majority of teachers (72%) found the data useful for tracking student progress in reading. Some teachers felt the system was helpful in communicating with parents (32%) and other teachers (32%). For example, several teachers used the computer printout during parent-teacher conferences; they reported that many parents responded favorably to their child's graphed data. Nine of the twenty-five respondents (36%) stated that the information was useful for instructional planning. The most frequently cited example was teacher reevaluation of student placement in reading groups. Others commented that they changed students'

reading placements based on the data. Finally, 28% of the respondents remarked that their expectations about student achievement potential had changed. In one case, a teacher referred a student to special education; she had not previously been aware that the student was having problems. In other cases, students did better than teachers had expected.

Insert Table 2 about here

Participants also were asked to answer questions about the efficacy of the data system in general (see Table 3). When asked whether Minneapolis Public Schools should continue this type of system to track student progress, 68% responded positively, while 20% said no. With respect to participant beliefs about whether trends in the data reflected actual student progress, over one-half (56%) of the participants answered yes, while 16% responded no. Finally, 80% of the participants evaluated the organization of the measurement materials as sufficient.

Insert Table 3 about here

Validity of Measurement System

Investigating the validity of the student reading data is essentially a replication study. Deno, Mirkin, & Chiang (1982) demonstrated earlier that the number of words read correctly during a one-minute timing from a basal reader correlates highly with

performance on the Stanford Diagnostic Reading Test (Karlsen, Madden, & Gardner, 1977), the Woodcock Reading Mastery Test (Woodcock, 1973), and the Peabody Individual Achievement Test (Dunn & Markwardt, 1970).

For this study, several tests were administered to a group of 26 third grade students. The criterion measures were the reading subtest scores from the (a) Stanford Achievement Test (Madden, Gardner, Rudman, Karlsen, & Merwin, 1973): Vocabulary, Reading Words, Comprehension, Total Reading and Word Study, (b) the reading portion of the SRA Achievement Series (Naslund, Thorpe, & Lefever, 1978): Vocabulary and Comprehension, and (c) the Ginn 720 Reading Series (Clymer & Fenn, 1979). Subtest scores were correlated with the number of words read correctly by each student from the basal reader. The obtained coefficients are displayed in Table 4. With the exception of Vocabulary, the coefficients were of high magnitude and ranged between .80 and .90.

Insert Table 4 about here

A second approach to examining the validity of Words Read Correctly is to compare it with other standardized tests of reading as to their correlations with an external criterion. In this analysis, teachers were asked to judge student achievement level in reading on a scale from 1 to 5 (Teacher Judgment). Performance on the direct measure of reading and on the standardized tests then were correlated with the Teacher Judgment variable. These coefficients are presented in Table 5. Words Read Correctly correlated .77 with Teacher Judgment

and was the second largest coefficient. Coefficients for the remaining standardized tests ranged from .47 to .81. The .77 coefficient was then compared to the remaining coefficients by examining the significance of the difference between two correlation coefficients for correlated samples (Ferguson, 1971). The coefficient for Words Read Correctly was significantly greater than SRA Vocabulary, SAT Vocabulary, and Ginn Reading Level.

Insert Table 5 about here

Sensitivity to Pupil Growth

Verification of an assessment procedure as sensitive to pupil progress is dependent upon an external measure or criterion. Teacher ratings of student performance again were used as the criterion variable in the analysis of sensitivity. The same 26 third-grade students used in the validity analysis were rated on a scale from 1 to 5 by the teacher in terms of how well the student had progressed in reading during the four-month period. Progress measures derived from the standardized tests and the direct measure of reading then were correlated with the Teacher Judgment score. It was reasoned that those measures correlating highest with Teacher Judgment were the most sensitive to growth. For Words Read Correctly, the progress measure was the difference between the mean of the first three weeks subtracted from the mean of weeks 14, 15, and 16. For the SRA Vocabulary and Comprehension Tests, which were administered at Weeks 1 and 16, the difference scores were used to monitor student growth.

