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EDITORIAL POLICY

The Journal of Precision Teaching is a multidisciplinary journal dedicated to a science of human behavior which includes direct, continuous and standard measurement. This measurement includes a standard unit of behavior, frequency, a standard scale on which successive frequencies are displayed, the Standard Celeration Chart, a standard measure of behavior change between two frequencies, frequency multiplier, and a standard, straight-line measure of behavior change across seven or more frequencies, celeration. Frequencies, frequency multipliers, and celerations displayed on the Standard Celeration Chart form the basis for Chart-based decision-making and for evaluating the effects of independent variables.

The purpose of the Journal of Precision Teaching is to accelerate the sharing of scientific and practical information among its readers. To this end, both formal manuscripts and informal, Chart-sharing articles are considered for publication.

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 Celeration 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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Teachers in resource rooms often find children who are quite accurate in their addition facts, but seem to "plateau" far below the aim set for them. They learn the smaller sums (1+1, 2+3) with facility, but the larger sums (9+7, 7+8) bring out the fingers. Motivation and extra drill do not seem to increase the frequencies significantly and both the teacher and the student become frustrated and discouraged.

Last year, while observing a student teacher in a resource room, Anne Lankenau, I noticed she was using a procedure with great success to get beyond that plateau to fluency. It was a method of curriculum slicing which she and her cooperating teachers called "doubles, neighbors, and two houses away."

Precision teachers are familiar with curriculum slicing. Hansen and Lovitt (1973) described program slicing as a procedure to individualize instruction. Teachers, faced with poor performance on mixed addition facts or facts with sums 11 to 18, have frequently sliced back to the t6s or the t7s and asked the student to reach aim frequencies on each small slice before moving on. Collections of practice sheets, such as those from the Great Falls Precision Teaching Project, often have many different versions of finely sliced curriculum in math, as well as reading, spelling, and writing.

Claudia Partlow and Kay Hermann, Anne's cooperating teachers, decided to slice their curriculum a little differently. They noticed that the children seemed to have an easier time remembering the doubles (6+6, 8+8, 5+5 etc.) than the random combinations. They borrowed an idea from a fellow special education teacher, Pat Richardson-Bieber, and devised a practice sheet which contained only the doubles(see Figure 1). They prepared two other practice sheets which capitalized on the students' facility with the doubles. The first, called "doubles and neighbors", contained the double problems mixed with others in which the two numbers only differ by one(see Figure 1). The final sheet, called "doubles, neighbors and two houses away", included the doubles and neighbors mixed with problems in which the digits differed by two (i.e. two numbers away from the doubles). Samples of these problems would include 7+7 (double), 7+6 (neighbor) and 5+7 (two houses away). When all these practice sheets are learned to aim, there are only 8 facts("exceptions") and their reciprocals which the child still needs to learn in order to perform the addition sums 11 to 18 sheet (see Figure 1).

The first step in using the "doubles, neighbors, and two houses away" procedure was to teach the children all the double combinations. Standard drill and practice instruction procedures were used including one minute timed drills and/or peer assisted SAFMEDS.

After reaching aim on the "doubles" sheet, the children were taught using the following "neighbors" learning strategy:

1. Look at each problem;
2. Are the numbers "neighbors"? (that is, consecutive numbers such as 4+5, 3+2);
3. Find the smaller of the neighbors;
4. Double it;
5. Add 1 to your answer;
6. Write your new answer below the problem.

This procedure short cuts teaching reciprocal problems (i.e. 5+6, or 6+5) because the children learn to ignore the order of presentation of the numbers. In "two houses away" the children followed a similar method. They first identified the problem as a "two houses away" problem, then found the smaller number, doubled it and added two. Although this procedure seems lengthy, the data these teachers collected indicated that it helped their students move from low frequencies to aim and fluency.

Charts 1 and 2 show the data from two typical children in this resource room. Both are primary aged students referred for learning problems and both had difficulty reaching fluency in their addition facts with sums 11 to 18. Lee was an ESL (English as Second Language) student and also had some mild learning problems. He showed dramatic improvement as soon as the doubles sheet was introduced(see Chart 1). His correct frequency jumped from a median of 13 digits per minute to a median of 32 digits per minute. He went on to easily reach his aim of 40 digits per minute on the "doubles and
### Figure 1
Sample Rows From Practice Sheets

<table>
<thead>
<tr>
<th>DOUBLES</th>
<th>6</th>
<th>8</th>
<th>9</th>
<th>7</th>
<th>5</th>
<th>2</th>
<th>4</th>
<th>1</th>
<th>3</th>
<th>2</th>
</tr>
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<td></td>
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<td>+9</td>
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<td>+2</td>
<td>+4</td>
<td>+1</td>
<td>+3</td>
<td>+2</td>
</tr>
</tbody>
</table>

