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EDITORIAL POLICY

The *Journal of Precision Teaching* is a multi-disciplinary journal dedicated to a science of human behavior which includes direct, continuous and standard measurement. This measurement is composed of standard units of behavior—frequencies—which are collected and recorded on a standard scale—the Standard Behavior (Celeration) Chart. Collections of frequencies are summarized on this Chart using a standard measure of behavior change—celeration. Frequencies and celerations displayed on the Standard Behavior (Celeration) Chart form the basis for Chart-based decision-making and for evaluating the effects of independent variables.

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Materials submitted for publication should meet the following criteria: (1) be written in plain English, (2) contain a narrative that is brief, to the point and easy to read, (3) use the *Journal of Precision Teaching Standard Glossary and Charting Conventions*, (4) contain data displayed on the Standard Behavior Chart that justify conclusions made, (5) be submitted in quadruplicate to the editor, and (6) include one set of original charts or hand-drawn copies. Each formal manuscript will be reviewed by one consulting editor and two reviewers, two of whom must approve it prior to publication.

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A PRECISION TEACHING PROJECT WITH LEARNING DISABLED CHILDREN

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University of Washington

Kathryn Fantasia
Renton School District

Abstract

This set of investigations sought to evaluate the effects of Precision Teaching (PT) instruction on the academic performance of elementary age learning disabled children. In these studies, data were kept in reading, math, and spelling. They were analyzed in terms of percent difference, from first to last assessment, and slope accuracy (accuracy improvement multiplier), throughout the treatment. In Study 1, the data from 182 LD youngsters in resource and self-contained situations indicated that their performances in the three subjects improved significantly. In Study 2, the performances of 13 LD children in a PT class were compared with those of 13 youngsters in a non-PT situation. The scores from the former children were higher for most measures and significantly so in reading. In Study 3, the performances of 14 LD children in a PT classroom were compared with those of 13 nonhandicapped youngsters in non-PT classrooms. Generally, the performance gains of the handicapped youngsters were more than those of the nonhandicapped, and significantly so in reading.

Precision Teaching (PT) techniques have been used since 1965 in classrooms in efforts to increase academic performances of children. This method, originally developed by O. R. Lindsley at the University of Kansas, is made up of five components (Lovitt, 1982). Following is a brief description of each:

Pinpoint. First, the teacher must carefully define the behaviors selected for instruction. Some examples are: to read orally a specific first-grade text, to write certain second-grade words, to write answers to selected third-grade math problems.

Count. Once the teacher has defined the behaviors, he must count the number of times they occur. For reading orally, he might require the child to read aloud for one minute from a text while he counts the number of correctly and incorrectly pronounced words.

Chart. Pupils' performances are charted on the Standard Celeration Chart. These data are charted both as number correct and incorrect per minute (frequencies).

Aim. Once the teacher has defined carefully the objectives, she should establish aims. She must know the extent to which a behavior should change. Although these aims can be derived in several ways, the performances of handicapped youngsters are often used.

Evaluate. Teachers are encouraged to study frequently the patterns of charted data and from them, make instructional decisions. Obviously, the more frequently the behaviors are charted, the more accurate the teachers' decisions can be.

Only a few studies have compared the effects of PT instruction with other approaches on students' performances. Of those, none were published in journals. One was a doctoral dissertation by Bohannon at the University of Washington (1975). The 48 pupils in his research were in the primary grades and classified as mildly handicapped. Half of them were assigned to experimental conditions and half to contrast groups. All of the youngsters received instruction in resource rooms. The teachers in the experimental settings used PT techniques; that is, they charted performances daily, considered the aims, and made decisions from the data. Instructors in the contrast situations did not use these procedures. They did, however, schedule as much time for instructing reading as did the teachers in the other group. The data from Bohannon's six-week study indicated that the performances of the children in PT settings were significantly better on five of seven reading measures than those of the youngsters in the contrast situations.

The second study of this type was Merkin's dissertation at the University of Minnesota (1978). There were 52 elementary age, mildly handicapped students in her research. These youngsters, all of whom were in resource rooms, were assigned to one of four groups: three experimental and one control. The teachers in the former groups used PT techniques to varying degrees, whereas the instructors in the control situation did not. The results of her four-week study indicated that the reading performances of the pupils in the experimental groups were generally better than those of the youngsters in the control group, and furthermore, the performances of the children in classes where decisions were made from the charts were
significantly higher than the others.

The third investigation to compare PT instruction with another approach was directed by Beck in Great Falls, Montana (1979). The pupils in his research were nonhandicapped first, second, and third graders. He assigned 294 of them to experimental classrooms and 312 to contrast situations. Teachers in the former settings used the standard PT practices; the others did not. Before and after a one-year program, standardized achievement tests and PT probes were administered to all the children. These data showed that reading performances were superior on both measures for the first and second graders in the experimental group. As for math, the scores of the second and third grade children in the experimental group were higher in both measures than those of the other youngsters.