Although Ginn basal reading levels were available at the beginning and end of the four-month period, they were not used in the analysis because of teacher inconsistencies in using mastery criteria for moving students through the readers. For example, in third grade, where 749 unit mastery tests were given in the four-month period, students failed to meet criterion on 262 tests (35%). All pupils had been advanced to higher reading levels despite failing the criteria on the unit mastery tests.

Correlation coefficients between Teacher Judgment and the dependent measures are presented in Table 6. The Words Read Correctly measure showed is the highest correlation, .43. This coefficient was significantly greater than the .01 coefficient for SRA Vocabulary, but was not significantly different when compared to SRA Comprehension (Ferguson, 1971). While the low magnitude of the coefficients may be surprising, this may be partially due to the lowered reliability of difference scores (Thorndike & Hagen, 1978).

Insert Table 6 about here

A second approach to analyzing sensitivity to growth is to determine the extent to which students progressed on the various measures. Correlated t test analyses were used to analyze the amount of growth on Words Read Correctly, SRA Vocabulary, and SRA Comprehension between the initial and later stages of the study. Larger t values are indicative of greater change or growth. Means, standard deviations, and t values for this analysis are presented in

Table 7. Change was most evident for Words Read Correctly (t = 6.65, $p < .001$) and least for SRA Comprehension (t = 1.65, p = .113).

Insert Table 7 about here

Judging Program Placement and Efficacy

This analysis was confined to School A, where students were enrolled in grades 1-3. Three types of program placement were analyzed: regular education (N = 130), Title I service (N = 104), and special education (N = 24). The analysis conducted examines the mean number of Words Read Correctly of the students in each program. If this measure is useful for determining eligibility, it should reliably differentiate students placed in the various services. The mean number of Words Read Correctly for each level of service at the different grade levels is reported in Table 8. The Total Sample means, also found in Table 8, were subjected to a one-way analysis of variance with program placement functioning as the independent variable in the analysis.

Insert Table 8 about here

Results of the ANOVA were highly significant, $F(2,269) = 111.8$, $p < .001$. A Student-Newman-Keuls follow-up test was used to compare the placement group means. The mean for regular education placement was significantly greater ($p < .05$) than Title I and special education means. Title I and special education, however, did not differ

significantly. Comparison of these two groups at each grade level, however, showed significant differences at grade 2 and grade 3.

Finally, an attempt was made to judge the efficacy of each level of service by examining student learning rate. The slope of each pupil's performance was computed for weeks 1 to 16. The mean slope at each grade level for the different levels of service is presented in Table 9. Substantial differences are apparent. For example, the average first grader in regular education made gains at a rate of about 4.4 words per week, whereas the average first grade special education student made about a 1.6 word gain.

Insert Table 9 about here

The analysis of the data, however, focused on mean slope within each level of service across grades. Total sample mean slope for regular education was 2.8; it was 2.8 for Title I and 1.7 words per week increase for special education. ANOVA results indicated a significant difference among means, $F(2,255) = 3.70$, $p = .026$. The follow-up test indicated that the mean learning rate of both regular education and Title I students was significantly greater than special education students. Regular education and Title I did not differ significantly from each other.

One question arising from these results is: How do learning rates of special education students differ from low-functioning students placed in regular education and Title I? Those students in regular education and Title I services who read at or below the

special education mean for their grade level were identified as "low-achieving." The learning rates of low achievers were then compared to the special education students. The mean slope for "low achievers" was 1.66 with a standard deviation of 1.20. Special education students had a mean of 1.72 and a standard deviation of .97. The two means are not reliably different (t = -.22, p = .824).

Discussion

Implementation of wide scale change in any organization is probably best served if the process is examined systematically. This approach has been adopted by Minneapolis Public Schools in their attempt to design a system for monitoring student progress. The present study described the implementation of a progress monitoring system in two elementary schools.

