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ABSTRACT

The effects of two data-utilization rules on spelling achievement were compared for an 11-year-old boy who had been diagnosed as learning disabled (LD). During instructional sessions, the boy was taught and measured on sets of difficult spelling words. Graphed data were analyzed using a concurrent schedule design whereby equivalent behaviors are treated simultaneously with different approaches to determine relative treatment effects. One treatment approach involved the following data-utilization rule: if the student's performance fell below the expected level on 3 consecutive days, the teacher made changes in the student's program. In the second treatment, the teacher made changes in the student's program every 5 to 10 days. Results indicated that, in the second data-utilization condition, the student's trend lines over a 6-week treatment period were superior to trend lines in the first data-utilization condition. (Author/CL)

University of Minnesota

Research Report No. 120

THE EFFECT OF ALTERNATIVE DATA-UTILIZATION RULES ON SPELLING ACHIEVEMENT: AN N OF 1 STUDY

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Abstract

The effects of two data-utilization rules on spelling achievement were compared for an 11-year old boy who had been diagnosed as learning disabled. During instructional sessions, the boy was taught and measured on sets of difficult spelling words. Graphed data were analyzed using a concurrent schedule design whereby equivalent behaviors are treated simultaneously with different approaches to determine relative treatment effects. One treatment approach involved the following data-utilization rule: If the student's performance fell below the expected level on three consecutive days, the teacher introduced a program change. In the second treatment, the teacher made changes in the student's program every 5 to 10 days. Results indicated that, in the second data-utilization condition, the student's trend lines over a six-week treatment period were superior to trend lines in the first data-utilization condition. Implications for practice and further research needs are discussed.

The Effect of Alternative Data-Utilization Rules on Spelling Achievement: An N of 1 Study

PL 94-142 requires special educators not only to develop an individual educational program (IEP) for each identified handicapped student, but also to monitor the IEP objectives and to make an effort to assist each child in achieving his/her goals. Currently, special educators typically monitor progress toward goals in an unsystematic and informal fashion, employing summative evaluation to certify program completion and to attest to the amount of progress made. This evaluation technique is an after-the-fact format whereby inadequate progress is documented rather than acted upon.

An alternative evaluation procedure is formative; frequent and direct information on student progress is collected to determine regularly the effects that program changes have on pupil performance. With formative evaluation, teachers can make changes as necessary to assist children in meeting goals (Starlin, 1971). Although formative evaluation appears to be more effective than summative evaluation in facilitating children's goal attainment (Haring, Maddox, & Krug, 1972; Haring & Krug, 1975; Jenkins, Mayhall, Peschka, & Townsend, 1974), inadequate information exists to determine which aspects of formative evaluation are essential in producing those differential effects.

The effectiveness of data-utilization rules is an aspect of formative evaluation that has been investigated. With data-utilization rules, teachers are required to implement instructional changes when student performance data conform to a prespecified pattern. Occasional studies of the effects of alternative data uses

indicate the potential importance of employing such prespecified rules. Frumess (1973) randomly selected 45 boys from 15 self-contained classrooms for minimally brain-injured (MBI) students and assigned each to one of five conditions: (1) Self-Chart, Self-Set Aims (SCSSA), where students graded, tallied, and recorded their own math fact performance and set their own weekly aims on graphs; (2) Self-Chart, Teacher-Set Aims (SCTSA), where teachers set the weekly aims; (3) Teacher Chart, Teacher Set Aims (TCTSA) where the children graded and tallied the number of math facts correct and incorrect per minute, but teachers charted and set weekly aims; (4) No Charting or Setting Aims (NCSA) where children graded and tallied but there was no charting or aim setting; and (5) Control Group. The results of this experiment are difficult to interpret, since although the SCSSA and SCTSA groups made significant gains over all other groups, the NCSA group improved significantly more than the TCTSA group. Frumess speculated that teachers may not have used the data they charted to implement instructional changes. Such an hypothesis supports the use of data-utilization rules to help teachers realize when ongoing programs are inadequate and when instructional changes are necessary to effect student growth.

In concert with this hypothesis, White (1971) demonstrated that teachers do not utilize data to make program changes unless they are required to do so. He found that many teachers allow programs to remain intact long after those programs appear to affect student progress.

