The use of frequency in establishing instructional aims

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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.

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 (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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As part of its goal to disseminate research, the University Affiliated Facility for Developmental Disabilities (UAF) at the University of Missouri in Kansas City, under the direction of Carl Calkins, assisted with the production of this Journal.
The Use of Frequency in Establishing Instructional Aims

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To know when to introduce new skills, teachers must decide when students have mastered skills they are currently learning. In the field of Precision Teaching, criteria for mastery or proficiency are often referred to as instructional aims. These aims are usually defined in terms of correct and incorrect frequencies. For example, an instructional aim in reading might be 150 words per minute with 2 or less errors. Sometimes the incorrect frequency is not mentioned and assumed to be near zero per minute. These frequencies, charted on the Standard Celeration Chart, are sensitive measures of both accuracy and fluency. The latter is crucial because it is the discriminating factor between a student who is acquiring a skill and one who is fluent or proficient in that skill.

Several procedures have been used by Precision Teachers to determine proficiency. Lovitt and Hansen (1976) suggest using a percentage of improvement. For example, a child can progress to the next reading level (meaning he has attained mastery) when he has improved 25% over his baseline frequency in oral reading and when he answers comprehension questions with 90% accuracy.

Another method used to determine proficiency or instructional aims is peer comparison. Frequency data are collected from children who are achieving satisfactorily and their performance is used as an aim.

Normative data are also helpful in setting criteria for proficiency. A group of students perform a task and the mean correct frequency (or a higher percentile) is used as the mastery criterion for all students.

Another method of determining proficiency combines teacher performance and tool skill frequency. Eaton and Hansen (1978) demonstrated a relationship between tool skill frequency and basic skill frequency. For example, a child who writes digits slowly (tool skill) will probably also write answers to math facts slowly (basic skill). An adult may write digits random at a frequency of 75 digits per minute. A child may write digits random at a frequency of 60 per minute. Using a proportion formula:

\[
\text{child's frequency} = \frac{\text{adult's frequency}}{\text{adult's tool skill frequency}} \times \text{child's tool skill frequency}
\]

the child could be expected to write answers to math facts at a frequency of 45 digits per minute.

In the absence of frequencies that reflect standards of proficiency, or suggest instructional aims, the aforementioned procedures have been helpful. Although disagreement continues regarding proficiency standards, enough data are now available to suggest tentative proficiency levels or instructional aims for selected academic tasks. These data have largely resulted from several Precision Teaching projects (e.g., Koeng & Kunzelmann, 1980; Precision Teaching Project; Regional Resource Center Diagnostic Inventories, 1971; SIMS Reading and Spelling Program, 1978) and are based on an extensive sampling of student performance. The frequencies collected by these projects and various additional investigators are either suggested as proficiency levels or indicate the performance levels of high-achieving peers. Occasionally, wide discrepancies exist between early data and more recent data or major project data. When this discrepancy occurs, it is feasible to give the recent data or the project data more weight. This article presents current frequency data on selected academic tasks that suggest tentative proficiency levels and discusses implications for teachers.

\text{Results}

Suggested proficiency levels for academic readiness skills are presented in Chart 1. Three of the four investigators examined see-say lowercase letters random and see-say uppercase letters random separately, but each obtained identical frequencies for the two tasks. For this skill it appears that a useful proficiency level is in the range of 80 to 100+ letters per minute.

Two of the four investigators examined hear-write letters of the alphabet random. Proficiency level ranged from 80 to 110 letters per minute.

Two or more investigators examined hear-write numerals random, hear-say counting any sequence, see-write numbers random 1-5 and 0-9, and see-write letters random. Proficiency levels in these pinpoints have wide ranges. More data would be helpful.

Chart 1. Suggested Proficiency Levels for Academic Readiness Skills
More data also are needed on numerous other pinpoints which were examined by only one investigator. These pinpoints were not presented in Chart 1 but include think-say numerals in sequence, see-say sets 1-5 and 1-9, see-say picture name, think-write first name, think-write numerals in sequence, think-count orally 1-10, and think-say alphabet.

Frequencies reported for reading skills are presented in Chart 2. Enough nonspecific grade level data are provided to suggest proficiency levels in each skill area: see-say isolated sounds (80-100 sounds per minute), see-say words in list (80+ words per minute), and see-say words in text (100+ words per minute). More data are needed in the graded skills (see-say words in list—grades 2-4) before proficiency levels can be ascertained.

Frequencies reported for math skills are presented in Chart 3. Enough data are reported to suggest proficiency levels in all of the graded tasks. It appears that the proficiency range for most math facts is 55-75 digits per minute.

Frequencies reported for spelling skills are presented in Chart 4. There are not enough data points to indicate proficiency levels in spelling; however, the ones included provide an initial frame of reference for spelling skills.

Certain learner characteristics, such as age, grade level, and achievement level, may influence the establishment of proficiency levels or instructional aims. Wolking (1973) sampled the performance (one-minute timings) of 740 individuals on numerous academic tasks. He noted that by the sixth grade the median child attained approximately 85% of adult accuracy and 65% of adult speed on the academic tasks.

Discussion

Correct and incorrect frequencies have been used to determine proficiency levels. Although this approach has yielded very helpful information, it may be beneficial to examine rate of growth or celeration to determine proficiency. For example, consider that a student celerates at a desirable rate on a task for a two-week period and then stabilizes. Once the learning levels off, it may be extremely difficult to produce a celeration which is worthy of the intense instructional effort. Thus, the leveling off frequencies of some students may indicate that the instructional aim is achieved, proficiency is reached and a new skill needs to be introduced. It is also possible that something else is interfering with the student's progress and a change in curriculum or consequences is needed. The situation is analogous to the runner who reduces his time in running the mile by two minutes in the first three weeks of training and from that point it takes six months to reduce his time by 15 seconds. Simply stated, if a reader achieves 100-150 words per minute, it may not be feasible to spend much more time trying to obtain 200 words per minute. However, it should be feasible to introduce more difficult reading material and strive for 100-150 words per minute again.