The purpose of this research was to replicate and expand on those investigations in order to determine further the effects of PT instruction. Like the three studies just cited, the students in this project were of elementary age. Like two of the three, the youngsters were mildly handicapped, more specifically learning disabled. Furthermore, some of the students in this research were educated in resource rooms. Also, similar to the three referenced studies, this research dealt with reading (measures in math and spelling were also obtained). Finally, this study resembled the others in that contrast groups were organized in an effort to compare the effects of PT with other practices.

There was, however, one major difference between this research and the three previously discussed. Whereas only a measure of before and after treatment effects was gathered in those studies, we calculated two measures. In addition to acquiring a difference score from beginning to end of the study, we obtained a trend or regression score. We were able to calculate this measure of change because we gathered data during the treatment.

Method

Four parts comprise this section. The first is a description of the students and the settings. The second is an outline of the instructional procedures; the third is an explanation of the measurement procedures. The fourth section is a presentation of the research plan.

Students and Settings

The experimental students, those who received PT instruction, were from two sectors: the Experimental Education Unit (EEU), a facility at the University of Washington, and four public school districts. These students were from two classrooms at the EEU and from eight classrooms in the public schools. All of them were involved in Study 1 and a few served as experimental pupils in the other two studies.

In Study 2, 13 LD youngsters from a Seattle school were selected as contrast pupils. They were between the ages of 9 and 12, and were educated in a self-contained classroom. Furthermore, the racial and sex distributions were the same for those students as for those with whom they were matched. For Study 3, a collection of 13 nonhandicapped youngsters from an Olympia school were chosen as contrast youngsters. They were between the ages of 7 and 9, and from grades one, two, and three. These youngsters were paired as closely as possible on a number of traits with their counterparts in the PT program.

Instructional Procedures

The experimental pupils received PT instruction. Teachers employed the five instructional components outlined earlier. Youngsters in the two comparison settings did not receive PT instruction. Although their teachers devoted about as much time to reading, math, and spelling instruction as the PT teachers did, they did not pinpoint precisely the academic behaviors of their pupils, collect daily frequencies, or chart those frequencies. They also did not set performance aims or make instructional decisions from the charts.

Measurement Procedures

To obtain data from the pupils in this research, we used the Student Progress Inventory (SPI) (Note 1). Following is a brief description of the development of that instrument and how it is administered.

Development. Included in the SPI are curriculum referenced materials in reading, spelling, and math. There are seven levels of words or problems in the three areas, from kindergarten (K) to grade six.

The reading passages for grades one through six were from the Holt basal reading series. The material for the K level was a list of phonically regular CVC words. The spelling words for grades one through six were from five commercially available spelling programs. The K material was a list of phonically regular CVC words. The math problems for grades one through six were identified by several grade teachers as those that should be taught at the various levels. The K material was a sheet on which clusters of dots from one to nine were printed.
In developing and administering the SPI, the investigators attended to aspects of validity and reliability. In addition to the content validity of the inventory, that it was based on curricula used in the schools, data indicated that items and levels were of graduated, hierarchical difficulty, and that gains on the SPI correlated at .77 with the rank-ordered gains of pupils in classes as reported by their teachers. Internal consistency of the spelling and math sections of the test, as measured by alternate-item correlations, ranged from .74 to .96, depending on the grade level.

Reliability checks were conducted each time the SPI was administered. These checks were above 90% in each subject area for all the examiners.

Also related to reliability is that growth throughout the year on the SPI was highly linear. For all the handicapped and nonhandicapped pupils in the studies, individual performance regressions at test level accounted for high percentages of variance in the three subjects.

**Administration.** The first step in using the SPI was for the teachers to familiarize themselves with the three sets of materials at the various levels. Then they identified levels in the three subjects at which they expected each pupil to perform by the end of the school year. A teacher might project, for example, that a boy would achieve at third-grade level in reading, second-grade level in spelling, and fourth-grade level in math by the end of the year.

The children were then assessed at those levels four times throughout the year: October, December, March, and June. There were a few exceptions to this when children performed either too well or too poorly—according to criteria which had been developed—in any subject during the first assessment. In those instances, they were reassessed at a level one year higher or lower than the first testing. Thereafter, they were tested at the adjusted levels; no further changes were made.

During these assessments the pupils read a passage orally for the reading evaluation, and wrote answers and words for the math and spelling evaluations. Following warm-up periods in each subject, the pupils took the actual tests. In reading they read the same passage orally twice for one minute. They then took two one-minute timings in math. In spelling, they were first asked to write six words. Then a list of 30 words was dictated. In the spelling evaluations, the time necessary to complete all the words was recorded. Data were kept for second timings only.

Following these assessments the administrator counted the number of correct and incorrect responses for each pupil. Response units in reading were words and in math, digits. Response units in spelling were sequences of letters (Note 2). The examiner next determined the correct and incorrect frequencies for the pupils. To calculate the frequencies in reading and math he simply used the counts themselves, since those evaluations lasted only one minute. To determine the frequencies in spelling, however, the examiner divided the number of responses by the time of the sessions.