<table>
<thead>
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<th>NEIGHBORS</th>
<th>8</th>
<th>6</th>
<th>7</th>
<th>9</th>
<th>6</th>
<th>8</th>
<th>7</th>
<th>9</th>
<th>7</th>
<th>6</th>
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<td></td>
<td>+9</td>
<td>+6</td>
<td>+7</td>
<td>+9</td>
<td>+5</td>
<td>+8</td>
<td>+6</td>
<td>+3</td>
<td>+8</td>
<td>+7</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>DOUBLES, NEIGHBORS AND TWO HOUSES AWAY</th>
<th>8</th>
<th>6</th>
<th>9</th>
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<td>+7</td>
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<td>+6</td>
</tr>
</tbody>
</table>

| EXCEPTIONS | 8  | 3  | 9  | 4  | 9  | 4  | 5  | 8  |
|            | +5 | +8 | +6 | +7 | +3 | +9 | +9 | +4 |
Phase 1: Sums 11-18
Phase 2: +8s
Phase 3: Doubles
Phase 4: Doubles and Neighbors
Phase 5: Doubles, Neighbors and Two Houses Away
Phase 6: Sums 11-18

Chart 1. Lee Learns Addition Facts Using "Doubles, Neighbors and Two Houses Away"
Chart 2. Charles Learns Addition Facts Using "Doubles, Neighbors and Two Houses Away"
neighbors" and "doubles, neighbors and two houses away" sheets. When he finally went back to the original sums to 18 sheet, his frequencies were much more fluent than previously and he reached his aim in five days (see Chart 1).

Charles was quite severely learning disabled. He typically had a difficult time reaching aim on even simple skills, yet his data were similar to Lee's. He showed some improvement in addition with sums to 18, but he had reached a "plateau". When "doubles", "doubles and neighbors", and "doubles, neighbors and two houses away" were introduced, he quickly reached his aim on all the practice sheets (see Chart 2).

Claudia, Kay, and Anne reported that other children in the class also benefited from this procedure and shared their data and practice sheets at our monthly Precision Teaching gathering. Other teachers in the area began to use the same procedure with similar results.

Sometimes it is not IF you slice curriculum, but HOW you slice it that makes the difference for a child's learning. The area of curriculum evaluation and development is one that can be easily and effectively studied using Precision Teaching. Teachers can learn from the performance and learning of their children the most effective ways to sequence curriculum and to apply learning strategies to help them master basic skills.

REFERENCE


Marie Eaton is a faculty member and Anne Lankenau is a student teacher in the Department of Educational Curriculum and Instruction at Western Washington University, Bellingham, WA 98225. Claudia Partlow and Kay Hermann are teachers in the Bellingham Public School System.

The Pre-purchase Assessment: Guarding Against Those Nasty Dust Collectors*

Clifford Bourie
Merrimack Special Education Collaborative

Among the complex needs of multi-handicapped people, deficits in expressive communication are often the most profound. Without a fluent output channel, effective interaction with their environment is minimized.

Alternative communication systems have existed for years. Sign language, picture and/or symbol systems have, in many cases, greatly enhanced the communicative ability of non-verbal people. Ingenious applications of technology have enabled any reliable, voluntary movement to indicate a discrimination. The overt discrimination can be translated into a unit of information or communication.

The complexity of alternative communication systems ranges from direct selection of an object or its representation on a picture board via an eye gaze or touch (Shane, 1979) to encoding techniques on a personal computer with a voice synthesizer. The expense of alternative systems has an equally broad range. When presented with such a myriad of possible configurations, parents of multi-handicapped, non-verbal people sometimes become overly optimistic about the impact of technology. A complex electronic system can be seen as the magic key that will finally unlock the ability to communicate for their child.

Teachers are responsible for determining what alternative communication system, if any, is most appropriate for a person. Frequently, determining what is appropriate is a guessing game, with the prescription for a communication board based on absence/presence questions. Can he recognize objects? Can he identify photographs? What about line drawings? Without objective rules at the start, the guessing game usually ends with the "pieces", the communication system, in a closet gathering dust. A frequency-based assessment before the purchase may more precisely prescribe a system format to prevent a closet full of dusty magic keys.

Abdul is a 16 year old student in the Merrimack Special Education Collaborative's Basic Skills classroom. His medical diagnosis includes cerebral palsy and severe mental retardation. Spasticity in his extremities limits Abdul's mobility and fine motor performances. He communicates via a combination of gestures, approximated manual signs, and a few words. He identifies objects (hear, see/point), and can demonstrate their use. He can identify Rebus pictures of familiar objects (hear, see/touch), with varying accuracy (Rebus pictures can be obtained from American Guidance Service, *A special note of thanks to Jim Pollard for his fluent help in preparing this paper.
Cedar Pines, MN 55104). Abdul's parents hope that an electronic system will allow him to communicate more freely.

