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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.

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**PARALLEL BETWEEN FREQUENCY TESTING
AND PERFORMANCE ON ESSAY QUESTIONS
IN A THEORIES OF PERSONALITY COURSE**

**C. E. McDade
S. B. Rubenstein
C. P. Olander**

Center for Individualized Instruction

Abstract

Reinforcing high frequency of correct responses in a personality theories course resulted in student fluency with those theorists studied. This study examined the relationship between frequency testing of basic concepts and application of those concepts on essay questions. A consistent concomitant increase in frequency of correct basic concepts described or identified on flash cards and frequency of correct concepts written on essay questions was observed. When concepts were identified through an identical method on a microcomputer, similar results were observed.

In recent years there has been an emergence of alternative measurement and instructional strategies such as Precision Teaching (PT), Personalized Systems of Instruction (PSI) and Computer-assisted Instruction (CAI). Each system has produced valid principles which can be used to improve instruction. The Center for Individualized Instruction (CII), Jacksonville State University, has experimented with frequency testing, a component of PT, in conjunction with CAI and PSI. Frequency testing refers to assessing student accuracy and fluency with academic material during short counting periods.

Frequency testing key basic concepts in a discipline can result in a proficient understanding of these concepts by the student, as well as, positive reinforcement for the instructor (Merbitz & Olander, 1980). Both student and professor develop a common ground--a working fluency with the terminology--which allows them to discuss freely and confidently the more complex ideas in the discipline.

A combination of three innovative teaching methods--PT, PSI, and CAI--allows a student to learn through self-paced instruction, with no penalty for repetition of material or for being "slower" than other students. Large lessons are divided into modules which the student learns one at a time, achieving a fluency criterion determined by the instructor.

Microcomputers can be used for frequency testing students, since they can minimize bias and completely eliminate scoring errors. Scanlon

(1981) suggested that the computer is not meant to replace the teacher and should rarely be used without advisor or instructor supervision. In the CII, microcomputers are used to provide testing, exercises, or simulations, most requiring advisor-student interaction to interpret computer-generated feedback.

The unique nature of frequency testing makes convincing students of the validity of the method difficult at first, but this is soon overcome. When a student experiences feelings of accomplishment from reaching a goal, s/he is apt to seek further opportunities to realize additional achievement-oriented behaviors (Porter, Lawler, & Hackman, 1975).

The present study compares frequency testing under two conditions: flash cards versus computer-generated terms. It also examines the validity of frequency testing by observing parallels between frequency test performance and essay question performance in university undergraduates enrolled in a theories of personality course.

Method

Subjects and Setting

Six undergraduate students enrolled in PSY 335: Theories of Personality at Jacksonville State University (JSU) served as subjects in this study. All subjects enrolled in the class were unaware of any experimental design incorporated into their course policy, although they were informed that the policies of the course would be modified in response to student performance.

The course was structured under the Personalized Systems of Instruction (PSI) method used at the Center for Individualized Instruction. Student performance sessions were monitored by the instructor or by graduate and undergraduate advisors with knowledge of the course material. Students were allowed to come to the Center as often as they liked to seek help on material.

Procedure

Students taking PSY 335 were required to become fluent with the ideas of one theorist before proceeding to subsequent theorists. After fluency with three or four theorists was demonstrated, the student took a review test, contributing one-fourth of the course grade.

Student evaluation exercises were of two types: (1) description or identification of basic concepts, terms or definitions, and (2) composition of an essay. Frequency testing of the descriptions or identifications required two fluency criteria: (1) an accuracy criterion of

80%, and (2) a minimum correct frequency of 10 concepts per minute. A randomly chosen essay question was used to assess student knowledge of more complex concepts (i.e., application, integration, synthesis, or evaluation). If the number of correct concepts written exceeded the number of incorrect concepts (i.e., those omitted or definitely incorrect), the essay was scored, "Pass!" If not, the essay was scored, "Try again!" Once a student chose to frequency test, s/he was required to attempt an essay question immediately after the frequency session, regardless of whether fluency was reached.

Course material was organized into four units, each with three or four individual theorists. The frequency testing component of evaluation was presented on flash cards for the first and last quarters of the course, while an Apple II microcomputer presented it for the second and third quarters. The flash cards allowed the student to see and sort all ten terms to be defined and required the student to give a verbal response to an advisor. It was the advisor's responsibility to time the student and assess his/her accuracy. When the microcomputer controlled the frequency testing, it presented questions in the concealed multiple choice format, randomizing both questions and individual foils. The computer determined the student's accuracy and fluency. In both forms of frequency testing, the student received immediate performance feedback. The difference between the forms of frequency testing could be described as recall vs. recognition. After each testing period, the students were required to chart their frequencies correct and incorrect for both essay performance and the flash card or computer frequency testing. All charting was done on Standard Celeration Charts, usually with the assistance of an advisor.

Results

Number of attempts to read fluency with both types of frequency testing--the flash card technique and the computer-assisted testing--were compared. No significant difference was observed. The mean number of attempts to reach fluency on the material by recall on flash cards was 9.0 and by recognition on the computer was 10.2 (Mann Whitney U = 15.5, $p = .38$). Additionally, the individual quarters of the course were compared with a Kruskal-Wallis One Way ANOVA. No significant difference in the number of attempts to reach fluency was found ($H = 1.68, \Upsilon = 3$).

A consistent, concomitant increase was seen in frequency of correct basic concepts described or identified on both frequency testing methods (i.e., flash cards and microcomputer) and frequency of correct concepts written on essay

questions. Charts 1 and 2 display one student's performance on frequency testing of basic concepts and essay questions. Generally (for all students), as the frequency of correct concepts on the frequency testing component increased, the frequency of correct concepts on the essay questions also increased. The opposite also holds true for the frequency of incorrect concepts.

Typically, also, the frequency of words and concepts written per minute on the essay questions increased over the course. A comparison between the last essay question on the second unit and the thirteenth unit showed a mean increase in frequency of words of 5.8 ($t = 2, p < .05$), as well as a mean increase in frequency of correct concepts of 0.69 ($t = 0, p < .05$). The authors also observed that students were answering the essay questions concisely, without excessive verbage.

Discussion

The present study has two implications for improving college instruction. First, frequency testing key basic concepts, resulting in the student becoming fluent as well as accurate, facilitates student use of those concepts on essays. Not only do the students apply the concepts better as they identify them fluently, but they also do so more concisely.

Secondly, frequency testing requiring recall and frequency testing requiring recognition appear to have the same effect on essay performance. With no difference in the mean number of attempts to reach fluency, both formats of frequency testing are efficacious. Instructors with access to microcomputers can enjoy the benefits of computerizing frequency testing without fear of the machine "de-humanizing" the classroom. Those who do not have the technological advances in their settings can create flash card decks which will assess student performance just as well.

The validity of frequency for shaping and evaluating student performance is being supported by a growing body of empirical data. Given the charge of teaching unique individuals with varying levels of intelligence, motivation, and past academic performance, the university instructor may find frequency indispensable for accomplishing the task.