Following the four assessments, the data were analyzed in two ways. First, we computed percent difference scores between the first and fourth assessments for the correct and incorrect frequencies. If, for example, a child's correct and incorrect frequencies in reading were 35 and 7 on the first assessment and 65 and 3 on the fourth, her percent correct scores were 83.3% and 95.5%, respectively. Her percent difference score was 12.2%. The second way in which we analyzed the data was to calculate slopes (celerations) which referred to the manner in which the changes occurred over time. To do so, data from all four assessments were considered. If a boy's correct frequency in math was 10 on the first assessment, then 12, 15, and 18 on the next three, his slope (celeration) for corrects was 1.12. He improved, generally, at a rate of 20% from one assessment to the next. A similar score was calculated for incorrects. These two slopes (celerations) were then combined to derive a slope accuracy score, which is also called an accuracy improvement multiplier (Note 3). The percent difference and slope accuracy score in reading for one child are shown in Chart 1.

**Research Plan**

Three studies comprised this project. In the first, data are reported from all the LD students in the five situations in which PT techniques were used. The second was a comparison of a group of these LD pupils with LD children in non-PT classrooms. The third study was a comparison of a group of LD children from one PT classroom with a number of nonhandicapped children in non-PT classrooms.

**Results**

In this section, data from the three studies are presented. For each study, data are shown for three subjects—reading, math, and spelling—and are presented in two forms—percent difference and slope accuracy (accuracy improvement multiplier).
Chart 1. The Percent Difference and Slope Accuracy Score (Accuracy Improvement Multiplier) in Reading for One Child

- Correct celeration: \(x_{1.53}\)
- Incorrect celeration: \(1/2.01\)

Percent correct—fourth assessment: 99.0%
Percent correct—first assessment: 83.3%

Percent difference score: +16.7%
The reading, math, and spelling data for the 182 LD children in PT classrooms was analyzed for changes across assessments. The percent correct scores from the last assessment were significantly higher than those from the first assessment in all three subjects (p < .001, using a t test for dependent measures). Table 1 shows the mean percent difference and slope accuracy scores. The most and least changes were in reading and math. The greatest and least slope accuracy scores were also in reading and in math.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Mean Percent Difference</th>
<th>Mean Slope Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>42.4</td>
<td>1.66</td>
</tr>
<tr>
<td>Math</td>
<td>8.0</td>
<td>1.20</td>
</tr>
<tr>
<td>Spelling</td>
<td>18.3</td>
<td>1.37</td>
</tr>
</tbody>
</table>

Table 1
Summary Data for Study 1: LD Youngsters in All Five Locations

Table 2 offers data from 13 LD youngsters in a PT class and 13 LD children in a non-PT situation. These youngsters were from Seattle classrooms. The percent difference and slope accuracy scores were compared across groups. The PT classroom was superior to the non-PT class for both measures in all three subjects. The percent difference scores in reading for the PT children were significantly higher than those for the non-PT youngsters. The greatest difference in slope accuracy scores between the groups was also in reading.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Mean Percent Difference</th>
<th>Mean Slope Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>8.57*</td>
<td>1.48</td>
</tr>
<tr>
<td>Math</td>
<td>.92</td>
<td>1.07</td>
</tr>
<tr>
<td>Spelling</td>
<td>11.20</td>
<td>1.26</td>
</tr>
</tbody>
</table>

Table 2
Summary Data for Study 2: LD Children in PT Classes vs. LD Children in Non-PT Classes

Table 3 presents data from 14 LD students in a PT class and 13 nonhandicapped youngsters in non-PT situations. These students were from Olympia classrooms. The PT youngsters were superior to the others in four of the six comparisons. They were significantly superior in the percent difference score for reading.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Mean Percent Difference</th>
<th>Mean Slope Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>1.81</td>
<td>1.41</td>
</tr>
<tr>
<td>Math</td>
<td>1.76</td>
<td>1.20</td>
</tr>
<tr>
<td>Spelling</td>
<td>8.19</td>
<td>1.65</td>
</tr>
</tbody>
</table>

*p < .05 (dependent measures t-test)

Discussion

The data from this study, like those from the three cited earlier, indicated that PT, or certain of its features, was related to pupils' achievement in reading, math, and spelling, at least for students between the ages of 6 and 15. Furthermore, the greatest effects of PT were in reading. This was true in all three studies. In Studies 2 and 3 the children in the experimental groups made greater gains in all comparisons except two. The least effect was generally noted in math.

When the data were analyzed to determine if the setting in which the LD children were educated was related to their achievement, it was obvious that this was not a significant item. Although the gains of the youngsters in resource rooms were slightly better in reading and math than those of the students in self-contained situations, the scores of the latter children were generally better in spelling.

As for the gains at the various levels, the greatest and least gains in reading were at the first grade and kindergarten levels. In math, these extremes were noted at fifth grade and kindergarten, and in spelling, at kindergarten and sixth grade. Generally, the gains were fairly even across all levels in the three subjects.

With respect to the experimental classrooms in Studies 2 and 3, a few additional words are in order. In Study 2, a PT classroom of LD children was compared with a non-PT classroom of LD youngsters. The gains of the former students were generally better than those of the latter. These data are even more impressive if one is aware that when this experimental teacher was compared to the other nine experimental teachers in the project, with respect to the academic changes of the pupils, she came in ninth in reading, fourth in math, and sixth in spelling.

As for Study 3, although the pupils in the experimental group often surpassed those of the nonhandicapped students in regular classes, the teacher of the former students, when compared with the other experimental teachers, came in fifth in reading, fifth in math, and sixth in spelling.

