JOURNAL OF PRECISION TEACHING 1995, XII, 9 - 17 NUMBER 2 (SPRING 1995) Precision Teaching: By Teachers for Children Ogden R. Lindsley People often state that I developed Precision Teaching.When a student charts these "counts" on the Standard Celeration Chart, performance changes, or learning can be seen readily. Using the Chart, the student has a visual display of past performance and can see how performance must be changed to meet current aims or standards. Many teachers have found that behavior changes are much greater when students take such an active role. Policy 3: Use Standard Charts to Display Major Changes Skinner often urged his graduate students to look for important variables that produced major changes in behavior. He cautioned against wasting time measuring unimportant, small changes in behavior. At the time, I was aware that our cumulative response recorders forced us to look at major changes in response frequency in our laboratories. However, it was not until 1969, after 4 years of charting on standard multiply scales, that I understood why. I note? that in all cases the cumulative response recorders were built to display doublings in frequency on their charts. This doubling forced laboratory researchers to search for powerful interventions that produced at least a doubling in response frequency. In the Harvard Medical School Behavior Research Laboratory at Metropolitan State Hospital, the patients' response rates were automatically recorded on cumulative response recorders throughout each daily session. These cumulative response records displayed changes in their behavior frequencies within experimental sessions. Changes in behavior frequencies between and across sessions from week to week and month to month were charted by hand on 8 112- by 1 l-inch, 10- squares-to-the-inch chart paper. This paper was limited in the number of changes it could record, and as behavior frequencies increased, we had to rechart two or three times. However, it was not until I was training teachers at the University of Kansas Children's Rehabilitation Unit that I was compelled to have a custom chart printed. The teachers met once a week for a 3-hour class. I required that they improve a behavior of one of their pupils and also one of their own behaviors. The teachers shared their progress on these behavior change projects by showing charts in class each week. It took 20 to 30 minutes to share one behavior project because most of this time was spent describing each teacher's unique charting and recording system. In desperation, I had a Standard Chart printed with the full range of behavior frequencies, from 1 per day to 1,000 per minute, on a multiply (or logarithmic) scale up from the left, or short side of the paper. The long side had 140 calendar days, or 20 weeks, which is about 1 school semester. This chart had several advantages. First, by accommodating the full range of behavior frequencies on one Chart, a teacher could record any behavior of interest. Behaviors with low frequencies (e.g., a student getting into one or two fights per day) and those with high frequencies (e.g., a student reading several hundred words per minute) could be recorded on the same type of chart, eliminating the need for interpretation. Second, student performance data from an entire semester could be recorded on one Chart. Third, the logarithmic scale also made it possible to measure the rate of learning or celeration. Fourth, later we learned that the Chart could be used to accurately predict future performance, which helped in making decisions. For example, if learning was slow and the prediction was that several weeks would be required to master an objective, a teacher could try something else and accelerate learning. In order to standardize the interpretation of rate of learning and accurate prediction and to promote major changes in student performance, I designed the Chart so that a line from the lower left corner to the upper right comer of the grid represented a doubling in frequency every week (celeration period). This an& of about 33 degrees was the most sensitive part of the slope of the Chart. If the central slope of the Chart was a doubling, it should prompt our teachers to produce doublings of their pupils' frequencies each week. In the same way that the doubling cumulative response recorder grids prompted the early laboratory free- operant conditioners to search for major variables, I hoped that the Standard Chart doubling would prompt our precision teachers to discover major classroom variables that would accelerate learning. Because the Standard Celeration Chart forces us to look for at least doublings in pupil performance frequency, it blinds us to very small changes. For this reason many researchers avoid the Standard Celeration Chart because it makes the small changes they may ' have produced (e.g., changes from 11 to 13 responses per minute) look trivial. In fact, when changes from 11 to 100 responses per minute can be produced easily, a change from 1 1 to 13 is trivial and should be seen as such. Policy 4: The Child Knows Best When I was a graduate student, I trained a rat whose behavior did not extinguish exactly as the charts in Skinner's (1938) book had shown. My rat had at first responded much more rapidly when his responding was no longer reinforced. This rapid responding went on for about 30 minutes, at which time the rat stopped abruptly. I took the cumulative record of the rat's unusual extinction to Dr. Skinner and asked him how this happened. How could the rat do this when the book showed a very different gradual extinction curve? Skinner answered, "In this case, the book is wrong!And I answer, "Then please go back and ask him, because, after all, the child knows best." . '. Contributions of Precision Teachers Applying these founding policies of Precision Teaching has enabled many teachers to discover effective teaching techniques. Some of these discoveries are mentioned here. Academic pegormance can be accelerated by Chart display. In 1965, Lois Cox, supervised by Thomas Caldwell, found that pupil academic performance frequencies increased when pupils displayed their Charts. Lois also found that fourth-grade children enjoyed computing and charting their own daily performance frequencies. Self-recording is simplified with wrist tally cards. In 1966, Jean Stables cut 3- by 5-inch blank cards in half and held the 2 112- by 3- inch card to her wrist with a watch strap. She used this wrist tally card to record six or seven different behaviors. At the end of the day, the tallies were counted and charted and the dated cards were filed in a card box. Pupils can count academic and nonacademic behaviors and display their performance on the Standard Celeration Chart. In 1967, Carl Koenig, under my supervision, taught a special class of six 9- to 1 1-year-old boys classified as emotionally disturbed. The pupils timed and counted their own arithmetic and both