In an attempt to investigate more directly the effect of data-utilization rules on children's academic performance, Bohannon (1975)

compared student achievement when teachers used decision rules with achievement when teachers relied on their clinical judgment. Teachers assigned to the first group employed the following decision rule: a child's program would be altered if his/her performance fell below a minimum daily expectation for two consecutive days. Results revealed that gains for the data-utilization rule group were three to four times greater than the average gain for the clinical judgment group.

With elementary age students from special education resource programs, Mirkin (1978) also studied the effects of employing a data-utilization rule on pupils' reading performance. In this study, the decision rule appeared to be the most important component of the formative evaluation system; five out of the six treatment differences involved the data-utilization rule. Therefore, evidence indicates that the use of data-utilization rules represents one component of formative evaluation that accounts for improved student gains. Nevertheless, it remains unclear which specific rules are most useful.

The purpose of the present study, then, was to compare the usefulness of different decision rules. Specifically, the effects of two data-utilization rules on a student's spelling achievement were compared. The first decision rule is similar to that proposed by Liberty (1972, 1975). It specifies that a "static" aim (final performance objective) be specified, and a "dynamic" aim be drawn on the graph by connecting the median baseline performance with the static aim (see Figure 1). Then, the rule dictates that a change in the student's program be implemented whenever student performance falls below the dynamic aim for three consecutive days. The use of

this three-day decision rule (White & Haring, 1976) is based on the assumption that it is critical to alter ineffective strategies as early as possible to maximize the growth of special education students (Howell, Kaplan, & O'Connell, 1979).

Insert Figure 1 about here

The competing decision rule investigated in the current study relies on the assumption that, in addition to maximizing rate of goal attainment, it is never appropriate to assume that a child is achieving maximally. Therefore, regardless of whether student performance is commensurate with the expected level of achievement, the special educator must make program adjustments regularly to determine whether even greater progress is possible. This decision rule stems from an applied behavior analysis (ABA) framework, where the teacher is viewed as experimenter. Each intervention period is evaluated relative to the effectiveness of previous ones. Effective changes are maintained or enhanced and ineffective procedures are dropped. In this condition, the decision rule was (a) to introduce a program change and evaluate its effects every five to ten days, (b) to make a program change as soon after day four as the current program appeared unsuccessful, and (c) if the program ran a full ten days, make an adjustment even if the current program appeared relatively successful.

Method

Subject and Setting

The student who served as a subject in this study was an 11 year old male fifth-grader who had been diagnosed as learning disabled. He attended a program for children with special learning and behavior problems (SLBP) that served approximately two percent of children in grades one through six in an upper middle-class midwestern school. The students in this SLBP program left their regular classrooms, went to a resource room, and spent from 30 minutes to 2 hours daily in small instructional groups. Typically, the average fifth grader in this school scored two years above grade level on nationally standardized tests. Fifth grade students enrolled in the school's SLBP program scored six months to one year below grade level on nationally standardized tests.

The subject was selected because of his difficulty in learning spelling words. He was diagnosed as having above average learning potential with poor achievement in all basic skill areas. The subject left his regular classroom and spent one hour per day in the school's SLBP resource room grouped with a fourth grade boy and a fifth grade grade boy. He received assistance in reading, language arts, and math.

Procedure

Design. A concurrent schedule design (Hersen & Barlow, 1976) was used to examine the experimental question of which decision rule would effect greater spelling achievement. In this experimental design, two equivalent behaviors are treated simultaneously with different approaches to determine relative treatment effects.

Materials. Two hundred spelling "demons," or difficult spelling words, from Dr. Spello (Kottmeyer, 1968) and 100 words from Teaching Children with Learning and Behavior Problems (Hammill & Bartel, 1975) were transcribed onto 3" by 5" cards and randomly divided into two word packs labeled Word Pack A and Word Pack B. The two word packs were assumed to be equivalent in difficulty.

Goal setting, measurement task, and graphing. For the purpose of determining an appropriate goal, a fifth grade classroom teacher selected two girls and three boys from her middle spelling group. Children were tested individually. For one minute they wrote dictated words drawn alternately from the two word packs. The median performance of these children was seven correct and four errors per minute; this level of performance was established as the subject's long-term goal.

Throughout the study, the spelling test or measurement task was an analogous one-minute timing of the subject's writing randomly selected words from a word pack. Words correct and errors per minute were scored. One graph was designated Chart A for Word Pack A and one graph was designated Chart Graph B for Word Pack B. A static aim was drawn on each chart. (See Figures 1 and 2.)