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CALENDAR WEEKS

10 Jan 82
 DAY MO YR

7 Feb 82
 DAY MO YR

7 Mar 82
 DAY MO YR

4 Apr 82
 DAY MO YR

DAY MO YR

DAY MO YR

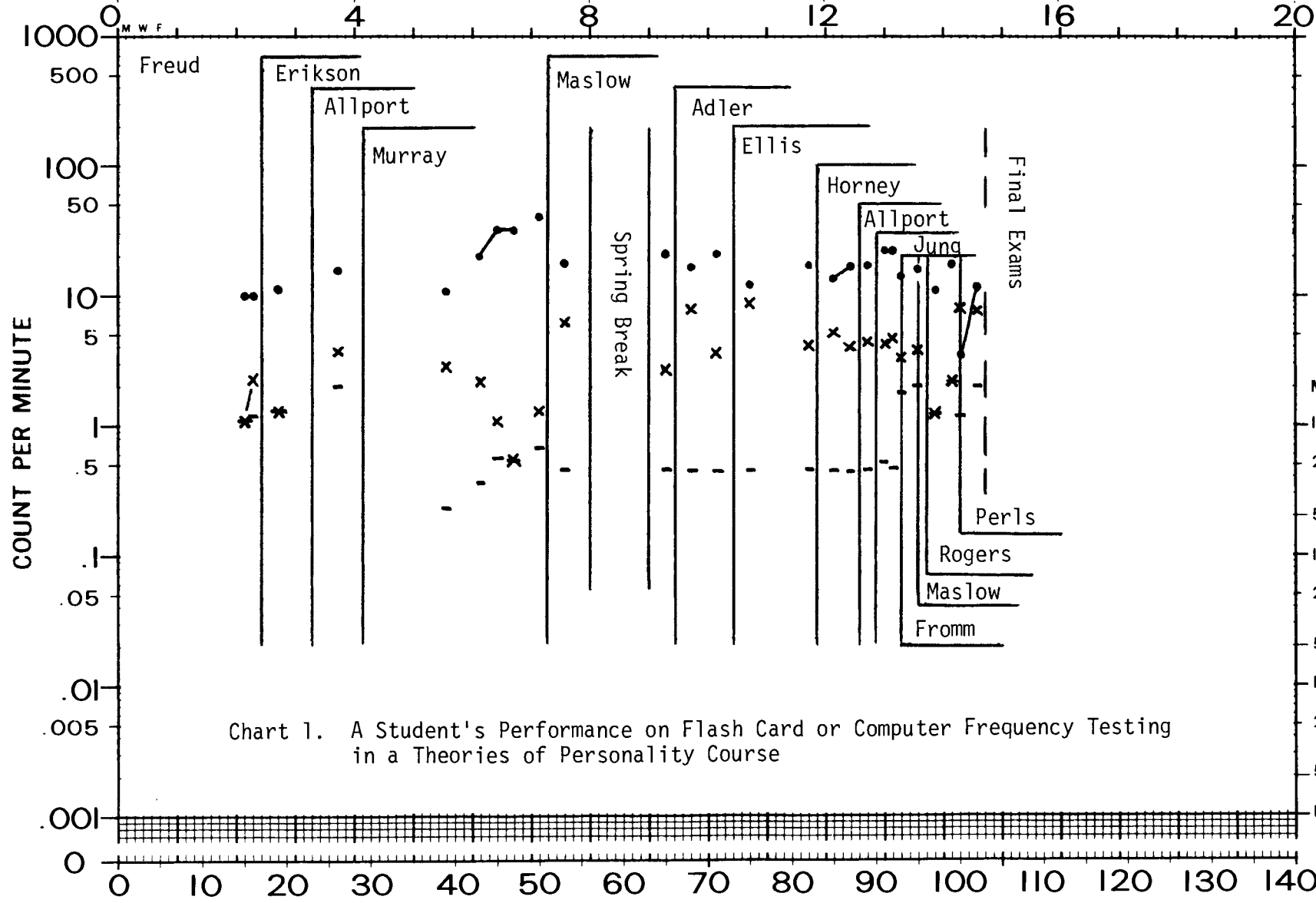


Chart 1. A Student's Performance on Flash Card or Computer Frequency Testing in a Theories of Personality Course

McDade, C.E., Rubenstein, S.B., and Olander, C.P. Parallel between frequency testing and performance on essay questions in a theories of personality course. *Journal of Precision Teaching*, Volume IV, Number 1, Spring, 1983.

McDade Olander Rubenstein SUCCESSIVE CALENDAR DAYS C.P. sees and says
 SUPERVISOR ADVISER MANAGER BEHAVIOR AGE LABEL COUNTED
 Center for Individualized Instruction Jacksonville State University Jacksonville, Alabama
 AGENCY

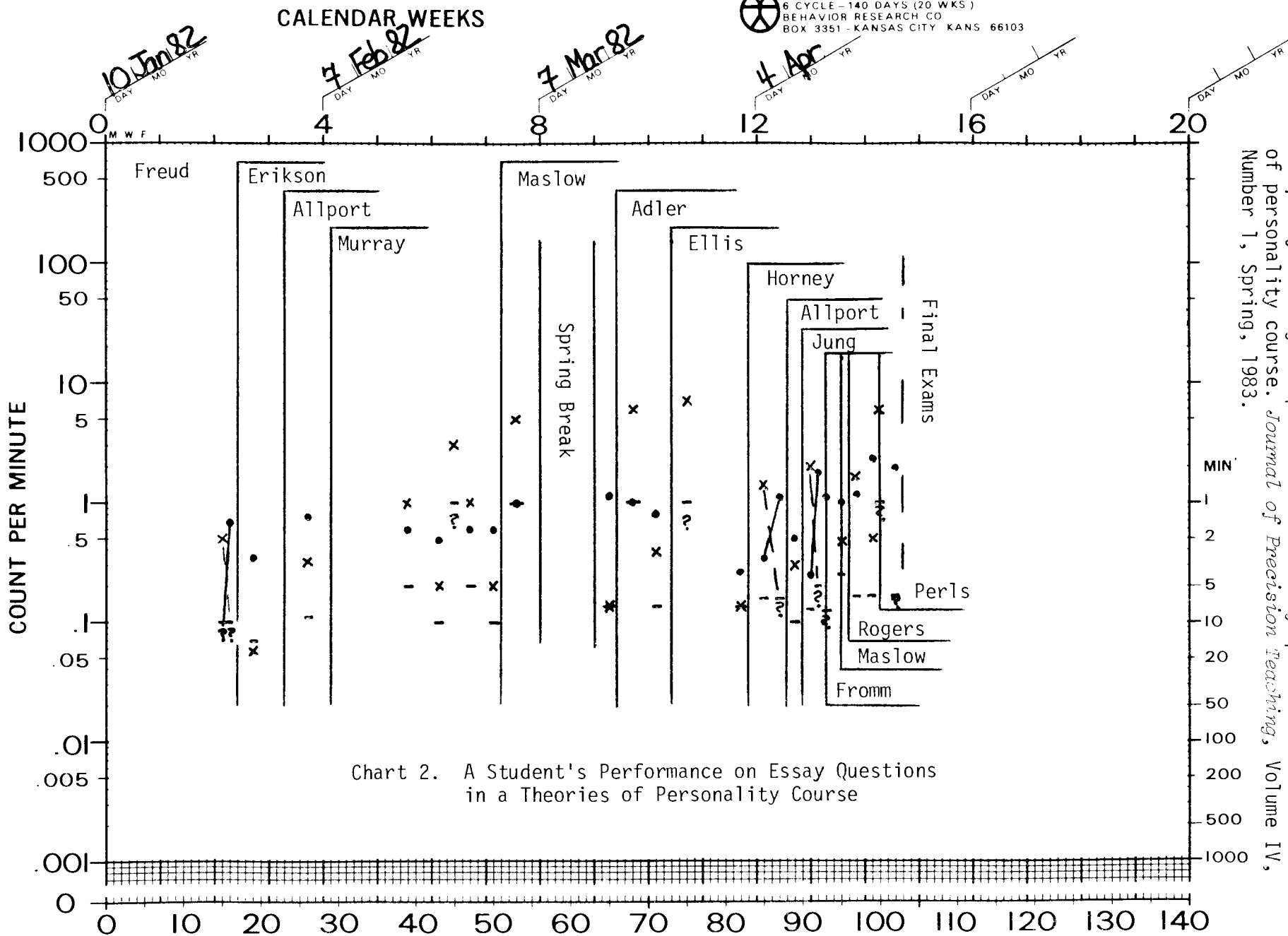


Chart 2. A Student's Performance on Essay Questions in a Theories of Personality Course

McDade, C.E., Rubenstein, S.B., and Olander, C.P. Parallel between frequency testing and performance on essay questions in a theories of personality course. *Journal of Precision Teaching*, Volume IV, Number 1, Spring, 1983.

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VARIABILITY: AN AID IN THE ASSESSMENT OF THE EFFECTIVENESS OF TRAINING PROCEDURES¹

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University of North Carolina at Charlotte

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Abstract

Pennypacker, Koenig, and Lindsley's variability procedure was used to illustrate the bounce in performance of eight severely/profoundly handicapped persons when they were trained to assemble two complex vocational tasks via two training procedures (total task presentation and backward chaining). From an analysis of the results, it can be concluded that subjects' correct performance under the backward chaining condition was significantly more variable than when correct responding was controlled by the total task condition. Practitioners are encouraged to quantify and analyze bounce to

¹The authors would like to acknowledge Owen R. White, University of Washington, for assistance in the analysis of the data; Jim Favell, Western Carolina Center, for editorial critique; Meda Smith, Western Carolina Center, for typing the final manuscript, as well as previous drafts; and Cynthia Stirewalt for assistance in re-drafting the design.

assist in making decisions about the effectiveness of training procedures.

