Precision Techniques in the Management of Teacher and Child Behaviors

Abstract: A practical method of evaluating teaching skills through precision teaching techniques is presented. Specific topics include: (a) measuring teacher contacts with various pupils; (b) measuring the effects of teacher behavior on pupil performance; and (c) establishing proficiency levels in writing and arithmetic.

Parents-teacher conferences and report cards require teachers to evaluate pupil progress. Unfortunately, these appraisals are often inadequate because the observation periods are too short, the tests imprecise, and the goals undefined (Zimmerman, 1969). Lack of time, heavy class loads, and inadequate materials too often result in the acceptance of less than precise measuring techniques and evaluation.

Important as the measurement of pupil performance, is the evaluation and measurement of teacher performance. Yet, systematic evaluations of teacher performance as it influences pupil performance are rarely carried out. Precision teaching, a system of continuous and direct recording of a pinpointed movement (Lindslcy, 1969), is a technique whereby teachers can efficiently and economically evaluate both pupil performance and their own instructional endeavors. Precision teaching involves five basic steps:

1. Pinpointing a pupil behavior.
2. Recording this behavior daily, computing the rate (number of responses over elapsed time), and charting it on a 6 cycle behavior chart.
3. Recording teacher behavior in relation to pupil behavior.
4. Analyzing data to decide what change in teacher performance might affect pupil performance, if a pupil performance rate needs to be changed.
5. Making only one change in teacher performance at a time and then re-evaluating.

Method

Children and Setting

Six or seven children were referred to the Engineered Learning Project (ELP) experimental classroom every 8 weeks. The ELP, a unique teaching situation (Walker, Mattson, & Buckley, 1969), is sponsored by the Department of Special Education, University of Oregon. The students, of average or above average intelligence, were behavior problems in their respective classrooms. Twenty-five children (24 boys and 1 girl) in grades 3 through 7 received instruction during the 1968-69 school year. All the children were below grade level in one or more subjects, as indicated by the Gates Mckillop Reading Test, Stanford Diagnostic Arithmetic Test, and daily performance rates.
The goal of the project was to alter teacher defined deviant behaviors of the students. Within this primary focus, the instructional goals were to pinpoint each child's deficit areas and to teach the needed skills as effectively as possible while searching for materials and motivators which could be used in the regular classroom.

**Charting**

Performance rates were charted on equal proportion 6 cycle chart paper with units ranging from .001 to 1000 over 6 logarithmic cycles. (See Figures 1-6.) This standardized chart is specifically designed for recording broad ranges of behavior, a great advantage when two very different behaviors are being charted. A teacher concerned with a behavior, e.g., temper tantrums, which might occur only once a day and a teacher concerned with oral reading rates which could occur at a rate of 200 words per minute could use the same type of chart paper to record either behavior.

**Data Collection**

Direct observation of academic behavior was made by the teacher, the teacher aide, and the students. Students recorded their start and stop times, while either the teacher or the teacher aide recorded and charted the rate on the 6 cycle chart paper.

Since the children attended the ELP classroom for only 8 weeks, immediate daily feedback was needed if the teacher's classroom planning was to be effective. The following teacher questions were typical: "Should Robert advance to 3-place multiplication, or does he need additional instruction and practice on basic facts and 2-place multiplication problems?" "Will Mark read better if I say 'good' for every three sentences he reads correctly?" "Am I giving equal instruction, time, and effort to each child?" By direct recording and charting, the teacher had a firm basis for the decisions she would have to make in program planning.

**Teacher-Pupil Interaction**

It is generally assumed that help and encouragement will accelerate pupil performance. However, without data pupil teachers have no way of knowing how often interaction occurs between pupil and teacher or whether the contact is pupil- or teacher-initiated. To obtain such data, a sheet of paper taped to each child's desk was used to record the times a teacher or teacher aide went over and spoke to the child. The sheet also indicated whether the contact was student- or teacher-initiated and noted in which subject area it occurred.

Figure 1 shows the teacher-pupil interaction data for one group. The vertical lines indicate the range of teacher interactions with the seven pupils, while the short horizontal lines show the daily median or middle rate. These pupil-teacher interactions were recorded daily for 166 minutes. The record floor at .006 on the chart was determined by dividing 1 by the time of the observation \((1 \div 166 = .006)\). The record floor indicates the time of the observation period and indicates the lowest rate (other than zero) at which a behavior could occur.

As illustrated on the figure, the first day's range extended from .1 to .3 with a median at .2. Multiplying these rates by the observation time determines frequency of interaction. On the first day the range of interaction was from about 17 to 50 with a median of 33. These data indicated that over a 22-day period the range of interactions remained about the same but the median rate of interacting had decelerated.