Since research has not conclusively determined proficiency standards for academic tasks, the teacher must use considerable discretion in setting aims with individual pupils in order to avoid overteaching and/or underteaching. As noted by Haring and Gentry (1978), the teacher should select aims that can be justified via empirical support or considerable experience.

Research on frequencies of specific skills is still in its infancy. Investigators are continuing to collect data on students of all ages and handicaps. These data may facilitate the development of improved methods for assessing and remediating academic deficits. Hopefully, proficiency standards that suggest instructional aims may also result from these investigations. When instructional aims become less arbitrary, efficient teaching and learning will occur.

REFERENCES


Koenig, C. H., & Kunzelmann, H. P. Classroom
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Chart 3: Suggested Proficiency Levels for Math Skills

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- Precision Teaching Project
- Starlin & Starlin (1973a)
- Wolking (1973)
- Koenig & Kunzelmann (1980)
- Precision Teaching Project
- Starlin & Starlin (1973a)
- Koenig & Kunzelmann (1980)
- Precision Teaching Project
- Starlin & Starlin (1973a)
- Koenig & Kunzelmann (1980)
- Precision Teaching Project
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Chart 4. Suggested Proficiency Levels for Spelling Skills

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CAN LEARNING OR VARIABILITY BE PREDICTED FROM LOW INITIAL PERFORMANCE: IMPLICATIONS FOR PRECISION TEACHERS AND EQUAL INTERVAL CHARTERS?

Patrick McGreevy, James G. Thomas, Lynette Lacy, Steven Krantz
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In 1972 Koenig used collections of final frequencies in all six cycles of the Standard Celeration Chart to establish the independence of frequency, celeration and bounce. Since that time, Precision Teachers have been using these standard measures of performance, learning and variability to make Chart-based decisions regarding their students' instructional programs.

For several years, Precision Teachers charted students' performance, while continuing to implement traditional public school curricular strategies. These strategies produced initial accuracy ratios (Pennypacker, Koenig, & Lindsley, Note 1) ranging from x5 to x50 and subsequent average celerations of approximately x1.2 for corrects and x1.2 for incorrects (McGreevy, 1978; Sokolove-Goettel, 1976; Wood & Ramsay, 1975). In other words, initial correct performances were relatively high with very few incorrects, while subsequent learning was relatively low.

In 1978 Lindsley began to question the effectiveness of curricular strategies that emphasized high initial performance and apparently provided less opportunity for learning. This questioning influenced the work of McGreevy (1978, 1980, 1981), Stromberg and Chappell (1980) and others.

McGreevy (1978) compared the initial correct performance and learning of a group of elementary school children on similar screening and remediation tasks. He found that screening tasks administered daily for 10 days without instruction produced lower initial correct frequencies and higher correct celerations. He concluded that the remediation efforts were relatively ineffective.

In 1980 McGreevy demonstrated low initial performance.

The authors wish to acknowledge the cooperation of John Heskett and Jim Friedebach of the Missouri State Schools for the Severely Handicapped.

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performance followed by rapid learning in a moderately retarded young man. The initial accuracy ratio was 1/9, while the subsequent celerations were 2.8 for corrects and 2.6 for incorrects. McGreevy (1980) suggested that low initial performance provided a greater opportunity for learning. McGreevy (1980, 1981) also suggested that "hard to do" (low initial performance) may not necessarily mean "hard to learn" (subsequent slow learning).

Stromberg and Chappell (1980) attempted to teach an entire second grade class a math curriculum at a pace suggested by the adopted text. Pairing this text with Precision Teaching for 4 months and 4 phases of instruction resulted in initial accuracy ratios ranging from 1 to 65, most of which included no errors. The median correct celeration was 1.4, while the error celerations were almost all 1.0. After 4 months, the investigators changed the task for all children. The new task included all the math operations introduced in the second grade text. This "leap up" in the curriculum produced lower initial performances and more rapid learning. The initial accuracy ratios ranged from 6 to 1.6 and included many errors. The correct celerations ranged from 1.3 to 2.7 with a median celeration of 2.0. The error celerations ranged from 1.6 to 6.5 with a median celeration of 2.4. In other words, the new task was "hard to do," but proved to be "easy to learn."

Several other investigators examined "hard to do" tasks and subsequent learning. Bower and Orgel (1981) generated high initial error frequencies in college students that were frequently followed by high correct and error celerations. Eaton and Wittman (1982) tested the "leap up" strategy with three handicapped students. Prior to implementing this strategy, all the students' initial performances were high and errorless, with accuracy ratios ranging from 8 to 40. Their subsequent learning was relatively slow, with correct celerations ranging from 1.4 to 2.0. The incorrect celerations were all 1.0. After implementing "leap ups," all initial performances were considerably lower, with accuracy ratios ranging from 1/4 to 3/8. The subsequent learning for all students was rapid, with correct celerations ranging from 2.5 to 10 and incorrect celerations ranging from 1/8 to 4.5.

The "leap up" or "hard to do" initial performance strategy represents a major departure from the pace of instruction suggested by most educators and publishers. The preliminary work of the aforementioned investigators indicates that this strategy results in greatly increased student learning. As this strategy continues to be tested, it is important to examine closely initial performance to determine if relationships exist between this dimension of behavior (Johnston & Pennypacker, 1980) and subsequent learning and variability. The present investigation extended the work of Koenig (1972) by comparing low initial performances relative to the counting period floor to subsequent learning and variability. These comparisons were conducted with data charted on the Standard Celeration Chart. The present study also compared low initial correct performances to subsequent correct learning charted on equal interval charts. All comparisons were designed to determine if some degree of "leap up" or "hard to do" was related to subsequent learning or variability and were seen as having implications for Precision Teachers and Equal Interval Charters.