The quantification of behavior change (celeration) and variability (bounce) are two of the many features of the Standard Celeration Chart that have a significant impact on the daily decision-making behavior of practitioners. The relationship between celeration and bounce and to what extent the bounce is due to celeration or uncontrolled variability is an important practical training issue. Frequently, this relationship is not used to its greatest practical utility--an aid in the assessment of the effectiveness of training procedures.

Pennypacker, Koenig, and Lindsley (1972) and White (Note 1) suggest that the more variability that can be explained by the effects of the celeration, the more effective the procedure, and the greater the predictive power of the procedure. In essence, measurement of variability during the treatment phase of a training program can be used to assist in assessing the effects of procedures on learning. The purpose of this paper is to explain Pennypacker et al.'s (1972) procedure for measuring and quantifying variability, and to apply this method to the assessment of the effectiveness of backward chaining (BC) and total task (TT) training procedures with severely handicapped persons.

Method

Subjects and Setting

The subjects were eight severely and profoundly handicapped individuals living in a state residential training facility. The five women and three men ranged in age from 14 to 58 years. Their I.Q.'s as measured by the Stanford Binet ranged from 14 to 27. Six of the subjects were enrolled in a vocational training program where they sorted plastic spoons, while two adolescent subjects were enrolled in an on-grounds school program.

The setting was a 5 by 4 meter room divided by a wall to provide two training rooms. The settings were tailored to be similar.

Apparatus

Two different items, a drain and a gate valve, were assembled by each subject. Each item consisted of seven different pieces. No pieces of the two items were identical or interchangeable. The drain was composed of a 7 cm by 3.5 cm drain head, a .65 cm rubber washer, a 6.5 cm hexagonal lock washer, a 4.5 cm by 10 cm pipe, a 4 cm slip nut, a 4.5 cm

plastic washer, and a 4.5 cm rubber stopper. The gate valve was composed of a 6 cm turn knob, a 1 cm nut, a 2.5 cm cap, a 4 cm by 4 cm valve, a 5 cm plastic washer, a 6.5 cm by 7.5 cm housing, and an 11 cm stem. Each item was placed in a wooden training tray (60 cm by 45 cm) that had seven different compartments. The items were organized in the order described above. Pieces for three drains or three gate valves were placed in each tray.

Procedures

Experimental design. The experimental design was a multielement design (Sidman, 1960; Ullman & Sulzer-Azaroff, 1975). This design is also referred to as an alternating treatments design (Barlow & Hayes, 1979). Figure 1 is a graphic depiction of the display of the design, using Johnston and Pennypacker's (1980) notation of design elements. The independent variables were the backward chaining (BC) and the total task (TT) training procedures. Daily correct and incorrect frequencies were collected for each of the two items and served as the dependent variable. Each subject started in a baseline (i.e., non-training) condition, against which progress in the training condition was evaluated. The baseline condition was also used to empirically validate that the learner could not assemble the item(s) without training. Trials were alternated as outlined in Figure 1. For example, on the first day of baseline, Subject 1 started with Setting 1, Trial 1, gate valve. During that trial the subject was allowed many opportunities to assemble pieces of the item for three minutes. The frequency of correct and incorrect pieces was recorded on a data collection form and a corresponding Standard Celeration Chart. Then, Subject 1 moved to Setting 2, Trial 2, drain. Trial 2 was conducted in the same manner as Trial 1. Subsequent to Trial 2, the subject remained in Setting 2 with the drain and completed Trial 3. After Trial 3, the subject returned to Setting 1 and the gate valve and completed Trial 4. This completed Session 1.

The second day of baseline opened with Session 2, Trial 5 (see Figure 1). Trials 5 and 8 were conducted in setting 2 with the drain, while trials 6 and 7 were conducted in Setting 1 with gate valve. Sessions 1 and 2 were alternated every other day until "steady state responding" (the celerations for the correct and incorrect frequencies were $X1$) was achieved. Data were collected and charted separately for each Trial number.

On the first day of training, Subject 1 started with session 1 in Setting 1 with the TT procedure and the gate valve. That trial consisted of one opportunity to assemble every

piece of that item. Immediately following the completion of Trial 1, Subject 1 moved to Setting 2 and was trained with the BC procedure on the drain. Trial 2 was one opportunity to assemble the last piece of the item. Subsequent to Trial 2, the learner immediately went to Trial 3 which occurred in the same setting and with the BC procedure. After Trial 3, the learner returned to Setting 1 with the TT condition and the gate valve and completed Trial 4. Session 1 was completed with the conclusion of Trial 4.

The second day of training opened with Session 2 which started with Trial 5. In Session 2, the order in which Subject 1 received the item and training procedure was reversed from that received in Session 1. On the third training day, Subject 1 received the sequence reported in Session 1 and on the fourth training day the Session 2 sequence, and so on for each subsequent day in the investigation. As in the baseline condition, data were collected and charted separately for each Trial number.

Training procedures—Backward Chaining (BC) and Total Task (TT). In the BC procedure the subject was presented with a "completed assembly" except for the last piece. When that piece was completed either correctly or incorrectly, the trial and the counting period were over. At the time of the study, the authors could not find published indicators of acceptable frequency aims for similar vocational tasks. Therefore, subjects were required to meet a criterion of six consecutive correct pieces (without assistance) across trials before attempting to learn the "next to the last" piece. On subsequent presentations, the item was presented to the subject with all but the last two pieces completed. The subject followed this progression until s/he was completely assembling an unassembled item.

In the TT procedure, every step was trained every time and the subject started with the first step of the task. When all 7 pieces were completed either correctly or incorrectly, the trial and the counting period were over. A total of six consecutive correct items (without assistance) across trials was the criterion.

Calibration and reliability. The data were collected by two principal trainers. The trainers received approximately 12 hours of training prior to the start of "live" data collection. The key elements of the calibration training were: (a) frequency of correct pieces, (b) frequency of incorrect pieces, (c) recording procedure, and (d) timing procedure. These elements were trained to ensure stability, accuracy, reproducibility, and generality of the record responses (Johnston & Pennypacker, 1980).