The quality of an assessment system is frequently measured in terms of technical adequacy (Salvia & Ysseldyke, 1981). However, demonstrating that specific assessment procedures are valid and reliable does not totally substantiate the worth of an assessment methodology. Although the importance of technical characteristics is acknowledged and presented in this report, we have endeavored to look beyond these qualities, examining the efficiency of the proposed model and teacher attitudes toward it. As a result, general statements regarding the utility of the system may be made.

A first issue addressed was that of how much personnel and time commitment was necessary. Actual time required for administration and scoring was quite low, approximately three minutes per student. Given the recent research on academic responding time, the trade-off is not

unreasonable. Graden, Thurlow, and Ysseldyke (1982), for example, found the average time allotted to students for reading aloud was 0.7 minutes a day. Reading from a basal reader once per week for one minute would represent a 48% increase.

Teacher attitudes toward the system also were examined. On all questions, a majority of the respondents favorably evaluated the progress measurement system. In some respects this finding is surprising since over half of the participating personnel were required to participate. Although several teachers initially objected to their involvement, there seemed to be a change in attitude by the end of the project. In fact, there was a general feeling among teachers that the information collected was instructionally relevant. This appears to be a positive characteristic viewed in light of teachers' low regard for the instructional usefulness of standardized tests (Thurlow & Ysseldyke, 1982).

Principals at both of the schools involved in the project supported the system, with one asking teachers to bring student reading graphs to Student Support Team (SST) meetings. The same principal also had graphs sent home with student report cards at the end of the year.

The technical adequacy of the measurement system in terms of both validity and sensitivity to growth also was documented. Words Read Correctly proved to be both highly valid and the best measure of student progress. The evidence serves to further reinforce the notion that a progress monitoring system based on direct and repeated measurement is feasible.

Finally, the results of the present study indicated that direct and repeated measurement may be used for more than progress measurement. Salvia and Ysseldyke (1981) delineate five purposes of assessment: screening, identification, program planning, program monitoring, and program evaluation. The data presented here concerning the placement of students suggests that direct and repeated measurement could be employed for eligibility decisions and efficacy research. Marston, Tindal, and Deno (1982) have suggested that the use of a common data base across all five decision-making areas would be advantageous because it would increase efficiency, improve communication, and be related more closely to the skill areas for which schools provide instruction.

In summary, the data suggest that direct and repeated measurement systems can be implemented on a wide-scale basis in our schools. The optimism must be tempered by the need for thorough organization and strong commitment from administrative levels. Given these conditions, direct and repeated measurement should be viewed as a viable alternative for monitoring student progress in the schools.

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Footnote

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Table 1

Frequency Analysis of the Number of Participating Educational Personnel by Job Description

Job Description	Total Number Participating
Teacher - Regular Education	24
Teacher - Special Education	4
Tutor	2
Aide	6
School Psychologist	1
Principal	1
Total	38

Table 2

How Teachers Used the Information Provided in the Continuous Evaluation Reading Project

Use of Data	Percentage of Teachers Using Data
Monitoring student progress in reading	72%
Communicating student progress to parents	32%
Communicating student progress to other teachers	32%
Planning for the instructional program	36%
Changed expectations regarding students' achievement potential	28%

Table 3

Attitudes Toward the Continuous Measurement System

	Yes	No	Not Sure	No Response
Do you think a system like this should be used by Minneapolis Public School teachers to track growth?	68%	20%	0%	12%
When there is a trend in the data (increase or decrease) does it reflect the student's growth?	56%	16%	16%	12%
Was the organization of the materials sufficient?	80%	0%	0%	20%

Table 4

Criterion Validity Coefficients for Words Read Correctly

	SRA Vocabulary	SRA Comprehension	Stanford Achievement Test 1	2	3	4	5	Ginn Reading Level
Words Read Correctly	.80	.80	.59	.84	.88	.90	.84	.83