Method

The first author was commissioned by the Missouri Department of Elementary and Secondary Education to conduct a pilot study designed to investigate the effect of length of instructional time and time of day on rate of acquisition. Data collected in the course of that study also served as data for the present investigation.

Subjects

Twenty-four students enrolled in Missouri State Schools for the Severely Handicapped and their twelve teachers participated in the study. Teachers were selected based on their willingness to participate. Students were selected by their teachers without a systematic selection process.

Procedure

With the assistance of the investigators, each teacher selected from one to three tasks for two students. Each teacher was instructed to select tasks that each student would likely find "hard to do." Each teacher was also instructed to select and conduct a one, two or three minute daily timing on each task and record the correct and incorrect frequencies on a data sheet. If the initial accuracy ratio was >1.0, the task was considered "easy to do" and a new task was selected. If the ratio was 1/11, that is, more incorrects than corrects, daily frequencies were collected on that task during a four week period. After each timing, the teachers spent between 2 and 10 minutes teaching the student how to perform the task. Each teacher selected her/his own teaching strategies and how and when to change those strategies.

Results

At the end of the four week period, the frequencies for 66 tasks were plotted on Standard Celeration Charts and equal interval charts (see Charts 1 and 2). Three measures of initial performance displayed on the Standard
Chart 1. The Dimensions and Measures of Behavior for One Student Displayed on the Standard Celeration Chart and the Correlations Comparing these Measures across 24 Students and 66 Tasks.

Correlations

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Chart 2. Two Dimensions and Two Measures of Behavior for One Student Displayed on an Equal Interval Chart and the Correlation Comparing the measures across 24 Students and 66 Tasks.

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<td>4</td>
</tr>
<tr>
<td>I</td>
<td>Learning</td>
<td>Gain Score</td>
<td>+16</td>
</tr>
</tbody>
</table>

Correlation Measures of Behavior Compared \( r \)

\[ r_{A \text{ to } I} = -0.02 \]
Celeration Chart were collected for each task: initial number correct, initial number incorrect and accuracy ratio. Since the timings (counting periods) were different for each task, and initial performance relative to the counting period floor was being examined, the initial number correct and incorrect were chosen as measures of initial performance. The initial accuracy ratio, the ratio between these two measures, was also used. The median and range of all three measures are shown in Table 1.

Table 1. The Median and Range of Three Measures of Initial Performance

<table>
<thead>
<tr>
<th>Measure</th>
<th>Median</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial number correct</td>
<td>1 movement</td>
<td>0 to 15 movements</td>
</tr>
<tr>
<td>Initial number incorrect</td>
<td>9 movements</td>
<td>2 to 54 movements</td>
</tr>
<tr>
<td>Initial accuracy ratio</td>
<td>/6</td>
<td>1.5 to /28</td>
</tr>
</tbody>
</table>

Two-thirds of the initial number correct were either zero or one correct movement. One-third of the initial accuracy ratios were /9, that is, between /9 and /28. These initial performance data indicate that the tasks ranged from "hard to do" to "extremely hard to do." These three measures of initial performance were compared to two measures of learning, correct celeration and incorrect celeration, and two measures of variability, bounce around correct celeration and bounce around incorrect celeration. All these measures were charted on Standard Celeration Charts. The initial number correct was also compared to one measure of learning, gain score. These measures were displayed on equal interval charts. All comparisons were conducted using Pearson product-moment correlations.

Chart 1 displays three dimensions and seven measures of behavior charted on the Standard Celeration Chart, the values of these measures for one student and the correlations comparing these measures across 24 students and 66 tasks. The correlations clearly indicate no relationship between initial performance and subsequent learning or variability. Chart 2 shows the same data for two dimensions and two measures of behavior plotted on an equal interval chart. Again, the correlations indicate no relationship between initial performance and subsequent learning.

Discussion

The data from the present investigation have implications for Precision Teachers and Equal Interval Charters. From the perspective of Precision Teachers, the data confirm that neither learning nor variability can be predicted from low initial performance, even when that performance includes few, if any, corrects and many incorrects. From the perspective of Equal Interval Charters, the data confirm that correct learning cannot be predicted from low initial correct performance. These data, along with the previous work of Koenig (1972), McGreevy (1978, 1980, 1981) Stromberg and Chappell (1980), Bower and Orgel (1981) and Eaton and Wittman (1982), suggest that the "leap up" or "hard to do" initial performance strategy should continue to be tested by Precision Teachers and Equal Interval Charters in a wide range of educational settings.

REFERENCE NOTE

1. Pennypacker, H. S., Koenig, C. H., & Lindsay, O. R. Handbook of the Standard Behavior Chart. Precision Media: Kansas City, Kansas, 1972. The initial accuracy ratio is the ratio of the initial correct frequency (or the initial number correct) to the initial incorrect frequency (or the initial number incorrect). This ratio is read on the Standard Celeration Chart as the distance from the initial incorrect frequency to the initial correct frequency.

REFERENCES


Lindsay, O. R. Personal communication, 1978.


Patrick McGreevy is an assistant research professor and the Director of Client and Community Services for the University of Missouri-Kansas City UAF, 2220 Holmes, Kansas City, Missouri 64108. James G. Thomas is a graduate student in the Department of Psychology, University of Missouri-Kansas City. Lynette Lacy is the lead teacher of the University of Missouri-Kansas City UAF Preschool for Handicapped Children. Steven Krantz is an assistant professor and the Director of University-based Training for the University of Missouri-Kansas City UAF. Christine Salisbury is an assistant professor of special education at the State University of New York at Binghamton.