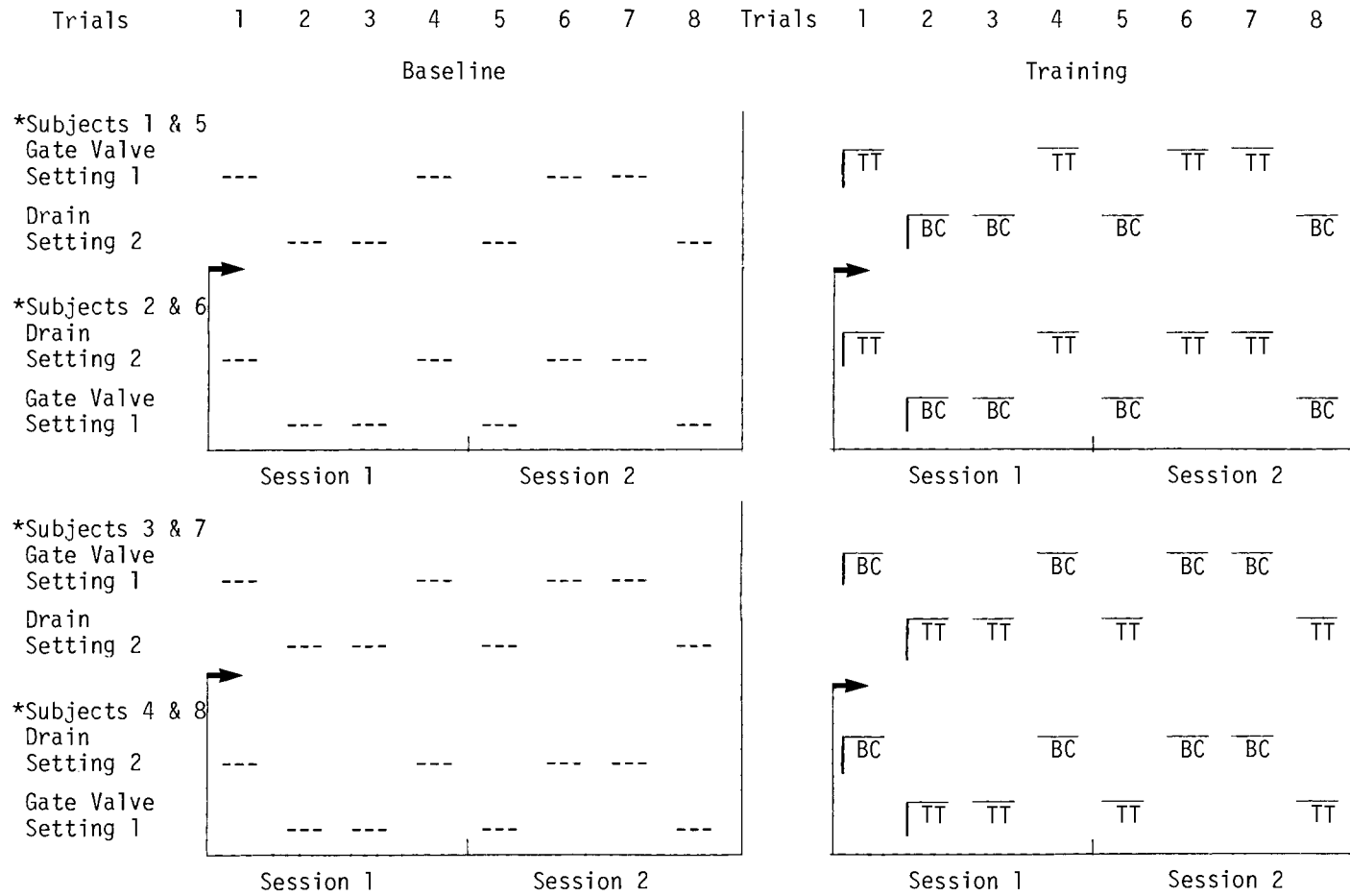


Figure 1. Experimental Design

During simulated "live" training (calibration), the trainers could introduce known sources of variation to provide assurance that the observer was exposed to a full range of possible values. Frequencies were also checked and compared to a mechanically produced record (i.e., videotape). These two calibration procedures are recommended by Johnston and Pennypacker (1980) and were used to ensure accuracy of human recording. When the trainers had trained each other in two consecutive trials without error, the calibration criterion was met.

For this investigation there was no measure of inter-observer reliability. This decision was based on Johnston and Pennypacker's (1980) statement that, "Using two or more observers to detect behavioral events cannot provide any information about the reliability of any one observer's judgment" (p. 163).

Measurement and Quantification of Variability

The variability (bounce) analysis used in the present study was secondary to the original celeration analysis. In the celeration analysis, Spooner (1981) found the TT procedure to be more effective than the BC procedure. After a thorough examination of the variability in the data, it was decided that the variability analysis could be used to help assess the effectiveness of the two procedures.

The procedure described by Pennypacker et al. (1972) is a measure of the total bounce **around** the celeration compared to the total bounce **including** the celeration (see Chart 1). Other investigators have used alternative terms to describe these bounce relationships. For example, Lindsley refers to the total bounce **around** the celeration as the "celeration course" because of the analogy between celeration and its bounce and a river and its banks (Graf, Note 2). Johnston and Pennypacker (1980) call the total bounce **including** the celeration a range coefficient. "The range coefficient is readily visualized as proportional to the distance between the largest and the smallest values displayed on a logarithmic scale" (Johnston & Pennypacker, 1980, p. 360). The ratio of these two measures is the percentage of bounce which is **not** accounted for by the celeration.

Pennypacker, Koenig, and Lindsley's (1972) Procedure

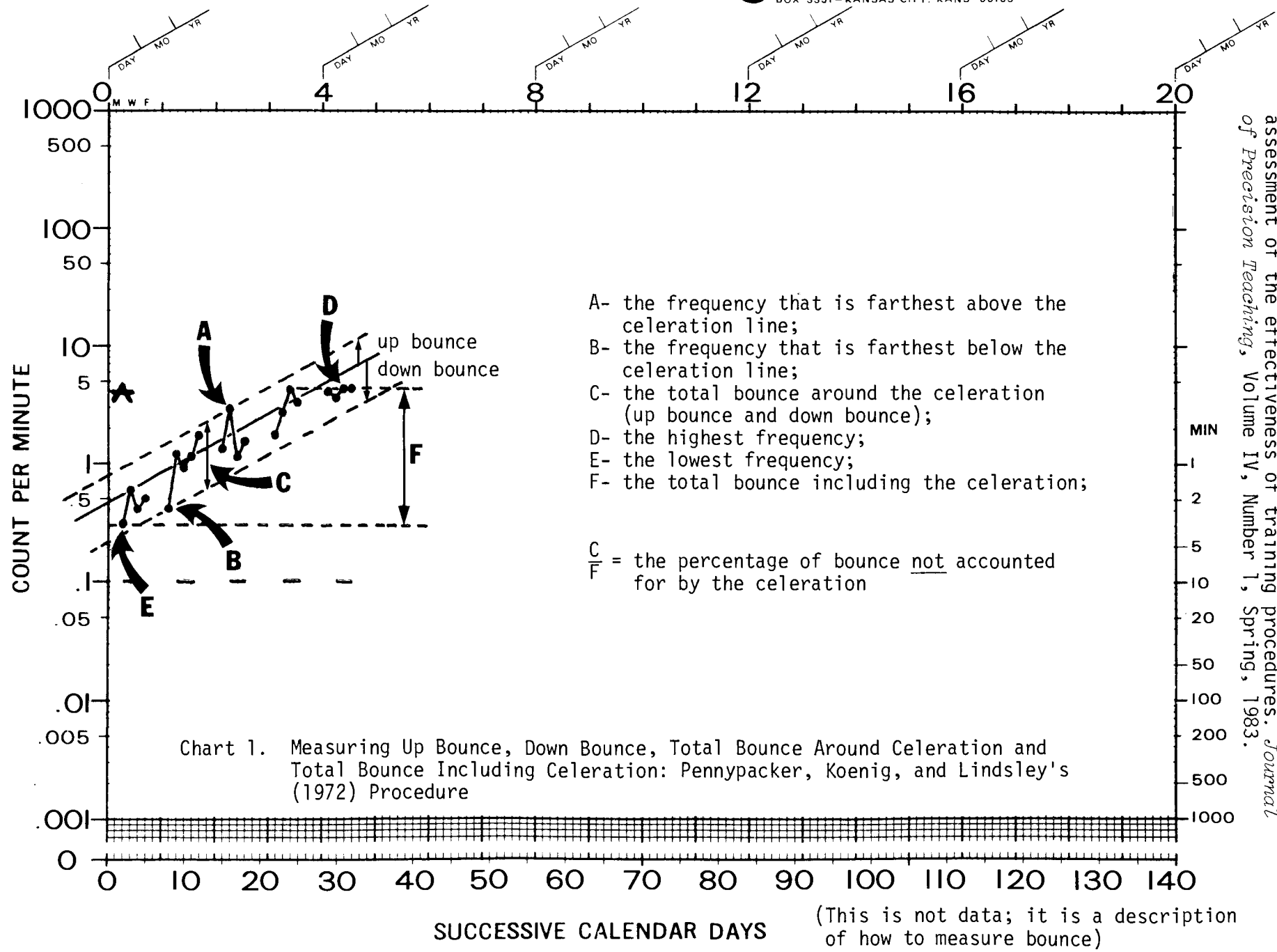
This procedure is a straightforward, powerful way of quantifying variability. It is not a statistical comparison for which a researcher needs a computer to determine the analysis. The procedure is conceptualized in the following format:

1. Measuring "up bounce," "down bounce," and "total bounce" **around** the celeration:
 - a. First, **draw the celeration line**.
 - b. Next, draw a line parallel to the celeration line which passes through the frequency that is farthest **above** the celeration line (see Chart 1, Point A). The distance along any day line from the celeration line to the new line is the up bounce.
 - c. Draw a line parallel to the celeration line that passes through the frequency that is farthest **below** the celeration line (see Chart 1, Point B). The distance along any day line from the celeration line to the new line is the down bounce.
 - d. The total bounce **around** the celeration is the total distance along any day line that is described by the distance of the up bounce and the down bounce (see Chart 1, Point C).
2. Measuring total bounce **including** the celeration:
 - a. Draw a horizontal line through the **highest** frequency in the set (see Chart 1, Point D).
 - b. Draw a horizontal line through the **lowest** frequency in the set (see Chart 1, Point E).
 - c. Measure the total bounce **including** the celeration as the distance between these two lines (see Chart 1, Point F).
3. Finding the ratio of total bounce around celeration to total bounce including celeration:
 - a. Take the measure of total bounce **around** the celeration as found in Chart 1, Point C and place it in the numerator of a fraction.
 - b. Next, place the measure that describes total bounce **including** the celeration, as found in Chart 1, Point F, in the denominator of the fraction.
 - c. Finally, divide the numerator by the denominator. The ratio is the percentage of bounce **not** accounted for by the celeration.