Insert Figure 2 about here

Baseline. For seven days, the student was tested on each word pack. The subject's baseline performance, the median score for the seven days, was 2.5 words correct per minute. A dynamic aimline then

was drawn on each chart from 2.5 at the end of baseline to the static aim. (See Figures 1 and 2.)

Treatments. At the beginning of the study, the student received five minutes of daily direct instruction on a random selection of words from each word pack. Under one condition, in Chart A, the decision rule was to make a strategy change if the subject's performance fell below his dynamic aimline three days in a row. Under the second condition, in Chart B, the decision rule was to make a strategy change every five to ten days, after four to nine days if the intervention was ineffective, but no later than after ten days even if the program appeared to be effective.

Throughout the study, the dependent data were the number of correctly spelled words per minute and the number of incorrectly spelled words per minute. The SLBP teacher carried out the various teaching strategies with the subject for about a 10-minute period for each word pack. She then shuffled each 3" by 5" deck of words five times and with a stopwatch dictated words from the deck for 60 seconds, as the subject wrote them on paper. At the end of the measurement period, the teacher counted words correct and incorrect from the deck and recorded the scores on the appropriate graph. On alternate days, card pack A or B was worked on and dictated first.

Results

On Figure 1, the dependent data for condition A were graphed: spelling words correct and errors per minute per day under the decision rule whereby a change was made when performance fell below the dynamic aim on three consecutive days. On Figure 2, dependent

data for condition B were graphed: spelling words correct and errors per minute per day under the decision rule whereby changes were made every five to ten days.

An analysis of these graphs confirms that baseline performance ran for seven days in both conditions and median performance for both condition A and condition B was 2.5 words correct with seven errors per minute. Over the last seven days of the experiment, performance in condition A was a median of five words correct and four errors per minute. Median performance in condition B over the last seven days was seven words correct and three errors per minute. A total of three program changes was made in condition B, whereas one program change was made in the other condition.

Trend lines calculated by the split median method, ranging from the data point on day 8 to the last data point were drawn for conditions A and B and are displayed in Figures 3 and 4. To calculate the average rate of progress per day over each trend line, the absolute value of the difference between the data point along the trend line for day 8 and for day 33 was divided by 25 days. In condition A, the student made no average increase in words correct per minute per day and made an average decrease in errors per minute per day of .06. In condition B, the student made an average increase of .16 words correct per minute per day and made an average decrease in errors per minute per day of .12. The average decrease for errors per minute per day for condition B was two times greater than for that of condition A. Since the trend line was flat for words correct per minute per day for condition A, no discrepancy ratio can be calculated

for the difference in trend lines for words correct per minute per day.

Insert Figures 3 and 4 about here

Discussion

Although the student approximately met his goal in both conditions, he made superior progress in both words correct per minute per day and errors per minute per day in condition B. Close inspection of Figures 1 and 2 reveals that the student's performance sharply fell after baseline in condition B, whereas it sharply rose in condition A. In part, this explains how superior progress was manifested in condition B even though the absolute difference in final performance between the two conditions was negligible. At about day 8, the student expressed the opinion that Word Pack B was more difficult than Word Pack A. However, as performance began to climb in condition B, the student expressed the belief that the two word packs were similar in difficulty. Therefore, it appears that the student's perception of word difficulty was influenced by his performance level and in no way explains the discrepancy between the post-baseline levels of performance on the two charts.

All of the program adjustments except the last one in condition B were instructional changes incorporating first oral then written practice. These types of interventions proved to be effective. This effectiveness is highlighted by the sharp increase reflected in the last three data points for words correct per minute in condition A;

these data points were obtained following the introduction of oral and written practice. The trend had been flat before the introduction of this last change. The student appeared to be putting forth his best effort; so the motivation intervention introduced as the last change in condition B did not produce a dramatic shift in trend.

A positive practice session seemed to produce better results during that day's measurement session in both conditions A and B. The student had a measurement session on each word pack each day, alternating packs on which he was measured first. The level of performance on the first word pack appeared to affect the level of performance on the second word pack. Therefore, there apparently was some transfer in performance between the two word packs.