A medical supplier loaned us a Zygo-16C communication board (Zygo-16C electronic communication systems can be obtained from Zygo Industries, Portland, OR 97207). The board is a matrix of 4 rows and 4 columns of 4x3" message areas. Each message area contains a single indicator light. The lights can be illuminated in succession by operating a switch in the Manual Scan Mode. In the Auto Scan Mode, the light advances automatically on a 3-second delay, or remains illuminated if the switch is depressed. Leaving the light illuminated can indicate a desired choice from among the displayed pictures or symbols. The automatic scan resumes when the switch is depressed again.

A series of 7 pinpoints based on face validity comprised the pre-purchase assessment. Performance data were recorded for 6-8 days on each pinpoint. Performance standards, or proficiency aims (Haughton, 1972, 1980) were determined via cold snapshots of 3 classroom staff (performance standards indicate proficiency levels and provide a basis for comparison among skills).

The pinpoints were:

**Hear, See/Touch Pictures.** This pinpoint allowed Abdul to tell us how well he could identify Rebus pictures of familiar objects. The pictures were: bus, chair, cookie, cracker, cup, milk, paper, toothbrush, and water. The pictures were chosen because the objects were common to Abdul's environment, and because they had been used previously during informal training sessions. We presented the pictures in groups of three. Abdul was asked to "Point to the ______." Corrects and errors were counted during 2-minute timings.

**Touch/Press Paddle Switch.** This pinpoint allowed Abdul to tell us how well he could manipulate the control mechanism. The switch was not connected to the Zygo-16C unit to minimize possible visual distractions. The number of audible switch closures was counted during 15-second timings.

**See/Press Switch (Advance Light).** The switch was connected to the unit. The unit was in the Manual Scan Mode. A single press of the switch advanced the indicator light to the next display area. This pinpoint allowed Abdul to tell us if the moving light effected his manipulation of the switch. The number of message areas illuminated was counted during 15-second timings.

**See Target/Stop Light.** This pinpoint allowed Abdul to tell us how well he could operate the unit in the Auto Scan Mode. The light advanced automatically every 3 seconds. The light stopped when the switch was depressed. Only the top row of message areas was used. A single message area was designated as the target by a large star. The other 3 message areas were blank. A correct movement stopped the light when it was in the target area. Errors were counted as any touch to the switch when the target area was not illuminated. The Auto Scan Mode imposed a ceiling of about 20 corrects/minute. Corrects and errors were counted during 1-minute timings.

**See/Touch Light.** This pinpoint allowed Abdul to tell us how well he could follow the light. We randomly advanced the light over all 16 display areas, and asked, "Where's the light?" Corrects were counted as touches to the illuminated light. Errors were any touches to lights that were not illuminated. Timings were 1-minute in duration. There was a teacher-imposed ceiling to the performance (Binder, 1983).

**See Picture/Touch Light.** This allowed Abdul to tell us if he could match the light and the picture. A picture was randomly placed in one of the 16 message areas. We asked Abdul, "Where's the light next to the picture?" The lights were not illuminated. Touches to the correct light, and to the inappropriate light (errors) were counted during 1-minute timings.

**See Picture/Stop Light.** This allowed Abdul to tell us how well he could operate the entire system in composite. A single picture was placed in different locations in the top row of the display matrix. Abdul was asked to move the light to the picture, and then place his hands in his lap to indicate that he was finished. Corrects were counted if Abdul put his hands down when the light next to the picture was illuminated. Errors were counted if Abdul advanced the light beyond the message area with the picture. The location of the picture and light were changed after
each error, and Abdul was asked to "Start again." Corrects and errors were counted during 1-minute timings.

Abdul told us the following (see Charts 1 and 2):

1. I can't identify pictures fluently or accurately. Performance standards are 25-31 corrects/minute. My pace was 5-9 corrects/minute and 1-5 errors/minute. My errors were accelerating more than my corrects.

2. I can adequately manipulate a paddle switch. My pace (48-142/minute) is well below performance standards (about 220-400/minute), but it's improving (x1.4), and it's more fluent than performance standards on other composite skills.

3. I prefer the Manual Scan Mode (72-120/minute) to the Auto Scan Mode (2-6 corrects/minute, 9-52 errors/minute, and errors accelerating at x2.3).

4. I can visually track the indicator light (7-18/minute), although well below performance standards (38-42/minute).

5. I quickly learn that a picture and the indicator light go together. My pace is 2-14 corrects/minute and 1-11 errors/minute, but corrects are accelerating at x5.3 and errors are decelerating at /7.3.

6. I don't stop pressing the switch when the appropriate indicator light is illuminated. I don't understand the functional relationship between the switch, light, and the picture. Although I can operate isolated portions of the communication system, I have difficulty putting all the parts together.

When presented with the information from the assessment in a plain English, straightforward manner, Abdul's parents agreed with us that purchase of the electronic communication system at this time would be, at best, premature. Abdul's educational plan was designed to increase his pace on accurate identification of Rebus pictures and in the component skills of using the Zygo system, such as see/touch light and see picture/touch light. However, given Abdul's performance and accelerations on this assessment, the priority for a system at this time would be a direct selection picture board.