Cori Brown is the Resource Coordinator and Beth Gibson is the Coordinator of Technical Services for the University Affiliated Facility (UAF), University of Missouri-Kansas City, 2220 Holmes, Kansas City, Missouri 64108.

The recent influx of micro-computers into the American classrooms has placed several pressing demands upon educational researchers and product-materials developers. A critical need exists for rate-based software, adequate promotion and marketing of the developed materials, a timing standardization for precision-teaching software, and the sharing of computer-generated data to determine present proficiency standards.
Chart 1. The Use of a Technical Assistance Clearinghouse (TAC)

x1.4 per 6 months

x1.3 per 6 months

SUCCESSIVE CALENDAR MONTHS

- requests for materials
  - items loaned

Calkins

C. Brown et al.

SUPERVISOR

University Affiliated Facility (UAF)

ADVISER

University of Missouri-Kansas City

MANAGER

BEHAVER

C. Brown

DEPOSITOR

AGENCY

COUNTED

CHARTER
Using Spark 80 multiplication tables software (Trifiletti, Trifiletti, & Williams, 1979), ten exceptional education middle school students with two months of intermittent keyboard practice were timed daily on 50 see-type random numerals (0-10) for a period of one school week. Frequency determination has been programmed into Spark 80, thereby making comparison with other frequency-oriented programs somewhat difficult. It is worthwhile to note that Spark 80 uses a clock-on/clock-off approach; the clock is on as the example is introduced, going off after the student response. With the introduction of the next example, the clock again comes on. We feel this is an excellent software approach. It reduces eye strain, anxiety, and video confusion, and, in our opinion, greatly increases the validity of the resulting scores. Time is also built into the program for introducing interventions.

The see-type random numerals program was improvised by Donna to give us an adequate gauge upon which to determine individualized proficiency standards. Donna transformed the Spark 80 Times 1 drill into a see-type random numerals (0-10) utilizing ordinary masking tape to cover the x1 on each example. The students and Ken were asked to quickly type the numeral displayed on their monitor. All the students (and Ken) completed all 50 numerals each day. The program computed digits typed per minute. The resulting data are displayed in Chart 1. From these and other data, we conclude and generalize:

(1) a see-type digits performance standard is presently 60-100 digits per minute;
(2) a see-type digits on random math operations (sums to 18, differences from 18, multiplication 0-9, and simple division) proficiency standard ranges from 50 digits per minute for the beginning typist to 70-80 digits per minute for the more experienced;
(3) an individualized performance standard should not be established for an individual until at least a week of data-gathering has taken place;
(4) accelerations of x1.5+ should be expected from novice typists during the first week of timings; frequency tends to level off at approximately 80-90 digits per minute after the first week of practice;
(5) as more and more students acquire digit-typing proficiency, performance standards should rise accordingly; frequencies of 100-200 digits per minute with no errors should be commonplace within several years; and
(6) for performance standard generalizations to be meaningful, software timing standardization is needed; for precision teaching to be meaningful as a national research tool in an age of micro-computer interactions, a standard timing gauge is critical; this must be accomplished while the technology is new, before the market is flooded with frequency-based software.

If you have questions about the software, please write us. We look forward to comment and similar data.

Kenneth U. Campbell and Donna McCarthy-Jensen are resource room teachers in north central Florida. Questions and comments should be sent in care of either author to Box 550, Micanopy, Florida 32667.

About PT

NOTES FROM THE EDITOR

Patrick McGreevy

Welcome to Volume III, No. 3. I would like to remind everyone to please help us with subscriptions. Encourage your agency to subscribe or give the Journal as a gift to a friend.

I would like to welcome Lynette Lacy as our new associate editor. She will assist in coordinating the review of manuscripts and preparing each issue for publication. I would also like to welcome Susan Evans, Julie Vargas, William Evans, and John Eshleman to the editorial staff. I look forward to working with these people.

Data-sharing groups are beginning to spring up around the country. Recently, "a small group of Alachua and Marion County (Central Florida) teachers founded the Association of Precision Teachers (APT). This quiet but landmark happening took place on August 10, 1982 at the home of Marie LaFave. The primary purpose of the group is to improve teaching and student learning through Precision Teaching procedures. Monthly meetings will be held. Programs at the meetings will include sharing data and procedures on a specified topic, supporting new Precision Teachers and planning ways to advance the cause of Precision Teaching and data-based instruction.
Chart 1. Determining Proficiency Standards for Digit Typing on a Micro-computer


<table>
<thead>
<tr>
<th>Days</th>
<th>10 students</th>
<th>11-32</th>
<th>see-type digits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Campbell/McCarthy-jensen</td>
<td>TRS-80</td>
<td>Spark 80</td>
</tr>
</tbody>
</table>
in this area." (taken from the APT Baseline, Volume I, No. 1, September 29, 1982) John Dowden, Bob Garner and Tom McInelly have organized a group in Omaha, Nebraska. Their next meeting is scheduled for early December. Most of you know that the greater Boston area data-sharing group led by Carl Binder was organized several years ago and is still going strong. If you decide to form a group, let us know about it and share your data for possible publication.

The Data-sharing Newsletter is back in business! I would encourage all of you to subscribe. Each issue is filled with useful data, references, and procedures. A yearly subscription is $10.00. To subscribe, send a check to: Carl Binder, Precision Teaching and Management Systems, P.O. Box 169, Nonantum, MA 02195.

If you would like to recommend changes in the format or content of JPT, don't hesitate to let us know. This is your Journal.