When the individual data were analyzed, it was revealed that on some days one child was asking for and receiving teacher attention at a rate 8 times higher than the other six students. When the pattern persisted on the fourth day, it was decided to cut down on teacher-initiated contacts, and this decision was successfully implemented.

The data also revealed that one child rarely received any teacher attention. What little interaction was made was initiated by the student. Although it was
decided to pay more attention to the pupil and a conscious effort to give him equal time was made, the chart showed that the previous pattern recurred. When the teacher-pupil interaction records of various groups of children were compared, it was obvious that variation was great between groups and among individuals within groups.

**Effect of Teacher Behaviors on Pupil Performance**

Filling out an IS Description is the first step of a teaching plan. The IS Description is a list of the environmental components which could have an influence upon the behavior, the specific effects of which have not been determined. With a lesson plan based on an IS Description (Lindsley, 1969), teacher behaviors, like instruction or verbal praise, are specified and can, therefore, be independently measured. The IS Description has two sides, one describing acceleration and the other, deceleration. The following is an explanation of a child's reading session planned on the IS Description:

1. Program: The activity was scheduled between 9:30 and 10:00 a.m. The child's oral reading rate was sampled for 2 minutes.

2. Programed events: The classroom events used to elicit Mark's reading responses were the book *Smashup* and verbal instructions such as “Remember to look at the ends of the words” and “Try not to repeat so many passages today.”

3. Movement cycle: Oral words read correctly was the behavior to be counted.

4. Arrangement: The ratio between the movement cycle and the arranged event was 3 to 1, the first number referring to the movement cycle, the second to the arranged event.

5. Arranged event: After Mark read three sentences correctly, the teacher said “Good!”

The program and programed events for the deceleration portion of Mark's IS Description were identical to the acceleration side. Incorrect words were counted, rated, and charted as the movement to decelerate but no arranged event, hence, no arrangement, was contingent on that behavior.

Consistency in following a lesson plan is important, but often difficult to maintain. Therefore, the teacher's responses, which formed the programed and arranged events for the child, were monitored. For example, if the teacher said “good” after three correct sentences, her response was counted as correct. If the teacher failed to say “good” or said “good” regardless of the number or the quality of the sentences that the pupil read, her response was incorrect and so tallied. Teacher errors declined from 3.0 per minute the first 5 days to zero the last 5 days during the charting.

Since teacher errors were reduced, the project was considered successful. However, the function of the change on pupil progress could be determined only by consulting the student's chart. These latter data indicated that as the teacher adhered more closely to her teaching plans, the pupil's correct reading rate accelerated.

In a similar project, “teacher helps” and a pupil's oral reading rate were simultaneously measured. Teacher helps consisted of teacher statements such as “Think hard,”
“What’s the beginning sound?” or pointing to a particular word or to part of a word. These data revealed that for a period of about 5 weeks the median rate of teacher helps in a 30-minute period was one per minute. During this same time, the boy’s median correct oral reading rate was about 15 per minute. During the final phase of the project, when the teacher attempted to reduce the helping rate, her median rate was zero and the pupil’s 45. Apparently, teacher helps were hindering the boy’s performance.

An analysis of the teacher’s actions indicated that some helps like “come on!” were program events (preceding or not contingent on pupil behavior) whereas others such as pointing to a mispronounced word were arranged events (followed by or contingent on pupil performance). On the teacher’s IS Description or plan sheet she had not included coaxing as a programmed event or pointing as an arranged event. She had written out a plan, but had not followed it consistently. This information would not have been available without measurement of teacher behavior.

Setting Proficiency Levels in Math

Teachers have many questions which are not answered by curriculum guides or teacher manuals: “Should the student be able to do basic facts (add, subtract, multiply, and divide) at 10, 50, or 60 answers per minute before advancing to more difficult problems?” “Will acquisition of new material vary when different proficiency levels are used?” “How can classroom data indicate when a child is most likely to succeed at a new task?”

In an attempt to find answers to such questions, performance rates of two children in the ELP classes were examined. To obtain these data the pupils were provided with a ditto sheet of 60 problems involving one or two movements. A sum requiring one written numeral, \(2 \times 3 = \), was counted as one movement, while a solution requiring two written numerals, such as \(6 \times 9 = \), was considered two movements. Five different dittos containing a mixed arrangement of the same 60 basic facts were used daily. To avoid pos-

tional memorization, no child received the same ditto two days in succession.

Both students, Robert and Sam, began on multiplication facts where the multiplier and multiplicand were from 0-5. According to Robert’s chart (Figure 2) his correct and error rates throughout the first 17 days generally accelerated. His median correct rate was 7 and his median error rate was .2 answers per minute.