Using Variability as a Measure of the Effectiveness of Treatment Procedures

For the variability (bounce) analysis, the most typical performance for each individual subject was compared across training procedures. This was done by comparing the charts for each of the four trial numbers, calculating the points of least difference and determining the most typical trial. Chart 2 shows a summary of the most typical celeration and the "celeration course" for all 8 subjects in the BC and TT training

CALENDAR WEEKS



- A- the frequency that is farthest above the celeration line;
- B- the frequency that is farthest below the celeration line;
- C- the total bounce around the celeration (up bounce and down bounce);
- D- the highest frequency;
- E- the lowest frequency;
- F- the total bounce including the celeration;

$\frac{C}{F}$ = the percentage of bounce not accounted for by the celeration

Chart 1. Measuring Up Bounce, Down Bounce, Total Bounce Around Celeration and Total Bounce Including Celeration: Pennypacker, Koenig, and Lindsley's (1972) Procedure

Spooner, Fred, and Spooner, Doreen. Variability: An aid in the assessment of the effectiveness of training procedures. *Journal of Precision Teaching*, Volume IV, Number 1, Spring, 1983.

(This is not data; it is a description of how to measure bounce)

SUPERVISOR ADVISER MANAGER BEHAVIOR AGE LABEL COUNTED

DEPOSITOR AGENCY TIMER COUNTER CHARTER

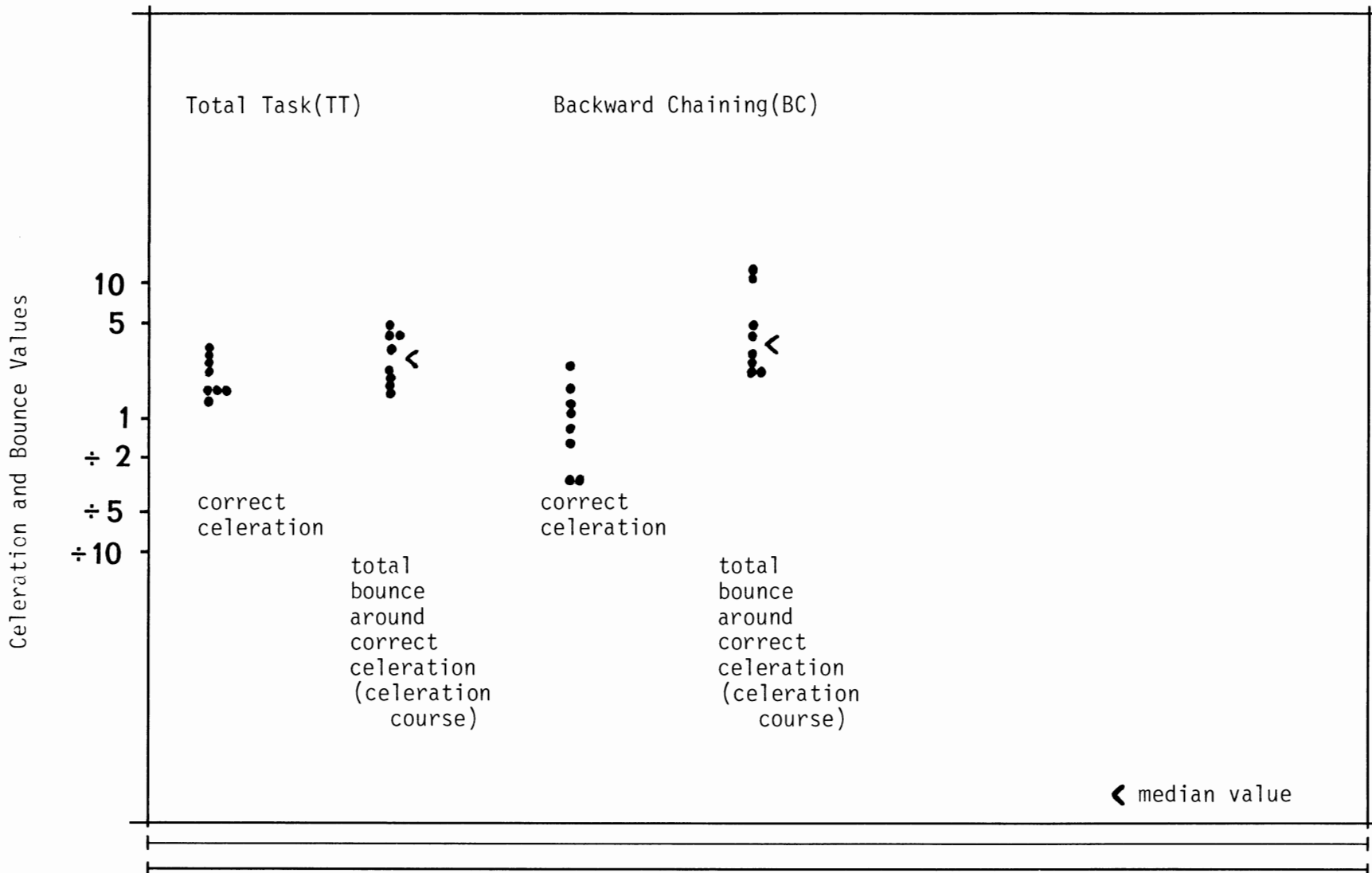


Chart 2. The Most Typical Celeration and "Celeration Course" for all 8 Subjects in the BC and TT Training Procedures.

Spooner, F. Spooner, D. _____

8 subjects assemble pieces of gate valve and drain

procedures. Using the median "celeration course" for each training procedure, it is evident that the BC procedure is 1.5 times more variable than the TT procedure. The percentage of bounce not accounted for by the celeration, for each subject's most typical BC trial, was compared with the percentage of bounce not accounted for by celeration for each subject's most typical TT trial (see Table 1). The range in bounce not accounted for by the celeration with TT procedure is 16% - 68%, with a median of 41%. The range in bounce not accounted for by the celeration with the BC procedure is 28% - 96%, with a median of 76%. In all but one case (Subject 8), the percentage of bounce not accounted for by celeration was less for the TT procedure. Charts 3 and 4 show Subject 2's most typical TT and BC performance (Trial 6). In the TT procedure (Chart 3), 16% of the bounce is not accounted for by the celeration. On the other hand, for the BC procedure (Chart 4), 85% of the bounce is not accounted for by the celeration.

Table 1

The Correct Celeration and the Percentage of Bounce not Accounted for by Celeration

Subject	Procedure	Correct Celeration	Percentage of Bounce Not Accounted for by Celeration
1	TT	X1.4	31%
	BC	X1.4	51%
2	TT	X1.5	16%
	BC	/1.05	85%
3	TT	X3.2	31%
	BC	X2.9	48%
4	TT	X1.6	51%
	BC	/1.4	83%
5	TT	X2.7	62%
	BC	/2.4	72%
6	TT	X2.4	16%
	BC	X1.3	85%
7	TT	X3	68%
	BC	X1.9	96%
8*	TT	X1.6	51%
	BC	/2.6	28%

*This is the only case in which the percentage of bounce not accounted for by the celeration is less for BC than for TT.

Discussion

Variability is a measure that may be used to assist in the assessment of the effectiveness of training procedures. Data in this study were used to illustrate Pennypacker et al.'s (1972)

procedure as a useful quantification tool when researchers are interested in more than just "estimating" variability. The median total bounce around celeration was 1.5 times greater for the backward chaining (BC) procedure than for the total task (TT) procedure. In all but one of eight cases, the percentage of bounce not accounted for by the celeration for the BC procedure was greater than the percentage of bounce not accounted for by the celeration for the TT procedure.

The results of this investigation call the researcher's attention to variability (bounce) as a measure of the effectiveness of training procedures. The relationship between celeration and bounce and to what extent that bounce is due to celeration is an important practical training issue. If bounce **around** the celeration is small and the bounce **including** the celeration is large, then a greater proportion of that bounce is accounted for by learning. The training procedure is also exerting greater control over subject responding. On the other hand, if the bounce **around** the celeration and the bounce including the celeration are both large, then a greater proportion of that bounce is not accounted for by learning. In this case, the bounce is attributed to uncontrolled sources and less control is exerted on responding by the training procedure. If the bounce is accounted for by learning, then the practitioner should continue to observe responding and continue with the training procedure. If the bounce is not accounted for by learning, then it would be necessary to plan a program change.