CHARTING ADMINISTRATIVE BEHAVIORS

Skip Berbaum & Ann Starlin

Administrative leadership and effective management are necessary for any institution or organization to run efficiently. Schools are certainly no exception. One of the consistent and clear findings of the "effective schools" research conducted in the 1970's was that schools that produced more of these fluent students, it seems appropriate, in continuing this logic, to similarly

to chart the behaviors of teachers and administrators (Sacajawea Project data), how many teacher charts are being kept? How many, administrators to run efficiently. Schools are organized several years ago and is still going strong. If you decide to form a group, let us know about it and share your data for possible publication.

The Data-sharing Newsletter is back in business! I would encourage all of you to subscribe. Each issue is filled with useful data, references, and procedures. A yearly subscription is $10.00. To subscribe, send a check to: Carl Binder, Precision Teaching and Management Systems, P.O. Box 169, Nonantum, MA 02195.

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Administrative leadership and effective management are necessary for any institution or organization to run efficiently. Schools are certainly no exception. One of the consistent and clear findings of the "effective schools" research conducted in the 1970's was that such schools were not necessarily those who were instructional leaders, rather than being just building managers. This is hardly an earth-shaking revelation. It should, however, "elicit the somewhat novel question "What is it that an effective (fluent?) principal does?"

This line of questioning in the 1960's and 1970's led not only to a precise description of what fluent students did, but actually altered some educational programs in a way that produced more of these fluent students. It seems reasonable to assume that classroom visits and classroom observations must be made.

In managing this aspect of my administrative behavior, I followed a guideline that seems to have growing application for us: Quantity precedes quality. Quantity precedes quality. Quantity precedes quality. Consequently, my objective was to visit classrooms. I made no initial difference between long or short visits, or between specific reasons for visits. If I entered a classroom, I made a count. My intention was to make many classroom visits. I made no initial difference between long or short visits, or between specific reasons for visits. If I entered a classroom, I made a count. My intention was to make many classroom visits and to chart the behaviors of the fluent principal. If education is reluctant to systematically collect and analyze data on ourselves? We don't think so either. (Quick, Ann, help me down from this soap box before the mob attacks.)

Enough of this chiding. Perhaps you would like to see an actual chart of a principal's behavior? Let me get the file of charts on myself. It happens, by the way, to be the skinniest folder in my filing cabinet. (Let he who is without sin cast the first dol.) This is not to imply that I have no need to chart more of my own behaviors. It simply means that I am like so many others in this field. I love to collect, analyze and judge data, as long as it is on someone else! (The chart, please, Ann. They are getting nasty again.)

The effective principal must know what is happening in her or his school. It is necessary not only to look at some end result, such as student performance data, but also to analyze classroom data that is necessary to properly assess the teaching/learning process. In managing this aspect of my administrative behavior, I followed a guideline that seems to have growing application for us: Quantity precedes quality. Consequently, my objective was to count classroom visits. I made no initial difference between long or short visits, or between specific reasons for visits. If I entered a classroom, I made a count. My intention was to make many visits to each room. Within these many visits would be long visits and short visits, and some formal observations. From this quantity of visits, I hoped to draw the "quality" component that is necessary to properly assess the teaching/learning process.

Phase 1 of the chart shows the number of room visits I made per week, when I counted and charted them daily (there data are summarized from another chart). I drew several conclusions
Chart 1. A Principal Visits Classrooms

Phase 1: Count & Chart Daily
Phase 2: Record Daily by Room; Chart Weekly Total
Phase 3: Resume Phase 2

no school

S. Berquam
SUPERVISOR
Port Angeles Public Schools

S. Berquam
BEHAVER

visits classrooms

Port Angeles, Washington

S. Berquam
AGE

COUNTED

S. Berquam
MANAGER
Port Angeles, Washington

S. Berquam
ADVISER

Port Angeles Public Schools

S. Berquam
DEPOSITOR

Port Angeles Public Schools

S. Berquam
AGENCY

Port Angeles Public Schools

S. Berquam
TIMER

Port Angeles Public Schools

S. Berquam
COUNTER

Port Angeles Public Schools

S. Berquam
CHARTER

Port Angeles Public Schools
from the charted daily data. First, there was so much bounce that trends were not always apparent. Second, there were days when I made few visits. If I were concerned about keeping visits rather constant from day to day, daily recording would have been necessary. This also would have shown the influence of regularly scheduled meetings, such as administrative team meetings on Tuesdays. Neither of these were important concerns, however.

After about four months of this recording, I focused on one main objective. That was to get into each classroom regularly, such as twice each week. I made a weekly record sheet with each room listed, and a space to check for each day of the week. From this sheet I could get daily totals, room totals per week, and total visits per week. I then charted total visits per week. If I met my objective of two visits per room each week, my weekly chart would be fairly stable. Phase 2 of the chart shows the result of my room visit schedule through the end of last school year.

Once again I learned that merely monitoring behavior is often enough to change it. When I improved my recording procedure in January, my weekly counts immediately increased. Also, a trend became evident. March counts started low (I was in Orlando for the Winter Conference), and there was a dramatic decline in May and June, as end of the year planning began to take much of my time.

Phase 3 shows data from the first three weeks of the current school year. I knew that I was attending more meetings than the previous September. I also knew that other activities were taking more of my time. (We were planning a staff development program in precision teaching, and a small conference to be held in November.) The data were beginning to make me somewhat uncomfortable.

As you can see by the chart, I made a traditional, somewhat predictable, and totally irrational decision upon being confronted with irritating data. I stopped collecting it. Here I was, an espoused disciple of data, and it took me four weeks to admit that the real reason I quit charting was not because I was too busy to chart, but that I did not like what the chart was telling me.

I had been making visits during that time, but not as many as I wanted. When I again started counting and charting, it forced me to rearrange my schedule to insure that I got into each classroom often.