The teacher using the decision rules indicated that two major points about the decision rules were important to consider. First, the student appeared to perform better when he saw positive results. This indicates the importance of positive feedback. Second, the student had a role in deciding on the nature of his interventions; this seemed to provide an incentive for him. Additionally, the regularity in which changes were made in condition B appeared to be motivating for the student. However, over a prolonged period of time, it may be difficult to generate effective interventions. In that case, one might opt to switch to the decision rule of condition A.

In conclusion, it appears that the decision rule operating in condition B, whereby changes were introduced regularly in an attempt to enhance continuously educational programs, is somewhat more effective in producing greater progress than the decision rule

operating in condition A, whereby changes were introduced only after performance fell below an expected level for 3 consecutive days. However, these results need to be investigated further with other students in other settings, and with other teachers.

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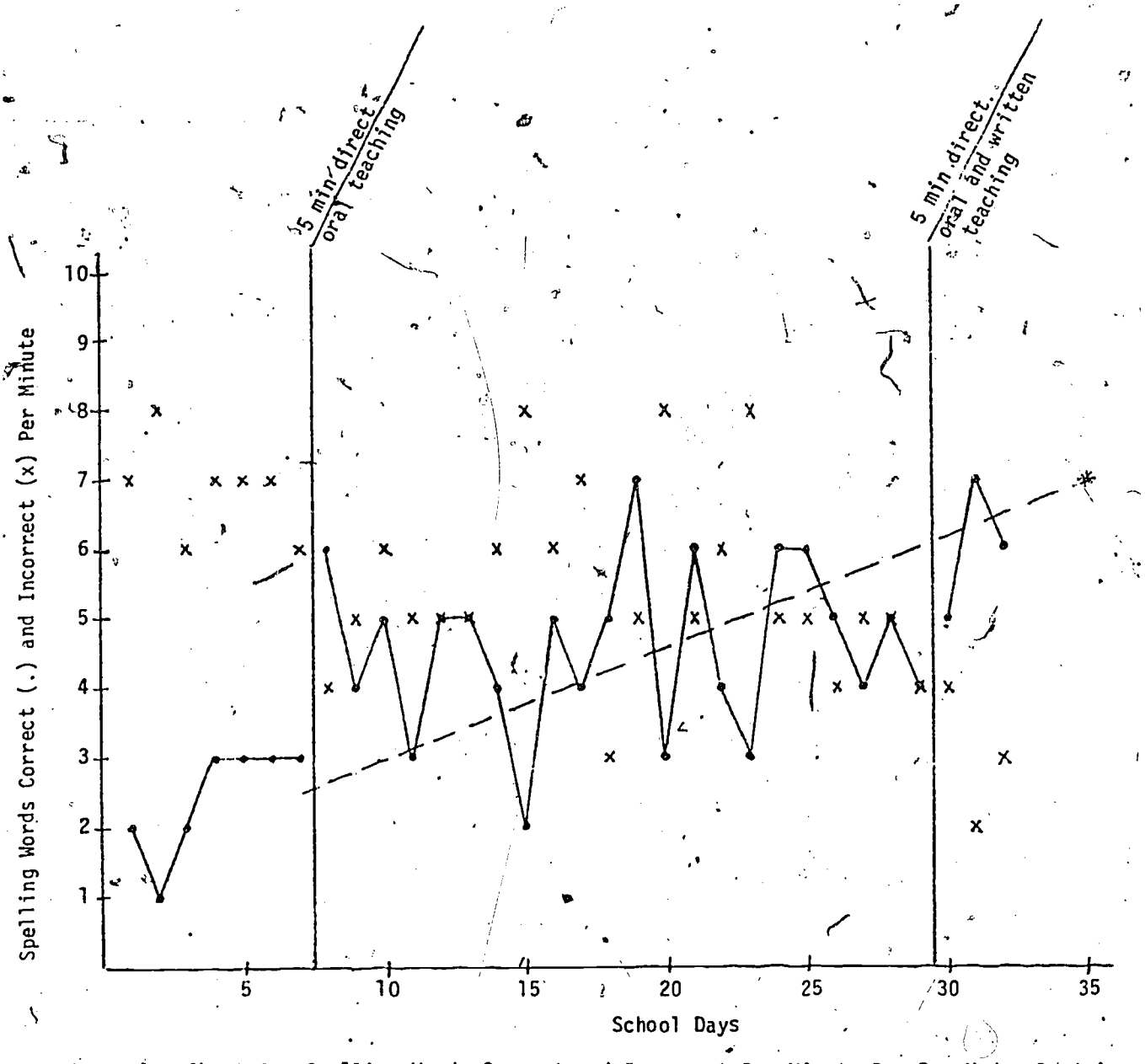