silent and oral reading frequencies. Each pupil also counted one nonacademic behavior (Koenig, 1967). Koenig's master's thesis at the U. of Kansas was the first to use the term Precision Teaching and the first to include Standard Celeration Charts. The chart was called six- cycle semilog graph paper at the time, and was later called the standard behavior chart (Pennypacker, Koenig, & Lindsley, 1972). Still later, the chart was correctly named Standard Celeration Chart, because what is standard on the chart is the angle of the celeration lines. A line from the lower left comer to the upper right comer represents a learning in which performance doubles every celeration period (i.e., times 2.0 per week, per month, per 6 months, or every 5 years, depending on the version of the chart that is employed). A line from the upper left corner to the lower right comer represents unlearning, or deceleration, in which performance halves each celeration period (i.e., divide by 2.0 per week, per month, per 6 months, or every 5 years). Self-selected competencies are more eflective than teacher-selected. In, 1969, Karen A. Curtis, supervised by Tom Lovitt, found that higher academic response frequencies occurred when the pupils selected their own reward contingenciea'than when the teacher selected them (Lovitt & Curtis, 1969). Pupils with orthopedic handicaps can chart their own behaviors. In 1969, Sally Slezak, under my supervision, taught two different classes of 'children with orthopedic handicaps. The first year she taught 8 primary pupils: 4 paraplegic qerehral palsied, 3 spina bifida, and 1 brain damaged. Of these, 4 were severe and 4 were mobile. ,The second year she taught 7 intermediate pupils: 3 paraplegic cerebral palsied, 2 spina bifida, 1 muscular dystrophy, and 1 chronic health disorder. Of these, 1 was severe and 6 were ambulatory. All the children used wrist counters, which they purchased with points they earned, to count their own nonacademic behaviors. Wrist tally boards were used to count up to six or seven behaviors on the same tally card. The daily tally cards were dated and kept by the children. . ' Sally discovered that they could use masking tape strips (better known as "stickies") to record behaviors.(Channels refer to the pathways by which the student receives information and produces a response: for example, see and write, see and say, and hear and write.) David found not only that correct learning and error learning were independent, but also that the learning in one channel ("See the name"IwPoint to the picture") was independent from the learning in another channel ("Hear the namem/ "Place your hand in the position"). Just as Young and Johnson had found that three curricula can be tried at once because their learning is independent, Keller found that two or more channels can be tried at once each day because their learning is also independent. A leap-up in curriculum improves learning and motivation. In 1979, Marilyn Chappel, supervised by her principal, Gene Stromberg, taught her second-grade class at Garfield School, Ottawa, Kansas, basic mathematics facts. Figure 2 is a copy of Hollie's mqthematics chart for the fall semester. She looked at basic mathematics problems and wrote the answers on Precision Teaching practice sheets during 1-minute timings (seelwrite). The dots on the Chart represent her frequency of correct additions during her best timing each day. The small x's are her error frequencies per minute each day. Learning (celeration) lines are drawn through the dots and x's to show the slopes of the correct and error learning in 'each curriculum phase. . . b '. Note that the +5 and +6 addition problem phases produced correct learning, but little error learning. When +5 and i 6 addition problems were mixed on the same practice sheet (the next two phases), error learning did not occur either. However, when all basic addition facts and all basic subtraction facts were mixed with basic multiplication facts and practiced without prior instruction (+, -,x) Hollie had both high correct (x1.6) and higher error (110.0) learning! Essentially the same beneficial effect of the curriculum leap-up on Hollie's correct learning (advancing well ahead in the curriculum to a new instructional objective) was seen on all the other children's learning. Their median correct frequency jumped down from 120 to 4 per minute from the last day of "mixed +5 and +6" to the first day of "mixed add, subtract, and multiply facts." Naming their "learning pictures" can help students monitor progress. In 1977, Pat All, under my supervision, taught her regular seventh-grade shdents to count and chart the words they spelled correctly. She had them sort their charts according to the patterns of data, called learning pictures, 'She asked them to name the pictures by their p.atterns. Figure 1 illustrates the learning pictures hamkd. The code in Figure 1 shows the correct celeration or learning line as solid line with an arrow at its left end. It would have been drawn through the daily correct frequencies that had been charted. It is moving as on the Chart from left to right. It should be considered as a vector in motion, the arrow pointing .to where the performance is going. The error learning line is short dashes with an arrow pointing in its direction. The record floor (the lowest frequency that can occur) is shown as two horizontal long dashes at the bottom of each picture. These floor lines indicate that each picture is about two weeks long. The floor lines also show how far the frequencies are above the Floor. Note that in the Aim picture the errors are below the floor, showing zero errors are being made. The students named Jaws after the wide-open jaws of the shark famous in a thriller movie the prior summer. Snowplow, Uphill, and Downhill came from the positions of snow skis while skiing. In Climb, Takeoff and Landing the correct celeration line is the flight of an airplane and its related error line is the surface of the ground. In Surface and Dive the correct line is the surface of the sea, and the error line is the path of a submarine. Note that all the names describe motion, showing that the students knew their learning is dynamic and has direction and that their performance is almost always changing for better or for worse. These relationships are useful as memory aids in sharing these learning picture names with other students. / Figure 1 1 THIRTEEN LEARNING PICTURES -------- IMPROVING PICTURES -------- ---- Line Code: -----) \ Cross- Jaws Take- Cllmb Uphlll Dlve Record over off floor --- MAINTAINING --- -------WORSEN1 NG ------- The students saw pictures with corrects maintaining and errors maintaining not as one picture, but as three very different pictures. One picture on which both frequencies were very low was known as the "Rock-Bottom."Acceleration of inter-city elementary school pupils' reading pe~ormance.Englewood Cliffs, NJ: Prentice-Hall.Lindsley, 0...17