The findings of this study and Spooner's (1981) previous work challenge the continued use of the BC procedure. With this procedure, learning is likely to be less and unaccounted variability greater when compared to the total task procedure. Practitioners should consider using the total task procedure because of its effects on both celeration and bounce.

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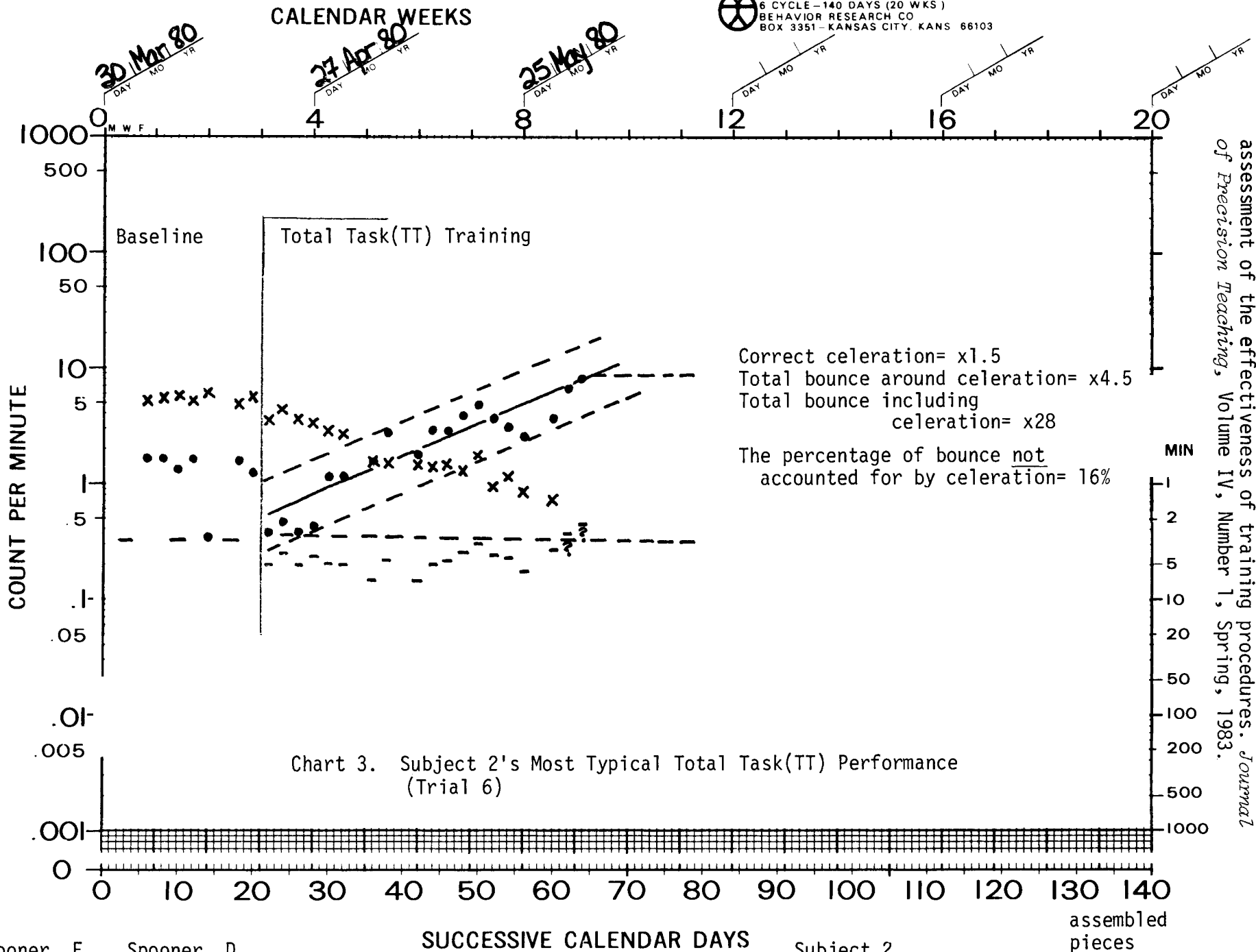


Chart 3. Subject 2's Most Typical Total Task(TT) Performance (Trial 6)

Spooner, Fred, and Spooner, Doreen. Variability: An aid in the assessment of the effectiveness of training procedures. *Journal of Precision Teaching*, Volume IV, Number 1, Spring, 1983.

Spooner, F. SUPERVISOR
Spooners, D. ADVISER
MANAGER

SUCCESSIVE CALENDAR DAYS

Subject 2 BEHAVIOR
AGE LABEL COUNTED
assembled pieces

DEPOSITOR AGENCY TIMER COUNTER CHARTER

of a 7-piece drain assembly

CALENDAR WEEKS

30 Mar 80
 DAY MO YR

27 Apr 80
 DAY MO YR

25 May 80
 DAY MO YR

DAY MO YR

DAY MO YR

DAY MO YR

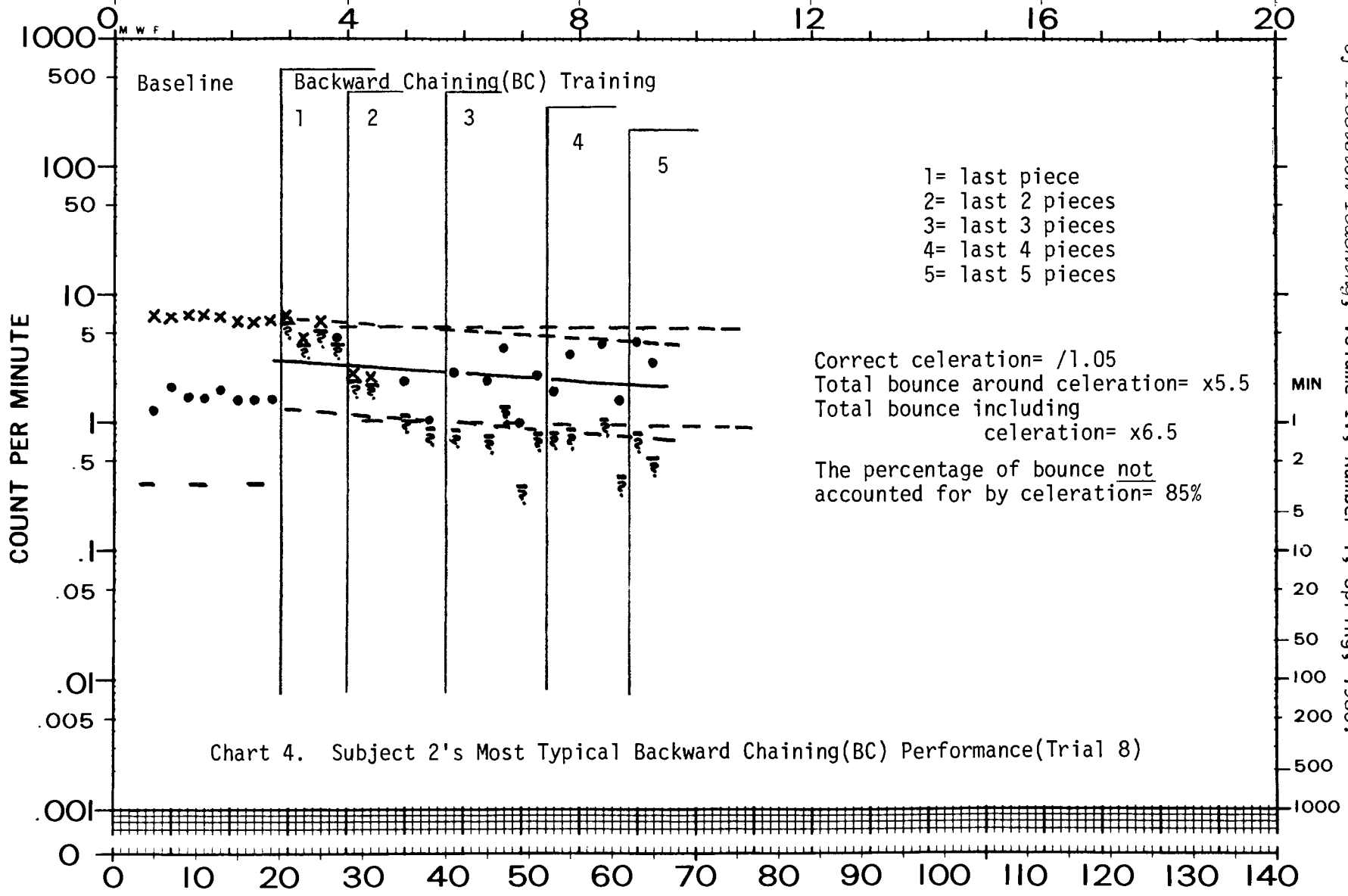


Chart 4. Subject 2's Most Typical Backward Chaining(BC) Performance(Trial 8)

Spooner, Fred, and Spooner, Doreen. Variability: An aid in the assessment of the effectiveness of training procedures. *Journal of Precision Teaching*, Volume IV, Number 1, Spring, 1983.