Figure 1. Chart A: Spelling Words Correct and Incorrect Per Minute Per Day Under Decision Rule Whereby a Change was Made When Performance Fell Below the Dynamic Aim for Three Consecutive Days

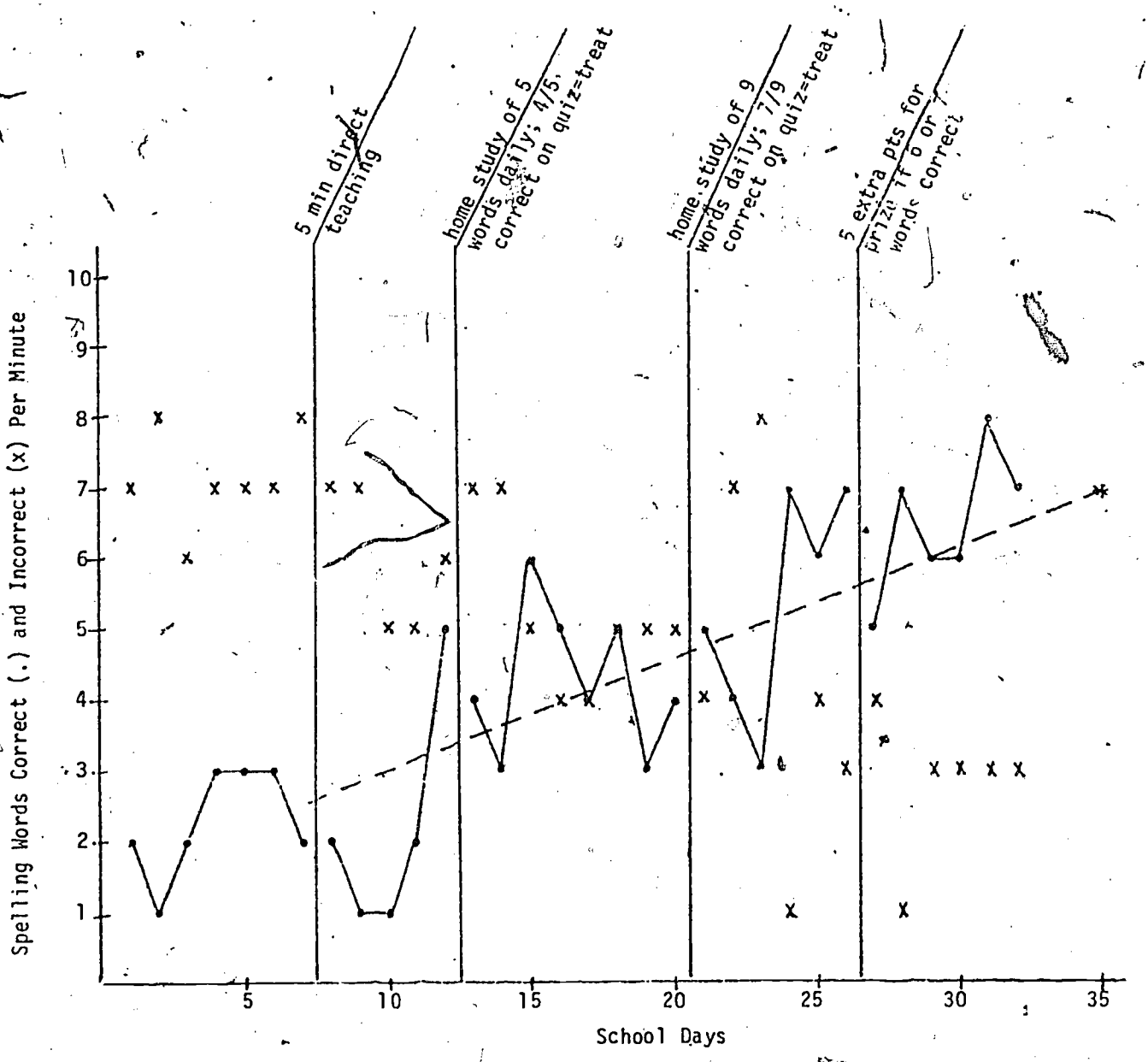

Figure 2. Chart B: Spelling Words Correct and Incorrect Per Minute Per School Day Under Decision Rule Whereby a Change was Made Every 5-10 Days