What direction should future PT research take? In our opinion, PT advocates still need to answer a very basic question, "Are children really better off when they are taught precisely?" This query could be framed more specifically, "Are elementary and secondary youngsters better off for being in PT classes?", or "Do children develop all kinds of behaviors and skills better when they are assigned to Precision Teachers?"

This study and the three that were cited furnish some credibility for responding to those questions, but many additional investigations should be arranged. However, that's only the beginning. The research of this type must be published not only in the Journal of Precision Teaching, but in other journals as well. As Precision Teachers, we must build our case for respectability step by step. That can be accomplished best if we all have equal opportunity to keep up with the findings and carefully expand upon them.

Another reason we must publish more research that responds to these fundamental questions is to convince others that our method is a good one. (That is, if our data do, in fact, support this!) We need all the muscle we can gather if we are to persuade state and federal agencies to adopt our practices and if we expect to influence school boards, administrators, teachers, parents, and pupils to use our wares. Our findings need to be made public. We've gone about as "fur" as we can go with our "data-based testimony."

The irony of this situation is that Precision Teachers have lots of data to suggest strongly that children are better off when they are taught precisely. Unlike many others in education who make brash claims sans data, we have tons of charts.

Many of these 6-cycle fragments are simply lying about in closets, storerooms, file cabinets, and desk drawers in Seattle, Great Falls, Salt Lake City, Kansas City, and elsewhere. They must be organized, scrutinized, analyzed, and published so they may be considered by the public.

Then, if we and others are convinced that children are indeed better off because of their precise experiences, at least two lines of research would follow. One would investigate PT practices linked with certain educational practices, methods, or techniques. It would be interesting to see the results, in regard to children's progress, when PT was associated with Distor, Corrective Reading, Morphographic Spelling, Montessori, Slingerland, Paebody Language Development Kits, or Frostig. Another important line of research would be to investigate carefully all the many features of PT. Let's face it, many PT practices are based as much on custom as they are on data. We'll list but a few of these practices:

- one-minute timings or other periods
- daily, weekly, or monthly charts
- one set of decision rules vs. another
- using adults, other children, or others to furnish aim frequencies
- one number of days at criterion vs. another
- relationship of frequency to retention and generalization
- scheduling timings before or after instruction
- various formats of practice sheets

Meanwhile, we, of course, should continue publishing our case studies. However, we still need to respond to the big question, "Are children really better off for using all those practice sheets, acetate covers, manila folders, and sponges soaked in vinegar?"

REFERENCE NOTES

1. Student Progress Inventory. A copy of this inventory is available for $3.50. Send a check to CHARTS, 14323 118th Ave. NE, Kirkland, WA 98033.

2. Counting sequences of letters. For more information on this method for scoring, write to CHARTS at the above address for a free copy.
Computer program for analyzing data. The data were all entered and analyzed by the Minitab program, which was developed by Owen R. White at the University of Washington. The procedure for determining the slope accuracy scores will be sent on request.

REFERENCES


Lovitt, T. C. Because of my persistence, I've learned from children. Columbus, Ohio: Charles E. Merrill, 1982.


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USING PRECISION TEACHING TO TEACH PRECISION TEACHING

Marie Eaton and Sheila Fox
Western Washington University

Odd, isn't it, how many of us in preservice or inservice teacher training find ourselves recommending or even mandating, that our students use procedures with their pupils that we do not use? We found this to be true recently when examining the Precision Teaching course at Western Washington University (WWU).

Precision Teaching is part of the core curriculum for special education students at WWU. Since the course is time consuming and demanding, we have alternated responsibility and each teach the course twice a year. We have been teaching chart-based evaluation since 1969 in a variety of preservice and inservice settings (University of Washington, Australia, University of Alberta and WWU). Over time, as with many college courses, the structure of the course has been modified. We began with a lecture orientation which included a self-project component. This practice in charting proved so useful that a field-based practicum was included. Specified objectives to be mastered were refined and finally a fluency requirement was included. All were good changes and improved the course in terms of both student evaluations and our own intuitive feelings.

Somewhere along the line, however, we had neglected the obvious. We were not using the essentials of Precision Teaching with our own students. Although they were asked to work to mastery or even fluency on specified objectives, there were no daily samples and students were not charting their own learning of Precision Teaching skills.

Fortunately, morning follows night, and the light finally dawned. Once we realized that we should be practicing what we were preaching, it did not take long to reorganize the course. We hoped that we might also be able to demonstrate for our students how to conduct daily timings on fairly complex material with 30 to 35 pupils each day and still have time for lecture and discussion.

We had previously divided the course into eight major units: 1) Terminology, 2) Pinpointing, 3) Charting, 4) Preparing Probes, 5) Reading and Drawing Celeration Lines, 6) Learning Hierarchy, 7) Making Decisions From Data, and 8) Principles of Behavior. The next step was to prepare probes and procedures that would allow students to time themselves or each other. For five of the eight units, flashcards (see-say) seemed to be the most efficient format for a probe. Table 1 shows probes and sample flash cards from the eight units.