What is the message here, friends? Perhaps that it's easier to ignore when you don't count. (Remember, ignore is part of ignorance.) I am sure there are many administrators and managers that are more diligent self charters than I. I am also sure that by sharing data and data collection procedures, we may begin to make as much progress in our own fluency as our students have in theirs. If you have a chart, share it. If you don't have a chart, start!

Here are some Chart Starters. Remember, start small, with a pinpoint that seems to be of major concern at the time: Number of phone calls; number of students sent to office (are Fridays really worse?); number of times YOU initiate a greeting to students; number of library books checked out; amount of ditto paper or Xerox paper used, by grade, room, subject, etc.; enrollment counts and projections; hot lunch counts; bus riding counts; daily attendance and tardiness, perhaps by period, if that is of interest; number of student charts kept; number of pages of professional reading. These are merely beginnings, and some of them may be inane, but if we can begin by regularly counting some simple behaviors, it will be easier to move to more complex pinpoints.

Send us your suggestions, and charted examples. In time, we may be able to describe the "fluent administrator."

REHABILITATION

Carl Binder & Charles Merbitz

The September, 1982 issue of Byte magazine was devoted to computers for the disabled, and has some articles of interest to the Precision Teacher. In particular, Paul Schweyda and Gregg Vanderheiden present a firmware card for the Apple II that allows a disabled person who can control only one type of input device to run commercial programs that require all other types of input. A Precision Teacher might use this device to have the microcomputer count and time behavior while running commercial programs that weren't designed to count and time.

Another interesting article, by Bruce Baker, reports on the development of a speech synthesizer using a language called 'Minspeak,' in which the disabled person selects concepts to communicate, not words, characters, or phonemes like other alternative communication methods. For example, a picture of a turkey represents "bad" or "danger," depending on the context. A microcomputer selects the word to send to a speech synthesizer based on context. If a Precision Teacher would work with Minspeak, we could have Standard Celeration Charts of concepts communicated per minute, and since it is on a microprocessor, all of the individual's
daily communicative behavior could be timed and counted. We know that people have circadian rhythms—which about weekly, monthly or seasonal undulations in concepts communicated per minute? Perhaps at the next Winter Precision Teaching Conference in Orlando we can discuss some of these possibilities.

See you there!

Please send any news items to:

Dr. Carl Binder
Behavior Prosthesis Lab
Walter E. Fernald School
Box 158
Belmont, MA 02178

Dr. Charles Merbitz
Rehabilitation Institute of Chicago
345 East Superior Street
Chicago, IL 60611

CONSIDERING STANDARDS

Erie C. Haughton

Performance standards! Who needs them?

Don't we have enough challenges in our day to day activities without introducing this nettlesome issue?

Exactly my own train of thought, or non-thought, about this topic unit, . . . At this point a montage of behaviors floods my inner eye, as I see people expected to perform, but inexplicably, could not. Searching backward and forward in their behaving systems, we (co-workers and myself) often found a key prerequisite performance either absent or else profoundly deficient.

Such findings, of profound lacks or deficits, led us to analyzing what we knew about performance-based decision making. Ten years ago this was a radical question as curricula decisions (for example) were largely based on quality considerations and/or were peer-norm referenced in our traditional, commercial standardized tests. Since performance decisions in our programs require specific, precise and topical data on both quantity and quality, we obviously had precious few performance references for our decision making.

That we have few reference standards in the Behavioral Sciences places us in marked contrast to other major human service providers. Concerned professionals in medicine, architecture and construction, transportation, nutrition and electronics are concerned about various standards influencing the quality of our lives. Not that there isn't more work to be done, enforcement improved and many refinements desired in this crucial area. We now take for granted, however, 37°C Celsius or 98.6°F Fahrenheit, resting pulse in the 60 to 80 beats per minute range along with 10 to 15 respiratory per minute ranges as among the indicators of adequate health. A lengthy listing of all the normal ranges of indicators signifying physical health is available. Those ranges are fairly well understood as are physical consequences resulting from being outside the range along with effective options for remediating debilitating deviations. On the other hand, suppose we require a such firm frame of reference in reading, writing or arithmetic? Until recently we have had no established performance standards against which we could compare our client's data. (Note: We require performance data not references that are related to such irrelevant factors as age or grade level.)

An early example of this dilemma occurred in my work about 1970 when, puzzled about some decisions required for grade one and two reading projects, I remember asking Clay and Ann Starlin what levels we could consider adequate in oral reading. Their best estimate was about 80 words correctly pronounced per minute. We needed a performance standard to guarantee children's successful progression in reading. Now, after many explorations based on performance and learning measurement, we know that preschoolers easily exceed 300 words per minute in the See text/Say words channel on practical and, practiced materials. These recent data underscore the retarding consequences of referring to age or grade averages when we need refined definitions of proficiency or fluency.

As many of you know, 80 words per minute exceeds 1982 grade one peer-norm referenced measurements by about x1.6. We, who are concerned about performance standards that insure proficiency, are required to learn what to expect from our performers and not from external data commercial sources. We learn about performance requirements from continuous assessment work with our cooperating behavers. Skilled people are like a carefully woven, beautifully symbolic tapestry—a wrap and woof of smoothly synthesized fluent performances.

The idea of relating to "standards" usually produces a mixture of interest, positive inferences, negative feelings, along with considerable trepidation. Quite a mixture! Such a mixture of inner reactions can combine to cause us to veer away from the issue. For good reasons too?

One of the most intriguing stories exemplifying the puzzle of our mixed feelings toward standardization relates to the habitual arrangement of our typewriter keyboard. My typing involves a QWERTY keyboard, established
by international agreement in 1905. This article has been prepared for publication on a 1982 micro-computer word processor, also using the QWERTY keyboard! Now, typewriters in 1905 were run by a sort of spaghetti-like maze of connectors which frequently jammed, even at low typing speeds. These machines especially jammed up as typists shifted from two-fingered hunt and peck typing style (popular in the early 1920's) to deciding to memorize the keyboard and to using all eight fingers to cover the typewriter's keyboard. Our QWERTY keyboard underwent careful design to slow down overzealous typists.