The assessment was an effective tool in several ways. It allowed Abdul to tell us his ability on related component skills required to operate a communicative system. It clearly identified deficits and their magnitude, and suggested goals to be addressed in his educational plan. It facilitated discussion of an appropriate communication system for Abdul between his parents and teacher. It saved a large sum of money. It prevented a sophisticated "magic key" that didn't quite "fit" from being discarded into a dusty closet.

REFERENCES


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[The following is Part I of an article written by Owen R. White, in which he uses a special, analogizing format. The remaining parts of this article will appear in subsequent issues.]

AIM*STAR WARS

[Setting AIMS that COMPETE]

Owen R. White

University of Washington

Episode I: The Deathstar

Once, a long, long time ago, on a charted performance record far, far from aim, the Learner Rebels were struggling to overthrow the bonds of
Chart 1. Abdul's Performance and Learning on the First Five Tasks of a Zygo-16C Assessment

Abdul performs tasks on Zygo-16C assessment.
Chart 2. Abdul's Performance and Learning on the Last Two Tasks of Zygo-16C Assessment
understand. Perhaps, though, there is still time before the storm troopers overrun his small, isolated, not very special homogenized behavior dairy. Just perhaps. This is the story of Uncle Owen's struggle.

Two years before young Eric hurled his angry challenge at the stars he was carefully considering what he had learned about performance aims (Haughton, 1980). He wrote of the basic reasons for establishing aims, reviewed more than a little of the history behind attempts to find meaningful performance aims, and charted a path for future growth. Basically, he identified four possible advantages for establishing high standards: (1) improved skill retention over periods of disuse, (2) greater endurance over periods of intense skill use, (3) improved rates of learning with related but more complex tasks, and (4) improved performance quality. With the possible exception of performance quality, Eric contended that a skill would generally prove more useful as higher frequencies were achieved. He believed that quality was also likely to improve (e.g., handwriting becomes more legible) as frequencies accelerated, but only up to a certain frequency. Above that point, quality might suffer. Even when seeking greater quality, however, superficiency might still be beneficial. After all, slowing down is always easier than speeding up to meet situational demands.

Fundamental to Eric's arguments, and the arguments of others, is the basic premise that a skill should be useful! It should not be lost once instruction is terminated, nor should it be so effortful that it cannot be used over any reasonable period. Similarly, if the skill in question is one step in a sequence of instruction, then the skill should be sufficiently mastered to allow rapid learning in subsequent curricular steps. That makes sense. I find no fault in the logic. Whether improved frequencies actually lead to those ends is an empirical question, but one for which a great deal of support has been garnered (Lindsley, 1977; Binder, 1981; Haughton, 1972; Berquam, 1981, 1981; Haughton, 1980).

Unfortunately, knowledge of general relationships (improved frequency generally equals improved skill usefulness) does not always transfer easily into specific frequency aims. Several studies with "mixed results" have been reported in which higher frequency aims did not always translate into improved subsequent performance. For example, Haughton (1980) reports a case in which higher frequencies did not lead to superior retention of math skills, a finding later replicated in the Great Falls School District Precision Teaching Project (Clement, 1978). In both of those studies, the authors conclude that relatively low frequencies in math were sufficient to maintain the same low frequencies over time. Possibly those low frequencies will prove to be nonfunctional when learners attempt to apply their skills in daily life. However, that takes more time to study.

It is relatively easy to study the notion that fluency at one step in the curriculum will facilitate progress at subsequent steps. All one need do is compare the celerations achieved in successive curricular steps. If the celerations remain high from one step to the next, the pupil must have been reasonably well prepared to move on. If the celerations begin to fall off, then perhaps the aims were not high enough to prepare the pupil for advancement. Evans, Mercer and Evans (1983) employed just such a strategy and found that, "...a relationship between frequency of saying letter sounds and growth during the subsequent task of saying CVC trigrams was not clearly demonstrated." They concluded that they had not found the "optimum or critical frequency for the prerequisite skill." In other words, faster is still better, we just haven't found the "right frequency..." Maybe, but the whole issue of "prerequisite skills" and the need to develop fluency at each level in a curricular sequence is now being seriously challenged. It would appear that "step ups" and "leap aheads" to high levels in the curriculum...

* For those who might be mislead, "Uncle Owen" was not Eric's uncle. Indeed, Eric was Owen's chart father. Owen owes much to Eric, and might not ever have known of the Learner-Fight Force had it not been for him. If Eric felt a reluctance to abandon Owen to his own fate, it was not out of familial loyalty, but rather the concern and patience which only the superficient can have for the somewhat slow.
will often result in improved learning and (eventually) improved levels of performance, even if the pupil is advanced to those higher levels in the curriculum before earlier, "prerequisite" skills have been mastered or demonstrably acquired (Lindsley, 1981; Eaton & Wittman, 1982; Bower & Orgel, 1981; McGreevy, 1980; Johnson & Jackson, 1980; Haring, Liberty & White, 1980).