The first five minutes of each class were spent timing and charting the probes. Students usually chose to reach aims on one unit before beginning the next, but they were able to take a timing on more than one skill if they chose. Students charted their own performance data on each unit and used the same data decision rules they were using with their pupils to determine if their growth was adequate.

The instructors reviewed the student charts twice a quarter (midterm and final) unless a student requested help. Students were responsible for selecting and implementing their own instructional or motivational changes. Aims
Table 1
Probes and Sample Flash Cards from the Eight Units of the Precision Teaching Course at Western Washington University—After the Course was Restructured in 1981

<table>
<thead>
<tr>
<th>UNIT 1 VOCABULARY (SEE-SAY)</th>
<th>AIMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front of Flash Card (See)</td>
<td>Back of Flash Card (Say)</td>
</tr>
<tr>
<td>an ignored day is</td>
<td>a day when data were collected but not charted identifying and describing a movement cycle</td>
</tr>
<tr>
<td>Pinpointing is</td>
<td>12/0 20/0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UNIT 2 PINPOINTING (SEE-SAY)</th>
<th>AIMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front of Flash Card (See)</td>
<td>Back of Flash Card (Say)</td>
</tr>
<tr>
<td>Movement cycle is</td>
<td>the behavior to be counted</td>
</tr>
<tr>
<td>Movement cycles must have</td>
<td>observable movement; repeatable behavior; a beginning and an end</td>
</tr>
<tr>
<td></td>
<td>12/0 20/0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UNIT 3 CHARTING (SEE-MARK)</th>
<th>AIMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students are given data to chart using all conventions.</td>
<td>25/0 35/0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UNIT 4 PROBES (SEE-SAY)</th>
<th>AIMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front of Flash Card (See)</td>
<td>Back of Flash Card (Say)</td>
</tr>
<tr>
<td>A probe is</td>
<td>a sample of a behavior's performance on a standard task under standard conditions.</td>
</tr>
<tr>
<td></td>
<td>12/0 20/0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UNIT 5A READINGCELERATION VALUES (SEE-SAY)</th>
<th>AIMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students are given a chart with celeration lines drawn and asked to read the value.</td>
<td>20/0 30/0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UNIT 5B DRAWINGCELERATION LINES (SEE-MARK)</th>
<th>AIMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students are given 6 to 10 days data and asked to draw &quot;quickie-split&quot; celeration lines.</td>
<td>10/0 20/0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UNIT 6 LEARNING HIERARCHY (SEE-SAY)</th>
<th>AIMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front of Flash Card (See)</td>
<td>Back of Flash Card (Say)</td>
</tr>
<tr>
<td>Fluency building usually begins when</td>
<td>the rate of correct responses passes 20/minute</td>
</tr>
<tr>
<td></td>
<td>12/0 20/0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UNIT 7A DECISIONS—WHEN TO CHANGE (SEE-SAY)</th>
<th>AIMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students are given charted data with 6 day celerations drawn and asked to decide whether to change.</td>
<td>12/0 20/0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UNIT 7B DECISIONS—WHAT TO CHANGE (SEE-SAY)</th>
<th>AIMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students are given charted data and asked to choose which type of intervention is most appropriate.</td>
<td>10/0 14/0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UNIT 8 PRINCIPLES OF REINFORCEMENT (SEE-SAY)</th>
<th>AIMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front of Flash Card (See)</td>
<td>Back of Flash Card (Say)</td>
</tr>
<tr>
<td>Contingencies are often stated in _____ relationships.</td>
<td>when:then</td>
</tr>
<tr>
<td></td>
<td>12/0 20/0</td>
</tr>
</tbody>
</table>

for each probe were set by sampling a few competent precision teachers (N=5) on each probe. The aims are listed in Table 1. A mastery and a fluency aim were selected for each probe. Students were required to reach mastery on all units. Those desiring an A in the course were required to reach fluency as well. We are hoping to follow these students to determine if those who selected and reached fluency aims were more likely to maintain their Precision Teaching skills in the field than students who completed the course prior to the fluency requirement.

We hoped that the change in our procedures would make our topic more believable, and perhaps our lives easier. (How novel to have students test and correct each other) However, we did not feel entirely comfortable with abandoning the traditional class format, so we retained the midterm and final examinations as gross progress indicators, just in case.

The results were unexpected and delightful. Charts 1 and 2 show the beginning and ending frequencies for students in one class. Celerations were not used to evaluate performance, because, in most cases, students gained fluency in the units in just a few days. Lectures became easier, because students were fluent in terminology and basic Precision Teaching skills. Less class time was spent explaining and re-explaining introductory concepts. More time was available for practice in data decisions and application of Precision Teaching in other areas of curriculum.

Another reflection of the rapid acquisition of information by students was the change in the midterm scores. As Table 2 indicates, the midterm scores prior to the change in procedures had averaged 75.5 on a 100 point scale. The range of scores was 33-100. After we began to use PT to teach PT, the average score rose to 89.8 and the range narrowed (64-100). We had fewer students who were still "lost" at midterm.

We are pleased with the reorganization of this course. Considerable refinement still needs to be done. The probes have been altered some since the first drafts. We hope to have the probes printed and available soon to others who care to use them.