Spooner, F. SUPERVISOR
 Spooner, D. ADVISER
 MANAGER
 DEPOSITOR AGENCY

SUCCESSIVE CALENDAR DAYS
 TIMER COUNTER

Subject 2
 BEHAVIOR AGE LABEL COUNTED
 CHARTER of a 7-piece gate valve assembly

Strategies and tactics of human behavioral research. Hillsdale, New Jersey: Lawrence Erlbaum & Associates, 1980.

Pennypacker, H. S., Koenig, C. H., & Lindsley, O. R. **Handbook of the standard behavior chart: Preliminary edition.** Kansas City, Kansas: Precision Media, 1972.

Sidman, M. **Tactics of scientific research: Evaluating experimental data in psychology.** New York: Basic Books, Inc., 1960.

Spooner, F. An operant analysis of the effects of backward chaining and total task presentation (Doctoral dissertation, University of Florida, 1980). **Dissertation Abstracts International**, 1981, **41**, 3992A. (University Microfilms No. 8105615)

Ulman, J. D., & Sulzer-Azaroff, B. Multielement baseline design in educational research. In E. R. Ramp, & G. Semb (Eds.), **Behavior analysis: Areas of research and application.** Englewood Cliffs, New Jersey: Prentice-Hall, 1975.

Fred Spooner is a visiting assistant professor at the University of North Carolina-Charlotte and a research associate at the Human Development Research Training Institute at Western Carolina Center, Morganton, North Carolina 28655. Doreen Spooner is the Director of Industrial Therapy at Western Carolina Center.

Chart-sharing

A COMPUTERIZED MATH DEFICIT REMEDIATION

Donna McCarthy-Jensen
Kenneth U. Campbell
North Marion Middle School

Paul is a twelve year old learning disabled student. He came to the North Marion Middle School resource room for daily instruction over a three-month period last winter until his family moved out of the school district.

In assessing his math skills, we found that Paul was proficient in basic addition and subtraction facts. He understood the concept of multiplication, but made many errors in see-say multiplication facts.

We had access to Radio Shack's TRS-80 hardware and John Trifiletti's Spark 80 Computerized Courseware for Instruction in Mathematics. This software program presents basic math skills in a Precision Teaching format. Individual skills are timed, with the number of correct and incorrect digits typed per minute recorded. When an incorrect answer is typed, the student is instructed to try the problem again. If a second incorrect answer is typed, the machine flashes the correct answer.

Paul had access to the computer for an eight to ten minute time period four days per week. He was put on the random X2 drill in January. As seen on Chart 1, Paul began in the acquisition stage of learning, completing 29 digits correctly with 12 errors in one minute. After four days with no sign of improvement, an intervention was made: Paul was told that he could earn "computer game time" if his corrects went up and his incorrects went down. Over four weeks, Paul's corrects accelerated at the rate of X1.3 per week to 50 digits per minute. This correct frequency was almost exactly the same as his multiplication tool movement frequency. His incorrects decelerated during the first week and "leveled off" at about three per minute.

We are very excited by the results of computerized instruction skill drills. Precision Teaching programs can take a student to proficiency if the prerequisites for learning the specific skill exist. Perhaps best of all, students enthusiastically approach each computer session.

Donna McCarthy-Jensen and Kenneth U. Campbell are resource teachers in Exceptional Student Education at North Marion Middle School, Citra, Florida 32627.

SELF-COUNTING IN THE TREATMENT OF GILLES DE LA TOURETTE SYNDROME

William H. Evans
University of West Florida

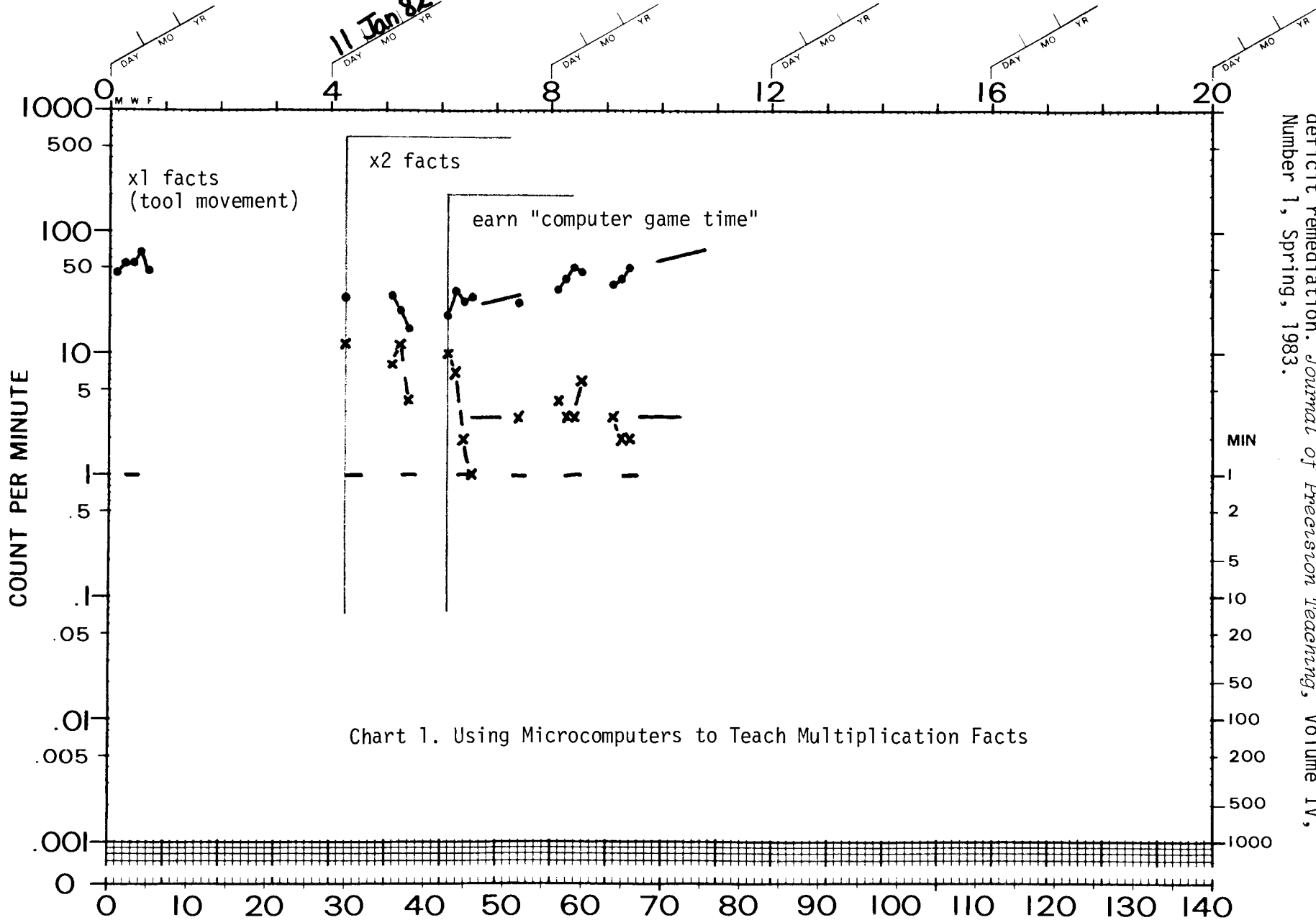
Susan S. Evans
Pensacola, Florida

Gilles de la Tourette syndrome is characterized by a high rate of involuntary physical tics and utterances which are often vulgar. The subject in this investigation was a 12 year old student who suffered from this condition. His classroom behavior was adversely affected by a high rate of utterances of an expletive. As indicated on Chart 1, an observer recorded the number of times this word was said during a 50 minute class period. An initial baseline phase was