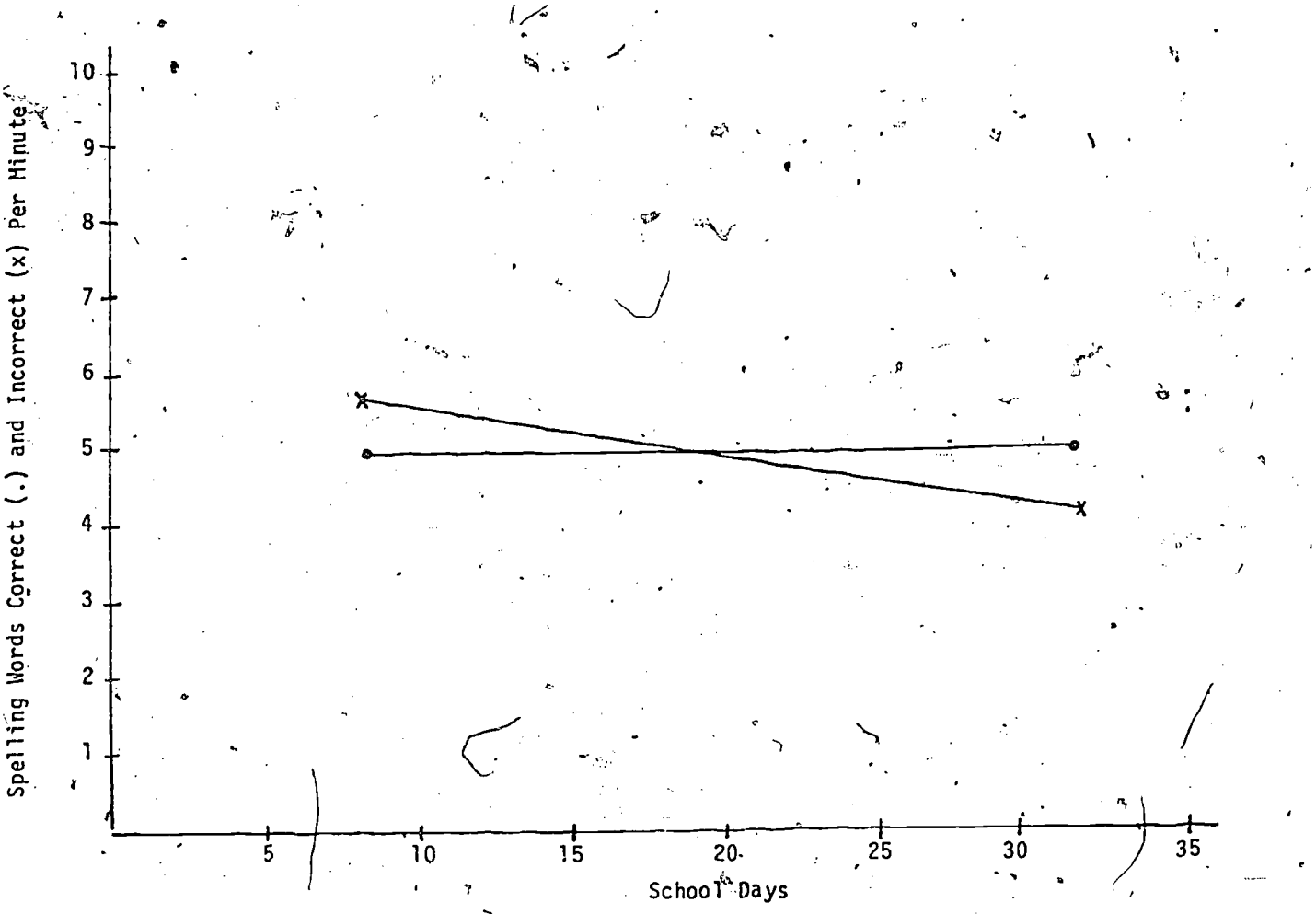

Figure 3. Chart A: Trend Lines Through Spelling Words Correct and Incorrect Per Minute Per Day for Decision Rule Whereby a Change was Made When Performance Fell Below the Dynamic Aim on Three Consecutive Days

