

A PRECISION TEACHING PROJECT WITH LEARNING DISABLED CHILDREN¹

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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

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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 nonhandicapped 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.

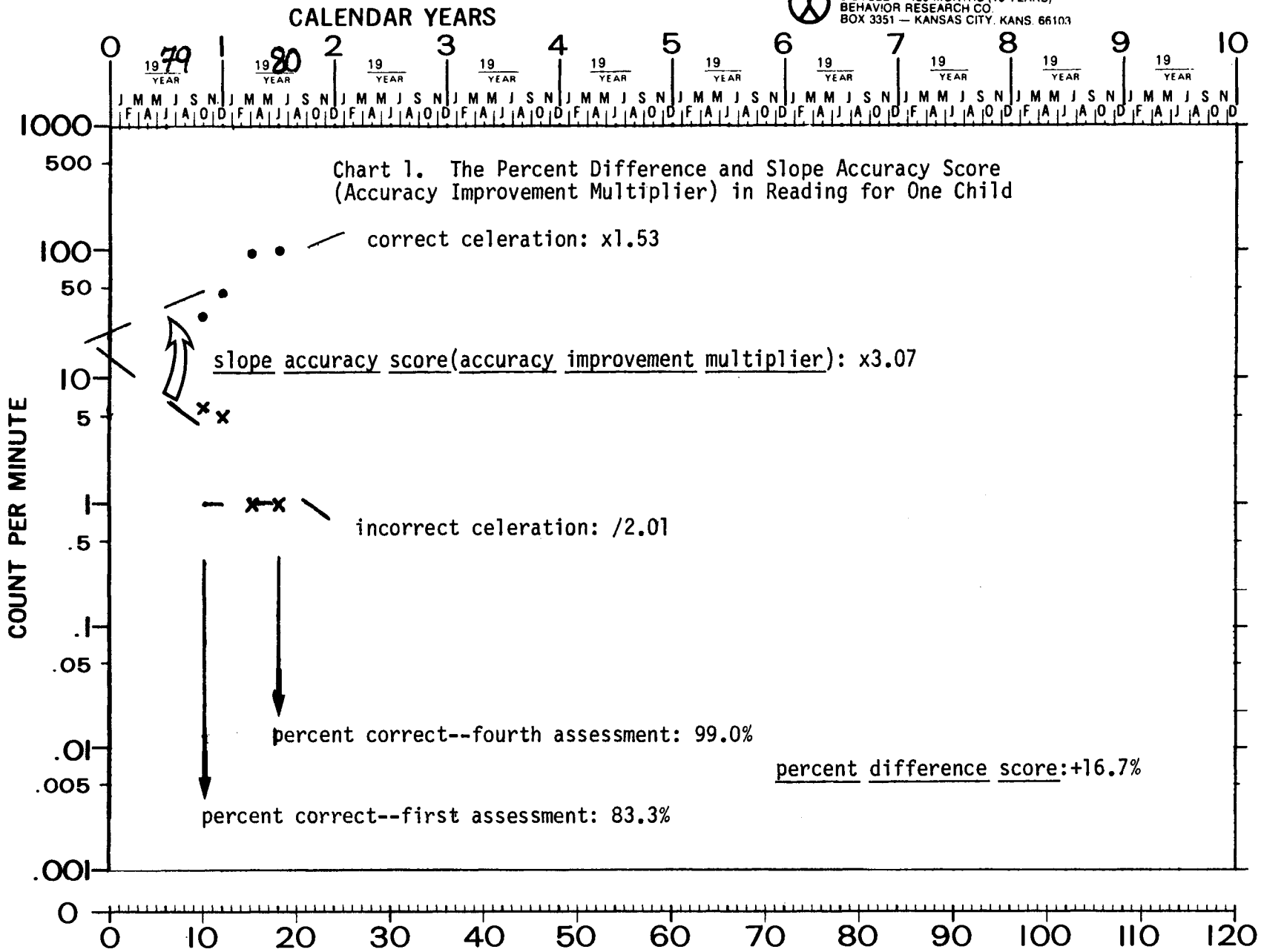
Following the four assessments, the data were analyzed in two ways. First, we computed **percent difference scores** between the first and fourth assessments for the correct and incorrect frequencies. If, for example, a child's correct and incorrect frequencies in reading were 35 and 7 on the first assessment 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 X1.2. 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).



Lovitt Fantasia			SUCCESSIVE CALENDAR MONTHS			S.	7	reads words	
SUPERVISOR	ADVISER	MANAGER				BEHAVIOR	AGE	LABEL	COUNTED
Olympia Public Schools		Olympia, Washington							
DEPOSITOR	AGENCY	TIMER	COUNTER	CHARTER					

Lovitt, Thomas C. and Fantasia, Kathryn. A Precision Teaching project with learning disabled children. *Journal of Precision Teaching*, Volume III, Number 4, Winter, 1983.

Study 1

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

	Mean Percent Difference	Mean Slope Accuracy
Reading	42.4	X1.66
Math	9.0	X1.20
Spelling	18.3	X1.37

Study 2

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

	Mean Percent Difference	Mean Slope Accuracy
PT LD(13)		
Reading	8.57*	X1.48
Math	.92	X1.07
Spelling	11.20	X1.26
Non-PT LD(13)		
Reading	1.71	X1.25
Math	-1.58	X1.05
Spelling	6.38	X1.17

* $p < .01$ (dependent measures t-test)

Study 3

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 3
Summary Data for Study 3: LD Children
in PT Classes vs. Non LD Children
in Non-PT Classes

	Mean Percent Difference	Mean Slope Accuracy
PT LD (14)		
Reading	7.58*	X1.75
Math	1.58	X1.31
Spelling	11.83	X1.46
Non-PT Nonhandicapped(13)		
Reading	1.81	X1.41
Math	1.76	X1.20
Spelling	8.19	X1.65

* $p < .05$ (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 ninth 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 "far" 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 **Distar; Corrective Reading, Morphographic Spelling, Montessori, Slingerland, Peabody 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.

3. 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.

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USING PRECISION TEACHING TO TEACH PRECISION TEACHING

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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