So, where are we? What aims do we establish? How do we find that "optimal frequency?"

The issue of a functional frequency aim for a particular skill and a particular learner is still empirical — we will never know how well a performance aim prepared the learner for meaningful skill usage until we try it and see. Did the learner retain the skill? Did the learner actually use the skill in extraintroductory activities? If so, then our performance aim was at least adequate (if not more than adequate). If not, well try, try, try again (White & Haring, 1980).

The empirical approach to validating an individual’s performance aim is certainly desirable and often not difficult. At times, however, it is not possible for us to follow our learners and determine how well we prepared them to succeed. Moreover, we have to have a place to start — a star by which to guide our ship — we have to have at least an initial aim or, as one of Eric's second graders pointed out, we'd be "aimless." Where will we find those "rising stars" to guide us in our initial attempt?

The most common approach would appear to lie in the assessment of "normal" or "competent" performers. The vast majority of published aims in the Journal of Precision Teaching and elsewhere are derived by assessing a pupil's peers, adults, or to rely on one or more of the "large project's" data sets (Mercer, Mercer & Evans, 1982). Why? Well, if most kids are able to make it with a certain frequency, then it ought to be good enough for our kids. That may not always be true.

Normal peers are often far from competent. Even the typical adult fails to maintain many skills at the useful level. For example, in a review of the literature, Horton (in progress) noted that approximately 98% of all adults "do not compute." They are so disfluent in basic math skills that they let the bank or the store clerk do any necessary calculations. When they are forced to work with numbers, they turn to a calculator for even the simplest of problems. (I, myself, was one of the first to own a wrist calculator.)

A second common strategy for estimating reasonable performance aims involves the assessment of "tool skills" (e.g., free/write digits as a tool for see/write digits to answer computation problems; free/say alphabet as a tool for see/say words in context). White & Haring (1980) suggest that tool skill frequencies should be at least x1.5 to x2.0 higher than "contextual use" frequencies. If one wishes a child to write digits to form math fact answers at a frequency of 80 digits per minute, the child should be able to free/write digits at a frequency of at least (80x1.5x) 120 to (80x2x) 160 per minute. Unfortunately, that strategy requires that one has already established the aim for the "use skill." To avoid that trap, one might use the same basic ratios between tool- and use-skill frequencies, but reverse the direction of computation. That is, assess the child's current basic tool skill, divide by a factor of 1.5, and use the resultant figure as the performance aim for higher level skills which use
that tool. If the pupil can free/write digits at a frequency of 100 per minute, then the aim for basic math facts might be (100/1.5) 67 digits per minute.

The advantage in the "work down from tool skills" approach is that it is always completely defined by the pupil's own performance -- it is not necessary to establish one aim (the use-skill aim) in order to determine another aim (the tool movement aim). However, if the child is not already competent in the tool skill, performance aims for the higher level skill will just reflect that incompetence.

Other variations on the theme of tool-skill/use-skill frequency ratios have been suggested (Eaton and Hansen, 1978), but utilizing tool-skill frequencies as a method of establishing contextual use-skill frequency aims always appears to require some leap of faith -- the assumption that one knows what the use aim should be (so one can establish tool movement aims), or the assumption that the learner's tool movement frequencies are functional (so one can use them to establish higher-level skill aims).

The last strategy for establishing aims which I have seen in practice is really a method for avoiding exact frequency aims altogether. In Shawnee Mission, Kansas, Henri Sokolove encouraged a practice suggested to her by Ogi-Wan Sixcycle, the original Learner-Knight. Each pupil simply works on one step in the curriculum for as long as he or she continues to get better. When the pupil "goes flat," the next step in the curriculum is introduced. No remediation; no added cues; no artificial consequences -- just "move on." Such an approach certainly embraces two concepts dear to the hearts of Precision Teachers -- "listen to the children" (when I stop learning it means that I want something different) and "emphasize learning" (it matters not where I am, just how fast I'm getting somewhere else). To be sure, upon inspecting some of Henri's charts I was surprised at just how low some of the frequencies were (grade level oral reading at 20-50 words/minute). However, the pupils were undeniably progressing nicely through the curriculum and, more importantly, were apparently well into the "independent practice" range mentioned by Haughton (1980). Frequencies on levels of the curriculum no longer directly taught continued to improve.