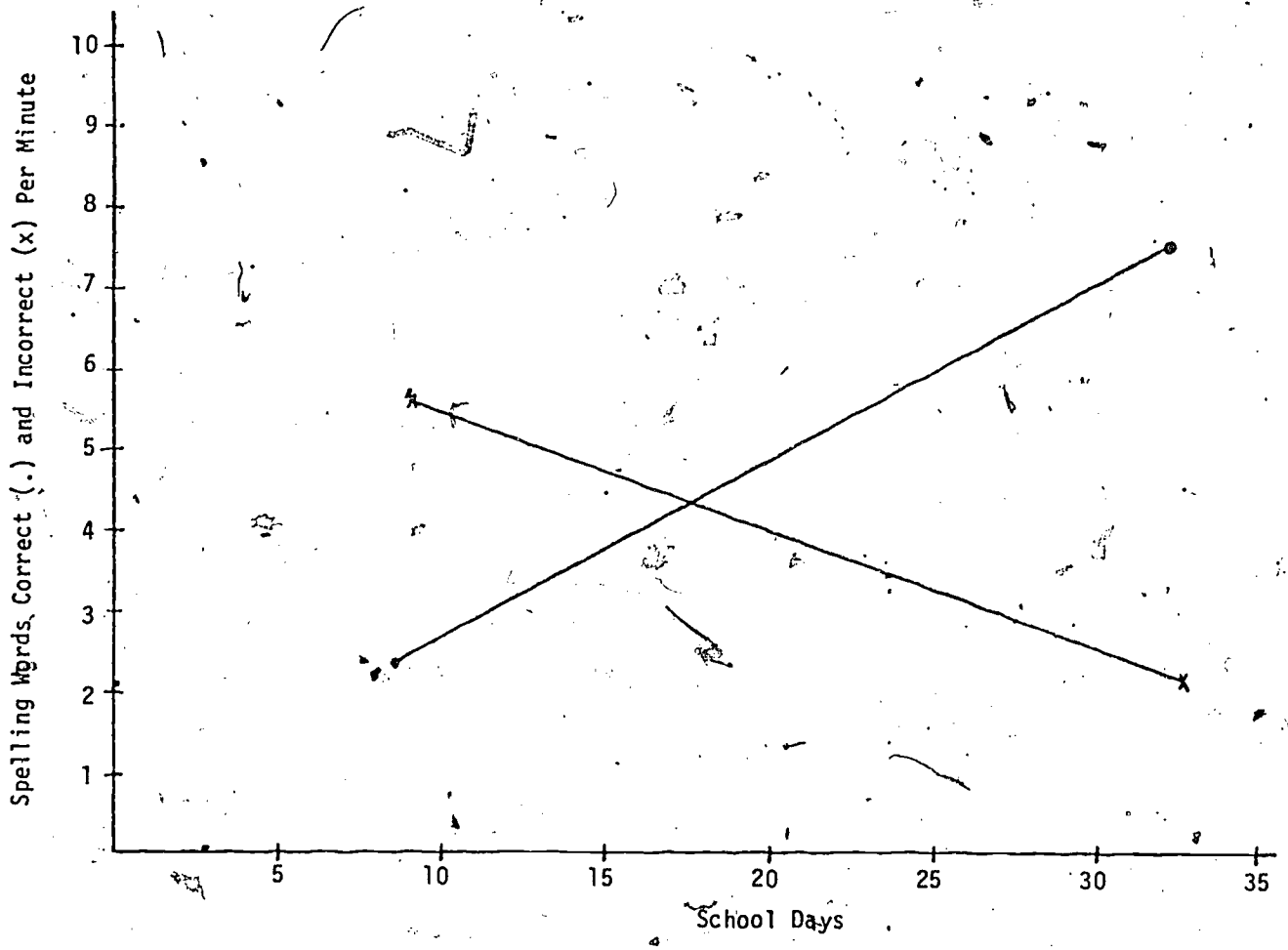

Figure 4. Chart B: Trend Lines Through Spelling Words Correct and Incorrect Per Minute Per Day Under Decision Rule Whereby a Change was Made Every 5-10 Days

PUBLICATIONS

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