Then, in the 1930's, Dr. August Dvorak decided to improve the efficiency of the typewriter.

A simple time and motion study combined with a letter frequency analysis, along with improvements in mechanical design promised to revolutionize typing as a communication skill. The Dvorak Simplified keyboard places vowels on the "home row," thus increasing the number, as well as the frequency of words typed in this position. A Dvorak keyboard increases x30, from 100 QWERTY to 3,000 words typeable on the home row. Most prefixes and suffixes become available on the home row, too.

Further effectiveness occurs because instead of the left hand typing about 56% in the QWERTY arrangement, the right hand takes 54% of the work load in the Dvorak Simplified keyboard. As you might expect, typing frequencies increase by about 35%. Furthermore, finger travel for skilled typists is reduced by a factor of 20 from about 30 kilometers (20 miles) per day to 1.5 kilometers (1 mile).

Further effectiveness occurs because instead of the left hand typing about 56% in the QWERTY arrangement, the right hand takes 54% of the work load in the Dvorak Simplified keyboard. As you might expect, typing frequencies increase by about 35%. Furthermore, finger travel for skilled typists is reduced by a factor of 20 from about 30 kilometers (20 miles) per day to 1.5 kilometers (1 mile).

**Figure 1**

**KEYBOARDS—home row configuration**

<table>
<thead>
<tr>
<th>1932DVORAK Simplified</th>
<th>1905 STANDARD QWERTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>a c e i d h n s</td>
<td>a s d f g h j k l</td>
</tr>
<tr>
<td>(3000 words)</td>
<td>(100 words)</td>
</tr>
</tbody>
</table>

A more recent British ergonometric modification puts the thumbs to work on six keys as well as operating the space bar. This ergonomic design, moreover, is angled crescent shape allowing arms to operate in a comfortable, angled position, rather than pressed firmly to the body as required by our rigidly aligned linear keyboards.

So, here is the enigma which exemplifies some of...
our classic, confused emotional reactions to the
topic of standardization. In 1932, we could have
shifted to a keyboard that is easier to learn,
facilitates typing in several ways and allows for
increased performance. Yet, today, even
micro-computers require a $200 keyboard
enhance-ment to allow you to use this (or any
other personal) arrangement of keys. We are
still stuck with an arbitrary, outmoded,
inefficient and error-producing keyboard layout.
Resulting from a decision to standardize the
keyboard almost eighty years ago. How could
such a disaster occur? Mainly because we lack
necessary processes and procedures to manage
standardization.

So, if you approach this topic of standardization
with mixed feelings, imagine how August Dvorak
felt, when, at his death in 1975, no significant
moves had been made in such an apparently
simple and well-documented area as the
typewriter keyboard. This is an amazing example
of how agreed-upon standards have retarded
progressive, desirable developments. And yet,
there are many examples of how standardization
contributes to our comfort, health and security,
especially in health and physical areas.

Determination of performance standards requires
effort and so does their implementation into our
daily lives. Such challenges confront established
attitudes, current practices, technical habits, "old
wives' tales," economic factors as well as some
of our fundamental values. Therefore, the topic
of performance standards is complexly puzzling,
even potentially terrifying.

In this series of articles, we will explore this
stimulating and challenging topic, and the various
aspects and concerns related to human
performance standards. I welcome communication
and contributions from others concerned about
and/or working in this area. My plan is to
discuss such aspects as quantity and quality
criteria, decision making, simultaneous and
sequential implications, the role of prerequisites
in developing behaviour patterns, as well as to
explore various stages and techniques for
studying and establishing meaningful standards.
Furthermore, in the next article I will illustrate
how peer-normed performance referencing
contributes to retarding, even disabling each of
us and our developing students.

Little is yet known in this crucial area of human
performance development—especially in schooling
and academic areas—and so, my hope is that we
will cooperatively investigate this topic together
to expand and refine our knowledge. This is a
topic whose effects determine the consequences
of each project or intervention conducted by us
in the interest of our trusting clients.

Position Available

The Rehabilitation Institute of Chicago, a
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Precision Teaching with the Standard Celeration
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counseling. Responsibilities include design and
execution of research projects that elucidate the
relationships between events (especially in
therapy) and changes in the behavior of persons
undergoing rehabilitation. Ph.D. with hospital
experience desired, ABD considered. Salary
competitive. Please send vita to:

Charles Merbitz, Ph.D.
Learning Research Unit
Room 981
Rehabilitation Institute of Chicago
345 East Superior Street
Chicago, Illinois 60611
(312) 649-6397

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Attractive specially drawn posters (12"x18") or pictures (8"x11") on which the student places a brightly colored sticker each time he or she performs a predetermined behavior. After all stickers have been placed on the picture the student may color it and use it as an attractive wall decoration. May be used for group or individual behavior management. Hundreds of uses! Stickers and complete instructions included. For grade levels pre-school-8th.

REINFORCERS FOR STUDENTS

CLASS OVER 300 REWARDS (POSITIVE REINFORCEMENT) CLASSIFIED BY AGE APPROPRIATENESS FOR USE IN THE CLASSROOM OR SCHOOL SETTING. Positive reinforcement can be sensitively regulated to be administered at predetermined intervals. The REINFORCER SYSTEM includes a system of rewards, work privileges, and material rewards commonly found in schools. A handy reference chart is provided to identify rewards, work privileges, or anyone desiring to motivate students. For grade levels pre-school-12th.