1 Vocabulary

2 Reading Words

3 Comprehension

4 Total Reading

5 Word Study

Table 5

Comparison of Words Read Correctly with Other Measures of Reading For Correlation with Teacher Judgment

	Teacher Judgment
Words Read Correctly	.77
SRA - Vocabulary	.63
SRA - Comprehension	.81
Stanford Achievement Test	
Vocabulary	.47
Reading Words	.68
Comprehension	.75
Total Reading	.74
Word Study	.68
Ginn Reading Level	.56

Table 6

Correlation of Teacher Judgment of Progress with Measures of Reading Progress

	Teacher Judgment
Words Read Correctly	.43
SRA - Vocabulary	.01
SRA - Comprehension	.36

Table 7

Comparison of Weeks 1 and 16 with Correlated T Test Analysis

Measure	Mean	S.D.		Prob
Words Read Correctly*				
Week 1	72.5	29.5	6.65	.000
Week 16	89.7	32.6		
SRA Vocabulary				
Week 1	14.5	6.4	3.23	.004
Week 16	16.9	7.3		
SRA Comprehension				
Week 1	15.2	6.1	1.65	.113
Week 16	16.5	5.9		

*Week 1 is the mean of weeks 1, 2, and 3.
Week 16 is the mean of weeks 14, 15, and 16.

Table 8

Mean Words Read Correctly for Each Level of Service by Grade Level

Grade	Mean Regular Education	Mean Title I Students	Mean Special Education
1	62.6	40.2	28.9
2	93.3	36.9	22.9
3	114.6	64.8	49.3
Total Sample	98.7	45.5	36.5

Table 9

Mean Slope of Words Read Correctly for Each Level of Service by Grade Level

Grade	Mean Regular Education	Mean Title I Students	Mean Special Education
1	4.4	2.7	1.6
2	2.7	3.9	1.4
3	2.6	1.9	1.9
Total Sample	2.8	2.8	1.7

" Eat away! " said City Mouse. 5
" You will like this food. " 10

Country Mouse said, " I do like it. 17
I may not go back to the country. " 25

City Mouse said, " Don't go back! 31
You can live here with me. " 37

When they were eating, 41
City Mouse saw something big. 46
He said, " Run! Run, Country Mouse. 52
And don't stop " 55

Away went City Mouse. 59
And away went Country Mouse. 64
They ran out of the house. 70
City Mouse called, " Come back, 75
Country Mouse! 77
There is no danger now. 82
The cat went back into the house. " 89

But Country Mouse did not stop 95
He called, " No, I don't like to live 103
where there is danger 107
I'm going home. " 110
Country Mouse ran up a hill 116
and into the country. 120

When he got home, he said, 126
" At last I can stop! 131

Mike Smith
Name

39
Correct

Figure 1. Sample Reading Sheet Scored for Correct Words

Appendix A

Teacher Evaluation Questionnaire

Continuous Evaluation Reading Project

How many students did you work with in the project? _____

Approximately how much time did you spend each week administering and scoring the measures? _____

How did you use the information provided by the Continuous Evaluation Reading Project?

(check)

_____ monitoring student progress in reading

_____ communicating student progress to parents

_____ communicating student progress to other teachers

_____ planning for the instructional program

_____ changed expectations regarding students' achievement potential

_____ other (describe

Explain any responses:

Do you think a system like this should be used by Minneapolis Public School teachers to track growth? Why or why not?

Other subject areas? (check)

_____ math

_____ social studies

_____ science

_____ (other) _____

_____ _____

_____ _____

What did you like about this monitoring system?

What did you not like about this monitoring system?

What would you recommend to improve the system if it were to be expanded in its use?

When there is a trend in the data (increase or decrease) does it reflect the student's growth?

Was the organization of the materials sufficient? How would you change the format?

Other commnets:

PUBLICATIONS

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