Some research topics have evolved as a result of the reorganization of this course. Presently we are looking at the graduates of our PT course and their utilization of PT in the field. Our research question is, "Do the students who graduated before the restructuring of the course use PT more or less frequently than those who learned PT to fluency by using PT?" More aim data for Precision Teaching skills also needs to be collected.

Table 2
Mean Student Scores on Mid-Term Examinations in the Precision Teaching Course at Western Washington University before and after the Course was Restructured in 1981

<table>
<thead>
<tr>
<th>QUARTER</th>
<th>MEAN</th>
<th>RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring 1980</td>
<td>71.8</td>
<td>44.4-97</td>
</tr>
<tr>
<td>Summer 1980</td>
<td>85.3</td>
<td>55-97</td>
</tr>
<tr>
<td>Fall 1980</td>
<td>71.4</td>
<td>33-100</td>
</tr>
<tr>
<td>Mean and total range</td>
<td>75.5</td>
<td>33-100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>QUARTER</th>
<th>MEAN</th>
<th>RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer 1981</td>
<td>93.5</td>
<td>64-100</td>
</tr>
<tr>
<td>Fall 1981</td>
<td>87.4</td>
<td>69.4-96.8</td>
</tr>
<tr>
<td>Winter 1982</td>
<td>88.6</td>
<td>76-100</td>
</tr>
<tr>
<td>Mean and total range</td>
<td>89.8</td>
<td>64-100</td>
</tr>
</tbody>
</table>
Chart 1. Beginning and Ending Frequencies for Students in the Precision Teaching Course (Units 1-5A) at Western Washington University -- after the course was Restructured in 1981.

Chart 2. Beginning and Ending Frequencies for Students in the Precision Teaching Course (Units 5B-8) at Western Washington University—after the Course was Restructured in 1981.
Even with these unanswered questions, we are happy about the results of these changes in the Precision Teaching course. We get less arguments about "how to do this stuff with 30 children"; there are typically 30 in the course. Teachers seldom say "this is fine for math facts, but how would you monitor more complex curriculum"; not one of them had suggested that learning Precision Teaching is simple. The timings are typically a time of excitement, and active learning. Try it, you'll like it.

Marie Eaton and Sheila Fox are special education faculty members at Western Washington University, Bellingham, Washington 98225.

Chart-sharing

TRY AND TRY AGAIN

Betty Dunn
Florida State University

This article discusses a project that was done as a class assignment at Florida State University. The project revealed that Precision Teaching can be a learning experience for both the student and the teacher.

The subject chosen for the project was an illiterate adult male who was being tutored at the F.S.U. Reading Clinic. Survival words such as danger, stop, open, warning, and wet paint were chosen to be taught because the client was having difficulties learning and remembering these words.

The client would see one of 20 survival words printed on a 3X5 index card and then say the word. A one minute timing was taken for 12 sessions and his correct and incorrect rates were charted on a Standard Behavior Chart. The words were taught by drill, modeling, and/or novel games immediately after the timing.

A phase change was introduced after six sessions. The words were reviewed before the one minute timing. Reviewing consisted of showing the word card and asking, "What does this say?" If the client answered correctly, the next card was shown. If the client answered incorrectly, he was asked, "What letter does this word begin with?" and "What sound does that letter make?" He was again asked to say the word. If he answered incorrectly the word was pronounced by the teacher and himself three times. Each word missed during review would be repeated until the client read it correctly.

A second phase change was implemented after nine sessions because the incorrect frequency was still high. This phase change involved reducing the number of words shown to the client. A stack of ten words was repeated for one minute. The client was also encouraged to say the words as fast as he could. Instruction at this time included a game that involved showing each word card for only two seconds. The word card was lifted from underneath the table to the top of the table edge, held there for two seconds, and then moved back underneath the table and out of sight. This phase change helped the client say the words instantly on sight rather than analyzing each letter in the word.

Before doing this project I knew that charting was very valuable but I didn't realize how important and helpful it could be to my teaching. Charting provides a learning picture. Instructional decisions can be based on this picture rather than on opinions. I seriously do not think that I would have made these two phase changes if I had not plotted the data on a Standard Behavior Chart.

I also realize that learning about charting is not the same thing as doing it. The more you chart the better you become at it. Charting makes you a better teacher each time you do it. So, keep on charting and try and try again.

Betty Dunn is a student of Mark Koorland's at Florida State University. Her residence is 440 Summerlin Ave., Sanford, Florida 32771.

PHASE CHANGES LEAD TO SUCCESS

Melony Randolph
Florida State University

I started tutoring Tracey in reading several months ago at the F.S.U. Reading Clinic. His diagnostic data revealed that he had a significant weakness in comprehension. I also observed that he was exceptionally slow in oral and silent reading. I therefore began to remediate Tracey in comprehension skills and reading speed. I decided to remediate by using a precision measurement technique that would
Chart 1. Phase Changes Help an Adult Male Learn to Read Survival Words
measure both of these skills at the same time. Tracey was given sixty seconds to complete as much of a modified cloze paragraph as he could within that period of time. Tracey plotted the number of correct and incorrect words that he wrote in the cloze paragraph on a Standard Behavior Chart. He did not find the chart difficult to understand or read, as I kept his record floor at a constant one minute. The Standard Behavior Chart made it easy for me to evaluate Tracey's progress, therefore, my daily instructional planning was also simplified. The timing became the highlight of our tutoring session. Tracey became very much involved pinpointing his own results and watching his progress. He actually enjoyed the challenge of beating his score from the previous day.