Despite Sokolove's(1978) very convincing and very extensive data, I must admit that the "as long as you progress" strategy was the most difficult for me to consider. Is the learner always right? Perhaps not, at least when it comes to signaling the end of the need to learn by ceasing to learn. Still, I have become more comfortable with the idea of moving ahead in a curriculum at the earliest possible opportunity. Step aheads and leap aheads are undeniably effective ways of accelerating learning in sequential material with many learners. I am more reluctant, however, to "let the learner decide" when it comes to establishing frequency aims for terminal skills -- skills which should become immediately integrated into the learner's daily behavioral repertoire and which must be maintained and used without continued instructional support -- the end of the line, as it were, in a curricular sequence.

I am simply unwilling, as a teacher, to abdicate responsibility for ensuring that at least minimal competencies are achieved in at least some important skills. I am unwilling to stop the program in dressing just because the learner goes flat at a frequency of .02 dressing sequences per minute, for I know that such a frequency will not be tolerated in the group home. I am unwilling to stop instruction (or at least continued practice) in basic math skills just because the pupil begins to decelerate after reaching 16 digits per minute. I know that such a frequency will not be sufficient for the pupil to keep up in science class... and I suspect that the learner would not maintain or use the skill as an adult.

I feel more comfortable with a "compromise" strategy suggested by Haughton (1977). Essentially, one establishes a "minimum frequency aim" and a "maximum frequency aim." The minimum frequency aim defines the lowest performance you believe will adequately prepare the pupil for advancement in the curriculum or independent use of the skill. If the learner falters before reaching the minimum frequency aim, the program is modified in some way to facilitate continued learning. Once the minimum performance aim is reached, the learner decides what will happen. As long as the learner continues to progress, the program is continued; once the learner "goes flat," the program is ended. A maximum performance aim is set at the level beyond which the teacher/manager is not interested in continuing to work with the skill. If the learner wishes to continue to develop the skill alone, fine, but the manager discontinues formal instruction for that skill and introduces a program to develop some new skill.

Where am I now?
I'm back at square one, trying to decide what those minimal performance aims should be. Am I left with norms, fancy ratios and simple guesswork? Is there no better way to estimate what might be functional? Must we simply "try it and see," follow up, and adjust as necessary? Perhaps not.

After carefully reviewing what young Eric, Ogi-Wan, and others (including, of course, the Learner-Rebels themselves) have been trying to tell me over the years, I would like to suggest several considerations which one might make when establishing a preliminary frequency aim. For the moment, I will limit my concern to "terminal proficiency", that is, the level of performance which will make a skill immediately useful to a learner, not just as one step in a sequence, but as an independent skill in its own right. In short, the aims discussed below are designed to allow the learner to:

1. Advance to a level of independence,
2. Maintain the skill over time, and
3. Perform some service of importance to the learner.

Each of the considerations which I would like to propose is based on the notion of "competition."

Peer Competition

The vast majority of performance aims are established on the basis of some form of "peer competition." One assesses what most kids do, and then assumes that if a new learner can achieve those levels of performance, the learner will at least be able to "compete." In some cases that may be quite true (e.g., athletic or academic games; competing for a position as a typist). Attempting to provide a learner with "normal frequency" might also be important socially. "Slow kids" stand out, and "differences" can lead to isolation (White, 1980). Providing the learner with the ability to compete with peers can lead to much easier acceptance by peer groups. That's nice. But "normal" is not always nice.

Patsy, a mildly handicapped elementary school student, had a moderate speech problem (difficulty in correctly pronouncing short vowels) that showed up in oral reading and conversation. Ruth Mundt, Patsy's teacher, decided to help Patsy develop more fluency in saying the "hard sounds" by simply having her read from a list of C-(short vowel)-C words each day. To establish Patsy's frequency aim, Ruth logically reasoned that if Patsy could say the sounds as fluently as her nonhandicapped peers, all would be well. A quick assessment of those peers revealed that an aim of 40 sounds per minute would do nicely for putting Patsy "in the middle."

As shown in Chart 1, Patsy had no real difficulty in achieving the aim of 40 sounds per minute. As her fluency approached that of her nonhandicapped peers, her errors just seemed to disappear — usually a good sign. After discontinuing the program, however, Ruth noticed that Patsy began to slip back into her old habits. When a formal assessment was conducted a month later, Patsy had dropped to half her former fluency and the errors had come back. The program was reinstated, the "normal aim" reached once again, and after crossing her fingers, Ruth terminated the program once more. Three weeks later Patsy was up (down?) to her old tricks, so it was back to the program.

At this point, many fine behavior analysts would point out that Patsy was having difficulty in "generalizing," and that contingencies should be established in the "real world" to encourage and develop the skill where it will actually be used. In other words, Ruth should start prompting Patsy and providing corrective feedback (plus an M&M or two?) throughout the day. Fortunately, Ruth was reluctant to engage in activities which might prove very embarrassing to Patsy (when was the last time someone corrected you in front of your friends?), so she opted to try for superfluency. Ruth doubled Patsy's frequency aim ("...now Patsy, you have a problem, so you must be twice as good as those who do not have a problem..."). It took only an extra 9 days (beyond the old aim of 40 per minute) to reach the new aim. The program was terminated. A month later Patsy was still superfluent. Ruth never noticed a problem after that during reading or conversation. Undoubtedly, Patsy is now a speech therapist or a linguistic specialist in the U.G. (United Galaxies).