EARN 'N CHOOSE

This is a motivational chart used to provide positive reinforcement for no individual or groups of students' ideal completion of specific behavior. The students(s) select with students. Each card has a reward written on it. The card writer tells what reward has been earned. Cards (rewards) can be varied as desired. It's an exciting classroom activity. Complete instructions, ideas for use included. For grade levels pre-school-12th.

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<th>Item</th>
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STANDARD GLOSSARY AND CHARTING CONVENTIONS**

Third Revision (October, 1982)

Accelerating Target --a movement the behaver, manager, advisor, or supervisor expects to accelerate; the frequency is symbolized by placing a dot on the Chart.

Accuracy Improvement Multiplier --a measure of change in accuracy over time; celeration correct/celeration incorrect.

Accuracy Multiplier --measure of accuracy: frequency correct/frequency incorrect; distance from frequency incorrect to frequency correct; also called the accuracy ratio.

Accuracy Pair --two movements, usually correct and incorrect, charted simultaneously.

Add-subtract Scale --any measurement scale on which adding and subtracting by a constant amount is represented by a constant distance; the "up the left" scale on an equal interval chart.

Advisor --person who advises a manager, usually viewing Charts on a weekly basis.

Behavior --person whose behavior is displayed on the Chart.

Behavior Floor --the lowest daily frequency possible for a particular behavior; 1/number of minutes behavior can occur; symbolized by drawing a solid horizontal line on the Chart.

Bounce Around Celeration --up bounce and down bounce combined; the range of deviations of frequencies from the celeration line.

Celeration --basic unit of measurement of behavior change; change in frequency per unit time.

Celeration Aim --the expected celeration for a given movement.

Celeration Line --a best-fit, straight line constructed through seven or more continuous frequencies of a given movement on the Standard Behavior Chart.

Celeration Multiplier (turn up or turn down)--value by which one celeration is multiplied or divided to obtain a second.

Change Day --first day of a phase change; symbolized by drawing a vertical line covering that day line on the Chart.

Counting Period Ceiling --the highest frequency observable under a given counting procedure; symbolized by drawing a dash line on the Chart connecting the Saturday and Monday lines.

Counting Period Floor --the lowest frequency detectable by a given counting procedure; 1/number of minutes spent counting; symbolized by drawing a dash line on the Chart connecting the Tuesday and Thursday lines.

Cycle --distance on the Chart between consecutive powers of 10.


Decelerating Target --a movement the behaver, manager, advisor, or supervisor expects to decelerate; the frequency is symbolized by placing an "x" on the Chart.

Double Improvement Learning Picture --both movements of an accuracy pair with celerations in the expected direction; for example <.

Down Bounce --the distance from the celeration line to the frequency farthest below it.

Duration --the amount of time it takes to complete one occurrence of a behavior; 1/number of minutes spent behaving.

Event-following Celeration Line --a celeration line drawn through all frequencies for a given movement just prior to a phase change.

Freehand Method --a method of visually estimating and drawing celeration lines.

Frequency --basic unit of behavioral measurement; the number of movements per unit time.

Frequency Aim --the expected phase-ending frequency for a given movement; symbolized by drawing \( \frac{W}{H} \) at the expected frequency on the day the aim was set.

Frequency Line --a horizontal line on the Chart; also called a counting line.

Frequency Multiplier (jump up or jump down)--value by which one frequency is multiplied or divided to obtain a second.

Geometric Mean --the appropriate method for obtaining an average on a multiply-divide scale.

Ignored Day --a day on which the behavior being measured occurs but is not charted.

Latency --the amount of time between the occurrence of a signal and the beginning of a movement; 1/time from signal to start of movement.

Learning --a change in performance per unit time; also called celeration.

Learning Picture --the celeration lines of both movements of an accuracy pair viewed together; for example <.

Manager --person who works with the behaver on a daily basis.

Median Celeration --the middle celeration in a celeration distribution; symbolized by drawing a "<" on the Chart.
Median Frequency — the middle frequency in a frequency distribution, symbolized by drawing a \( * \) on the chart.

Most Recent Celeration Line — a celeration line drawn through the last 7-10 frequencies for a given movement.

Movement — recorded behavioral event usually specified in terms of a movement cycle with a beginning, middle and end.

Multiply-Grade Scale — any measurement scale on which multiplying and dividing by a constant amount is represented by a constant distance on the "up, the left" scale on the Standard Behavior Chart.

No Chance Day — a day on which the behavior being measured has no chance to occur.

Overall Celeration Line — a celeration line drawn through all frequencies for a given movement.

Performance — the number of movements per unit time; also called frequency.

Periodic Celeration Line — a celeration line drawn through all frequencies for a given movement in a specific time period, such as bi-weekly or monthly.

Phase Change — a deliberate alteration made to the behavior's environment in an effort to improve the behavior being measured.

Quarter-Interest Method — a method for computing and constructing celeration lines.

Recorded Day — a day on which the behavior being measured has the opportunity to and is recorded.

Single Improvement Learning Picture — one movement of an accuracy pair with a celeration in the expected direction; for example \( \triangleleft \). .

Split-middle Line — a line drawn parallel to a quarter-interest celeration line, such that half the data points fall on or above the line and half the data points fall on or below the line.

Standard Behavior Chart — a standard, six-cycle semi-logarithmic chart that measures frequency as movements/time and celeration as movements/time/time; Daily, Weekly, Monthly, Yearly and Summary versions are available, also called the Standard Celeration Chart.

Supervisor — a person who views the Charts on a monthly basis.

Total Baseline — distance from the highest to the lowest frequency; analogous to range of an add-subtract scale.

Trend-following Celeration Line — a celeration line drawn through visible trends for a given movement.

Up Baseline — distance from the celeration line to the frequency farthest above it.


*Additions to the Second Revision (October, 1890).
Dedicated to Mrs. Irene McCreery,

Charles, taught us what we know.
children, who, by sharing therir
a very special person, and to the