In the second phase of the study more difficult problems were programmed. The multiplication program throughout this phase included problems whose multipliers and multiplicands were from 6 to 9. The data throughout this phase also revealed that correct and error rates were generally accelerated. It may be additionally observed, however, that an immediate correct rate drop and error rate increase were noted when the more difficult materials were scheduled. These performance changes continued to be noted as Robert was advanced to successively more difficult materials. Probably, Robert’s initial correct
rate of 7 and error rate of .2 were not proficient, since he experienced more and more difficulty as he was advanced to more difficult material.

Sam's performance on multiplication facts is illustrated by Figure 3. As noted throughout the first phase of 10 days when the 0-5 type problems were scheduled, his median correct rate was 20 and his median error rate, zero. When the more difficult problems were scheduled throughout the second phase, his correct median rate rose to 30 per minute, while his error rate remained generally at zero.

When still more difficult multiplication problems were subsequently scheduled, Sam's performance continued to improve. Unlike Robert, Sam probably reached a proficiency level on the first set of multiplication facts, since his rates on successive problems were always satisfactory.

One way to set a proficiency level in math is to have children write numbers for one minute. If the numbers are correctly formed and the child has worked efficiently, the number writing rate indicates the highest possible response rate (Haughton, 1969). Basic facts rates may be set just below the written number rate since the goal is complete mastery; however, solving complex problems may produce a slightly lower performance rate.

Multiple digit problems require more movement cycles per problem than one or two digit basic facts problems. The problem 608 x 2, for example, has 5 movements when all written numbers and the process of carrying to the tens place are counted. All movements must be counted to give equal credit for performance on more difficult problems. When all movements are tallied, a fairly consistent digit per minute rate is maintained whether complex problems or basic facts are involved.

Setting Proficiency Levels in Writing

This project attempted to set reasonable proficiency levels for cursive writing, and to assess the effects of student self-charting on individual writing rates. According to studies by Kunzelmann (1969), some pupil performance rates are about half that of adults. With this information in mind, the teacher calculated her own writing rate for several days. She observed that her rates were about 100 letters per minute, and she therefore established a writing rate of 50 letters per minute as a proficiency level for her pupils.

To obtain the pupils' writing rates, a mimeographed sheet containing paragraphs of cursive writing, penmanship paper, and pencil were distributed each day. At the signal, everyone, including the teacher, wrote as quickly and as neatly as possible for one minute. Then everyone corrected his own paper by circling any incorrectly formed letters. A brief discussion concerning the formation of letters occasionally preceded this correction period.

Although not all the children had reached the assumed proficiency level, every child, on the twelfth day of the project, was given his correct and error charts and told how to chart his own rate.

In the first phase, before self charting was introduced, the middle group rate was 28 correct letters per minute and was accelerating. After student charting began, the middle rate was slightly higher. The data
suggest that charting may have hindered the rate of cursive writing, since, as a group, performances during the second phase were decelerating (see Figure 4).

A further analysis of the relationship between proficiency level and charting was possible when the rates of individual students were examined. Mark's middle rate for the first 11 days was 53, slightly above the assumed proficiency level. After he began to chart, his middle rate continued to rise to 60 words per minute. Mark's self-charting could therefore be interpreted as an aid to his writing rate (see Figure 5).

On the other hand, Robert's chart showed a middle rate of 17 for the first 10 days, considerably below proficiency level, but accelerating. When self-charting was initiated, Robert's rates decelerated sharply, indicating that self-charting may have hindered a continued acceleration of his writing rate (see Figure 6).

These writing data, like those in math, seem to indicate that when a child has reached a proficiency level, new tasks and program events are less likely to cause a rate decrease, and some new program events, such as self-charting, may actually increase the rate. When the behavior is in the acquisition stage, new program events may slow down acceleration.

Conclusions

A thorough study of performance data can improve teaching skills. This study suggested the following conclusions: (a) Teacher behavior differs with different
children. Direct recording immediately clarifies these trends, allowing teachers to give parents and administrators interaction data objectively and accurately, and measures the effectiveness of attempted alterations of teacher or pupil behavior. (b) What a teacher plans and what she does often differ. When planning is based on an IS Description and the teacher’s performance is recorded, possible strengths or weaknesses in the plan and the implementation show up. (c) The attainment of a proficiency level before altering events seems necessary for optimum growth. A child should not struggle with new tasks until he is proficient in basic ones.

References

Haughton, E. University of Oregon. Personal communication, 1969.


Single copies of Exceptional Children may be purchased from:

The Council for Exceptional Children

Publications Sales
1411 S. Jefferson Davis Highway
Jefferson Plaza Suite 900
Arlington, Virginia 22202

Price $1.50 per copy includes postage and handling if check or money order accompanies order.