Baseline

For two days, September 20th and 23rd, I collected baseline data. I made up a different modified cloze paragraph on the 5.0 reading level, with four words from which he could choose his answers. I gave this paragraph to Tracey and instructed him to read it silently as he completed filling in the blanks with the correct words. I timed him for sixty seconds without him being aware of my actions. I followed this procedure for two days; the results were 3 correct and 0 incorrect on both days.

Phase Change 1

On September 27th, I gave Tracey another modified cloze paragraph and he was instructed to complete the paragraph as fast as he possibly could. I let him know that I was timing him for sixty seconds. I found it necessary to let Tracey complete the entire paragraph, as I made a mental note of how many he had completed at the sixty second mark. I revealed to him how many he had completed within sixty seconds after he had completed reading and writing. He proceeded to plot on the chart his number of corrects and incorrects. Tracey's results for both September 27th and September 30th were 3 corrects and 1 incorrect. These scores revealed a decrease in learning. He was not scoring at his dynamic aim (the minimum score he could receive without having to make a phase change). So, a phase change was necessary.

Phase Change 2

I decided to increase the probability of Tracey selecting the correct answers. I did this by eliminating 2 of the 4 choices he had previously been given. His probability of choosing the correct answer was now 50%, instead of 25%. I changed only that part of my procedure and kept the rest of the program the same. This technique increased Tracey's number of corrects and decreased his number of incorrects. On all 3 days, October 4th, 7th, and 11th, Tracey answered 4 blanks correctly and 0 incorrectly within sixty seconds. His current frequency improved, but then leveled off. A phase change was needed. Tracey had chosen his reinforcers and seemed to enjoy receiving them at the end of each session that he increased his correct frequency. Therefore, I assumed that the problem was in the programmed event.

Phase Change 3

Tracey had gotten off to a slow start and I was beginning to notice a decrease in his motivation to do the timings. I sensed that this phase change had to make a difference in his learning or all would fail for him and myself. I decided to introduce the skill previewing. Previewing is defined as any method which enables a child to read or listen to a selection prior to instruction and/or testing. I gave Tracey fifteen seconds to look over his paragraph and answers. He was allowed to ask for help with mispronunciations during the previewing period. He was instructed to stop previewing after fifteen seconds and to begin completing the paragraph, as I timed him for sixty seconds. He was also reminded to work as rapidly as possible because he was being timed. Everything in the program remained constant, with the only difference being the introduction of the previewing skill. This technique appeared to make the difference. He reached his static aim on the first day that previewing was implemented. We were both ecstatic. For 3 consecutive tutoring sessions, October 13th, 18th, and 21st, Tracey scored 6 corrects and 0 incorrects. We had finally found a technique to help Tracey increase his frequency of selecting and reading the correct words. He was reading more rapidly because he did not have to stop and dwell on individual words that he could not pronounce. Tracey was off and running to his long awaited reinforcer, PLATC. PLATO is a computer system which consists of different instructional activities.

Maintenance

We only had a few weeks left of our tutoring sessions, so I decided to do a maintenance check once a week for the remaining 3 weeks. Tracey maintained his static aim for the weeks of October 25th, November 1st, and November 8th.

Melony Randolph is a student of Mark Koorland's at Florida State University. Her residence is 1303 Ocala Road, Apt. 223, Tallahassee, Florida 32304.
Baseline: Modified cloze paragraph with four words to choose from

- Made him aware of the timing
- Eliminated two of the four words
- He previewed the words before the timing
- Maintenance

Chart 1. Phase Changes Help Tracey's Reading Comprehension
About PT

NOTES FROM THE EDITOR

Patrick McGreevy

This issue concludes Volume III of JPT. A subscription renewal reminder is enclosed with this issue. Please note that the individual/agency subscription price is now $16.00. The rate for full time students and libraries has also increased. These increases are necessary in order to cover past and present deficits. In order to receive the next issue on time, send in your renewal notice now. Encourage your friends and colleagues to subscribe. Volumes I, II and III are still available.

Please note the Charles Merrill ad. This instrument was developed by Precision Teachers. Mata Kay Morehead tells me that it includes practice sheets (probes) that can be used for timings.

The Journal needs formal manuscripts and Chart-sharing articles. Pencils ready...

Personally, I want to thank all of you for your support and your suggestions. The Journal is the effort of many and it's nice to be one of them. Please continue to offer your suggestions; they can only help improve the Journal.

TERMINOLOGY

Say Reward, Relief, Punishment or Penalty

Ogden R. Lindsley
University of Kansas

Experimental psychologists of the thirties and forties used reinforcement to mean pairing the conditioned stimulus (bell) with the unconditioned stimulus (food powder) in order to strengthen or reinforce the conditioned reflex (salivation to the bell alone). Examples are seen in Hull's theoretical book, 1943, page 71, and Hilgard's textbook on learning, 1948, page 55. The word reinforcement had been taken from 1927 and 1928 translations of Pavlov's work.