Obviously, "competition with peers" was not the appropriate method for establishing Patsy's aim. Ruth was diligent in following Patsy after the program to see if the new behavior was functional, however, and when her faith in the Normies failed, she studied carefully the plans of the Deathstar that young Eric had retrieved while rescuing Princess Learna. She was finally able to locate the weakspot in the monstrous Normie machine. She put her faith in the Learner-Force, and found an aim that worked.
Chart 1. Patsy Reaches Superfluency

The celeration lines on this chart are projected minimum celeration lines.
Amid thunderous MUSIC**, the Normie Death-star was destroyed.

How might we have guessed before the program started that Patsy needed superfluency? The clue might lie in the consideration of another type of competition, which will be examined in the next episode, "The Return of the Learner."

** REFERENCES **


Clement, R. (1978) Spring-Fall retention scores on precise monthly assessments. Unpublished manuscript, Great Falls Public Schools, Great Falls, MT.


** MUSIC, according to Ogi-Wan (Lindsley, personal communication, exact date unknown) represents the things we must remember about learning: learning is by (M)ultiples, not add and subtract; learners are (U)nique, what works with one learner may not work with another; learning is (S)pecific in that something may be "hard to do" but "easy to learn", "easy to get right," but "hard to learn," etc.; learning is (I)ndependent in that corrects can go up while errors go anywhere, success in one curricular area tells us nothing about other curricular areas, etc.; and learning is a function of (C)onsequences -- you can't tell why something happened until you see what comes after it.
Monitoring Color Naming

Susan Thomsen
Mississippi Bend Area Education Agency

Kris was referred to me by his classroom teacher 2 days after beginning kindergarten. Kris qualified for therapy with numerous articulation errors and language deficits. One of Kris' first objectives was to learn color names. Since knowing color names is an important kindergarten skill, I didn't want to spend all year teaching one color name at a time.

We started with a see/say probe with 35 circles and I randomly colored the circles the 8 basic colors. Kris was instructed to name the colors for 1 minute and to skip the ones he didn't know. Our data was flat, no learning was taking place and we were both confused (see Chart 1). I decided that the circles were too abstract, that Kris really didn't understand the concept of color, and that he wasn't going to learn the color names unless we made some changes.

We constructed a new probe with 8 pictures selected by Kris and colored each picture a basic color. Kris was instructed to say a color sentence about each picture (i.e., The apple is red. The pumpkin is orange.). Therapy was directed toward identifying the basic color of the meaningful objects and pictures, and practicing through imitation of the probe color sentences. Kris learned the color sentences, and the concept of color was finally making sense to Kris and me. I could see it on his chart and his face.

Next we stepped up to the original see/say color names probe. Within 7 charted days Kris was naming colors proficiently.

Our final phase was to step-up to a 5 minute generalization (carryover) activity. Kris was asked to tell me the name and color of objects picked from a box randomly. After 4 days, Kris could perform this task at a smooth pace with no hesitation.

We both learned from Kris' chart. Kris learned his colors and I learned the value of using meaningful material when teaching and continuing to let my students talk to me through their charts.

Susan Thomsen is a speech/language specialist with the Mississippi Bend Area Education Agency, 209 Fifth Ave., Camanche, IA 52730.

Study Methods in Graduate School

Lori Korinek and Bill Wolking
University of Florida

The purpose of this article is to share data from one student who used three different study methods to prepare for a final comprehensive written examination in a graduate level special education (mental retardation) seminar. Each study method was used to prepare for a specific topic covered in the seminar. The study methods and topics were: (1) rereading 1-2 page abstracts dealing with various conceptualizations of mental retardation; (2) writing and rereading an essay comparing and contrasting ten authors' perspectives on mainstreaming; and (3) reviewing and taking a daily timing on flashcards, with author names and publication dates on the front and with 2-3 relevant facts or ideas about observational learning from the respective authors on the back of the cards.

Many Precision Teachers endorse the use of flashcards and timings (SAFMEDS) as a highly effective learning tool. Bower and Orgel (1980) documented the effectiveness of SAFMEDS with college students.
Chart 1. Kris Learns and Generalizes Color Names Using Meaningful Material
A multi-element design was used to compare the three study methods and corresponding topics. The dependent variable was think-say ideas or facts about the topic during a one minute timing. Two timings were conducted daily on each topic. The timings were followed by approximately 20 minutes spent studying the topic. The study time was equalized at the end of each week.

Each data point on Chart 1 represents an average of two daily timings on think-say ideas about the topic. Notice that the data for each study method and topic are concurrent. As evidenced by the initial data points, the student possessed approximately equal entry-level knowledge about each topic.

Chart 1 indicates that the student's learning with the flashcard method of study and the topic of observational learning was superior in terms of the celeration for both corrects (x2.5) and incorrects(/2.7). The student's final performance under this same condition was again superior in terms of both accuracy (x17) and fluency(17 corrects/min.). It is important to note, however, that the student's learning and final performance were only slightly less with the essay method of study and the topic of mainstreaming. On the other hand, the student's learning using the flashcard method of study and the topic of observational learning was superior to that demonstrated using the abstracts method of study and the topic of conceptualizations of mental retardation in terms of the celeration for both corrects and incorrects by a factor of x1.7 and x1.8(celeration multipliers), respectively. This same superiority was observed in final performance, in terms of both accuracy(x2) and fluency(x2)[frequency multipliers].

These findings suggest that, for this student, simply rereading abstracts, a traditional method of study, was not as effective as saying author-fact flashcards or writing and rereading an organized essay. Replications with additional students and topics will determine if the observed relationships maintain across subjects and content.

Reference


Bill Wolking is a faculty member and Lori Korinek is a graduate student in the Department of Special Education, University of Florida, Gainesville, FL 32603.

About PT

NOTES FROM THE EDITOR

Patrick McGreevy

I would like to encourage all of you to submit Chart-sharing articles and manuscripts to JPT. Consider the possible benefits for children of your sharing a successful intervention with our readers. The cost is several hours of your time. If it takes you four hours to prepare the article and four children are helped, the cost-benefit ratio is one student helped/one hour spent. I would like to suggest that this is an effective, efficient, and loving way to spend time.

Also, help your teachers, and (yes) even the children, prepare articles. Remember, most of the discoveries of Precision Teaching have originated with a suggestion from a classroom teacher and with a child’s chart. An article prepared and submitted by a child would receive the immediate attention of the editorial board.

Information on the Fifth International Precision Learning/ Precision Teaching Conference is included in this issue. I strongly encourage you to consider attending this conference. Kathleen Liberty, Owen White and many others are working hard to make this an informative and enjoyable conference.

TEACHER TO TEACHER

Caryn Robbins

I had a chance to do a little reading this summer and picked up William Least Heat Moon's Blue Highways. Along his philosophical journey, Moon makes an observation which sums up a part of our philosophy as Precision Teachers (where Moon says "man", read "person"): The annals of scientific discovery full of errors that opened new worlds: Bell was working on an apparatus to aid the deaf when he discovered the telephone; Edison was tinkering with the telephone when he invented the phonograph. If a man can keep alert and imaginative, an error is a possibility, a chance at something new to him, wandering and wondering are part of the same process, he is most in error, whenever he quits exploring.
Chart 1. A Graduate Student's Performance and Learning Using Three Methods of Study
Precision Teachers view errors as possibilities. They change them from failures into learning opportunities. Few other teaching strategies have held this philosophy. Open learning classrooms have allowed children to learn through a trial and error process when engaging in experimental and enrichment activities. The more structured strategies have moved toward errorless learning. It's as if you can make errors when you're having fun with learning, but when you are seriously learning, you should not make a mistake.

It is much easier to believe that errors are learning opportunities than it is to live as if they are. After all, when you make a mistake in balancing your checkbook, the bank sends you an overdraft notice, not congratulations for a new learning opportunity. It would be nice to change this world view for our students. We'd like them NOT to feel the upset-stomach-red-faced-crawl-in-a-hole-and-die response to errors. We would like them to learn to feel what we believe.

I have been amazed when two and one-half year old children enter my classroom and have already learned not to make mistakes, by not doing anything. Since it's much easier to change a behavior, than to create one, my first goal for many children is to learn to make an error and not see it as a failure. It's a very important skill to have when a child is handicapped and will spend his/her life making errors in other people's eyes. I have not found a magical way to teach this skill. My primary strategy has been to talk to the children about my own errors, and tell them what I have learned. Many children look somewhat shocked to hear an adult admit a mistake, though they are used to seeing us make them.

REFERENCE


AROUND THE STANDARD CELERATION CHART

Patrick McGreevy

In the last issue, I suggested truncating (cutting) proportionally the Standard Celeration Chart, when submitting manuscripts to journals with a format smaller than 8 1/2 x 11 inches. I further suggested requesting that the journal print the charts without reduction or enlargement.

In order to encourage this process and thereby encourage the submission of Chart-based manuscripts to other journals, I am preparing black, camera-ready copies of the four daily charts suggested in Table 1 of my last column (last issue, page 44). Just like the charts printed in JPT, these charts do not contain a grid.

These charts will be available at a nominal cost. Just send me a note describing which of the four charts and how many of each chart you need. I will send them to you, along with a note specifying the charges for the charts and postage. I would suggest that you specify at least the number of charts you actually plan to use, since most copy machines, even expensive models, produce a copy that is not the same size as the original.
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