Positive or Negative Reinforcement

Skinner in his 1938 classic "The Behavior of Organisms," extended reinforcement from pairing stimuli to cover a second type of conditioning he called type "R" or operant behavior. He also introduced positive and negative reinforcing stimuli in the following quotation:

In the present example of pressing a lever the strength may increase if SI is, for example, food, and it may decrease if it is, for example, a shock. Thus there are two kinds of reinforcing stimuli—positive and negative. The cessation of a positive reinforcement acts as a negative, the cessation of a negative as a positive. (Skinner, 1938, p. 66)

Skinner saw positive and negative reinforcers as two alternative kinds of behavior strengtheners, what a layperson would call reward and relief. Positive reinforcers increased response rates when their presentations were contingent, and negative reinforcers increased response rates when their withdrawals were contingent. Positive meant reinforce by adding or a plus sign, and negative meant reinforce by subtracting or a minus sign. Skinner's meaning came from arithmetic, rather than the popular usage of personal feeling.

Although neither positive nor negative reinforcement were in the index of what we called "the B of O," they both appeared in the index of "Science and Human Behavior" which Skinner published in 1953. By then the use of positive and negative reinforcers to be two different kinds of rewards was clear in Skinner's and in other operant writing. For example, see Keller and Schoenfeld's 1950 college psychology textbook.

All this is very fine except for the fact that negative reinforcement meant the opposite of relief to everyone else....it meant...and still means, punishment! Positive reinforcement meant reward and negative reinforcement meant punishment, not only to the public, but also to behavioral scientists who were beginning to use Skinner's operant terms. Bijou and Baer made this error in their child development text in 1961. This is surprising when you realize that Bijou was on the same psychology faculty with Skinner at Indiana. The problem was not the ignorance or sloppy scholarship of Bijou and Baer; they were certainly trying to learn operant language. The problem was that Skinner chose meanings for his words that were opposite to the most common meanings for those words in the English language. Skinner chose
counter-meanings. Skinner's meanings for positive or negative were arithmetic add or subtract, and the public's meanings were feeling good or bad. So the confusion went on. It still goes on. About the only value to come from Skinner's counter-meanings was that if you wanted to be an academic snit, you could tell a well-trained from a poorly-trained operant conditioner by merely asking, "what is an example of negative reinforcement?" If the poor soul answered, "spanking a child for stealing candy" he or she was poorly trained!

**Reward, Relief, Punishment or Penalty**

What does all this have to do with us? Precision Teachers and Standard Celeration Charters have inherited much free-operant language, but we will create confusion using the words positive and negative reinforcement. We have a greater problem with these terms than the behavioral scientists do, because we deal directly with the public who use the counter-meanings.

The solution is to talk plain English.

Let's look at some school examples. If when we give a child a point for each letter spelled correctly, and the letters spelled correctly accelerate, the points were a reward. If when we give a child one minute off from clean-up duty for each help to other students in the classroom, and the helps accelerate, the minute off was a relief. Both rewards and relief accelerate behavior—people will work to get them.

If when we give a child one additional minute of clean-up duty for each aggression towards classmates, and the aggressions decelerate, then the minute added was a punisher. If when we deduct one point from the score for each letter spelled incorrectly, and the incorrectly spelled letters decelerate, then the point loss was a penalty. Both punishers and penalties decelerate behavior—people will abstain to avoid them.

Things that accelerate behavior when presented contingently are rewards; ones that accelerate behavior when removed are reliefs. Contingent events that decelerate behavior when presented are punishers; and those that decelerate behavior when removed are penalties. Clear and simple. No confusion between scientist and public. No confusion between teacher and parent. A slight problem is that the scientist has lost the dazzling jargon so dear to academics. But that is a small price to pay for clarity.

**REFERENCES**


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Journal of Precision Teaching

Index to Volumes I-II

April, 1980 - January, 1983

BEHAVIOR ANALYSIS


COMPUTERS


CURRICULUM/TEACHING STRATEGIES


Bower, R., & Orgel, R. To err is divine.


1 Chart-sharing articles are indicated with an asterisk.


**HIGHER EDUCATION**


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**LEGAL ISSUES**


**OUTCOME STUDIES**


**PARENT INTERVENTION**


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**PROGRAM EVALUATION**


**REHABILITATION/HABILITATION**


**SCREENING/ASSESSMENT**


**STANDARD CELERATION CHART/BEHAVIOR MEASUREMENT**


*Hicks, D., Johnson, E., & Framer, E. M. Why we should have used the standard behavior chart and celeration: A case study. *Journal of Precision Teaching*, 1981, 1(4), 14-16.


STATISTICAL TESTS


TEACHER TRAINING


Send your ideas and suggestions to our column editors!

If you have ideas or suggestions on terminology, send them to Dr. Ogden Lindsley, Educational Administration, Bailey Hall, Room 9, Kansas University, Lawrence, KS, 66045.
Dedicated to Mrs. Irene McGreevy, a very special person, and to the children, who, by sharing their Charts, taught us what we know.