CALENDAR WEEKS

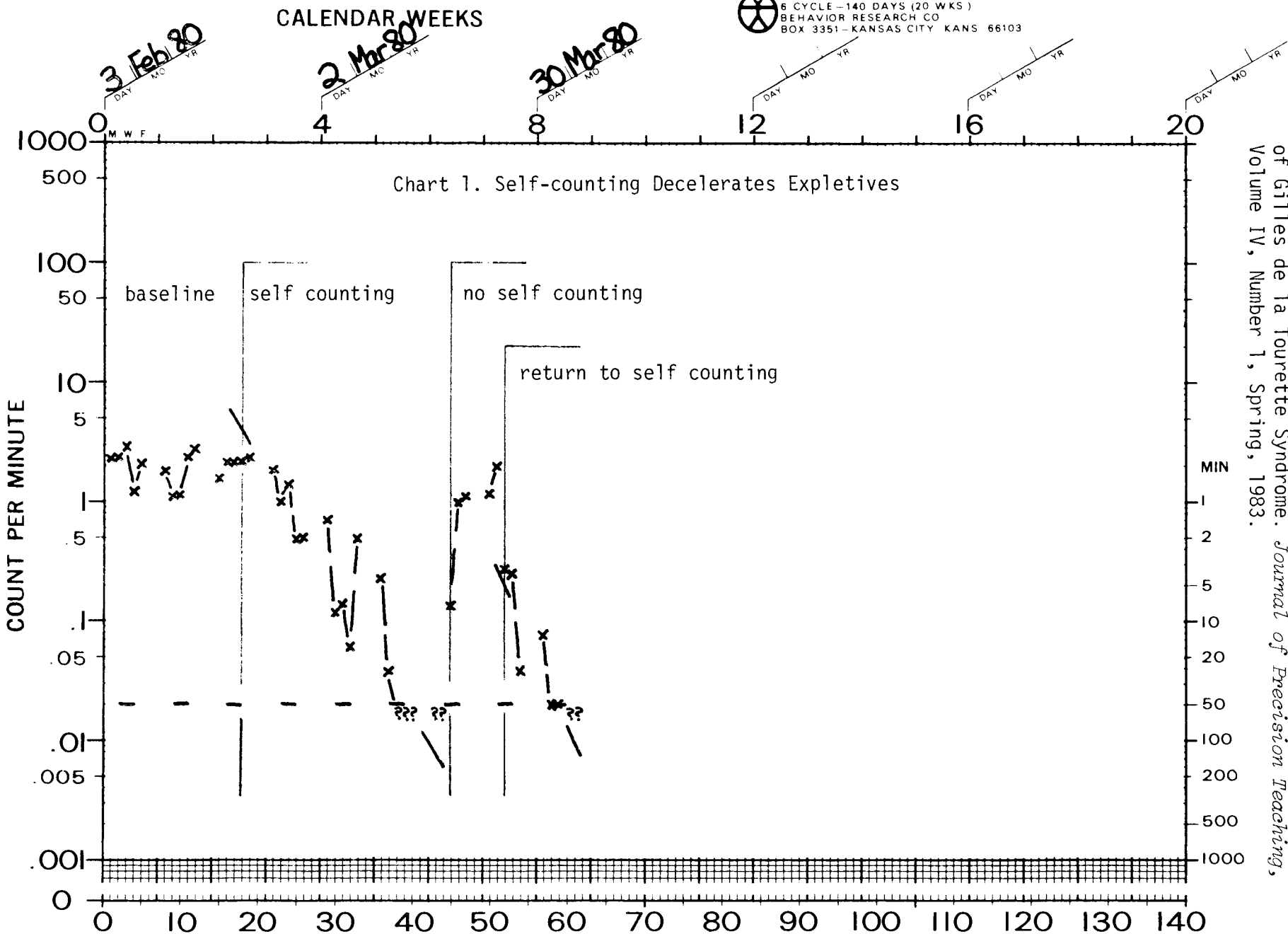


DAILY BEHAVIOR CHART (DCM-9EN)
 6 CYCLE - 140 DAYS (20 WKS)
 BEHAVIOR RESEARCH CO.
 BOX 3351 - KANSAS CITY, KANS 66103



McCarthy-Jensen, Donna and Campbell, Kenneth U. A computerized math deficit remediation. *Journal of Precision Teaching*, Volume IV, Number 1, Spring, 1983.

SUPERVISOR			ADVISER		MANAGER		Paul		12		types digits	
North Marion Middle School			Citra, Florida				BEHAVIOR		AGE		LABEL	
DEPOSITOR			AGENCY		TIMER		COUNTER		D. M-J.		on a microcomputer	
									CHARTER			



Evans, William H. and Evans, Susan S. Self-counting in the treatment of Gilles de la Tourette Syndrome. *Journal of Precision Teaching*, Volume IV, Number 1, Spring, 1983.

W. Evans			SUCCESSIVE CALENDAR DAYS	() 12	says expletive		
SUPERVISOR	ADVISER	MANAGER		BEHAVIOR	AGE	LABEL	COUNTED
Alachua County Public Schools		Gainesville, Florida		W. Evans			
DEPOSITOR	AGENCY	TIMER	COUNTER	CHARTER			

followed by a self-counting procedure in which the subject counted and recorded each utterance of the expletive. The number of expletives during this intervention decelerated at the rate of /5.5 per week. The last 5 data points indicated zero expletives during the class period. A baseline phase was reinstated and produced an immediate and rapid acceleration of expletives. Due to this rapid increase, the self-counting procedure was reintroduced. During this phase, the expletives decelerated to zero at the rate of /10 per week.

These data suggest that self-counting may be an effective means of treating individuals who have been diagnosed as having Gilles de la Tourette syndrome. Further research is needed, however, to determine if self-counting can reduce the frequency of other manifestations of this disorder.

William H. Evans is an assistant professor of Special Education at the University of West Florida, Pensacola, Florida 32504. Susan S. Evans is an educational consultant in Pensacola, Florida.

WE WERE SPELL BOUND

Denise M. Wright
Florida State University

On my initial visit to Fairview Middle School's Specific Learning Disabilities class, it was brought to my attention by one of the teachers that Lavoris, a sixth grade student, consistently received failing scores on weekly spelling tests. These tests were given in Lavoris' Language Arts class. The reason for the failing scores was due to the omission or insertion of letters in words, producing a high frequency of spelling errors. As a result of this information, I decided to work with Lavoris for two hours per week during a six week period, implementing various teaching strategies to increase the accuracy of his spelling.

To achieve the ultimate goal of increasing Lavoris' hear word/write word spelling (the method used during the weekly spelling tests), three strategies were implemented. A record of Lavoris' progress was kept using the Standard Celeration Chart. During the first weeks of data collection, I felt it was necessary to assess the number of words Lavoris could see/say from a selected list of 60 words. On each ten minute timing, Lavoris correctly see/said 20 of 60 words, with a frequency of 2 correct and 4 incorrect words per minute. These results indicated that Lavoris could not see/say the

selected words accurately.

In view of the difficulties Lavoris had, the use of picture cues was implemented as the first teaching strategy. One picture cue, selected from a magazine or drawn by Lavoris, was paired with the word it represented. Lavoris' task was to look at each picture and orally spell the word represented. With each succeeding session, the total number of pictures presented increased. Lavoris' see picture/say word spelling accuracy improved (see Chart 1).

Then, I felt it was necessary for Lavoris to advance to the next steps in achieving our goal of hearing words/writing words correctly. Therefore, new strategies were implemented. Lavoris was asked to select 30 words to work on during the next phases. He chose 34 words. This selection established the static aim of 34 words to be spelled accurately during movement based measurements.

All picture cues were omitted during the next two phases. For a period of one week, data were collected to assess Lavoris' hear word/say word spelling accuracy. During the final week of data collection, I assessed hear word/write word. Chart 1 shows that Lavoris' accuracy improved.

Lavoris and I were both extremely proud of his steady progress; however, our proudest moment came in a bitter-sweet victory. Lavoris attained the established static aim of 34 spelling words written correctly on the day I was scheduled to complete data collection and conclude our sessions. Had time permitted, the next phase would have concentrated on the use of strategies to increase Lavoris' speed in completing this task.

I decided to compare the spelling performance of Yolanda, a sixth grade student who was not enrolled in a special education class, with that of Lavoris. Yolanda was described by Lavoris' Language Arts teacher as an "average sixth grade speller." Each day during the three day period of data collection, I said the same 34 words to Yolanda in random order. Yolanda was asked to write the words as fast and accurately as possible. From Chart 1 it is evident that Yolanda's and Lavoris' speed performances were similar. In addition, Lavoris was considerably more accurate.

Denise M. Wright is a student of Mark Koorlang's at Florida State University. She resides at 7153 Irving Scott Drive, Jacksonville, Florida 32209.

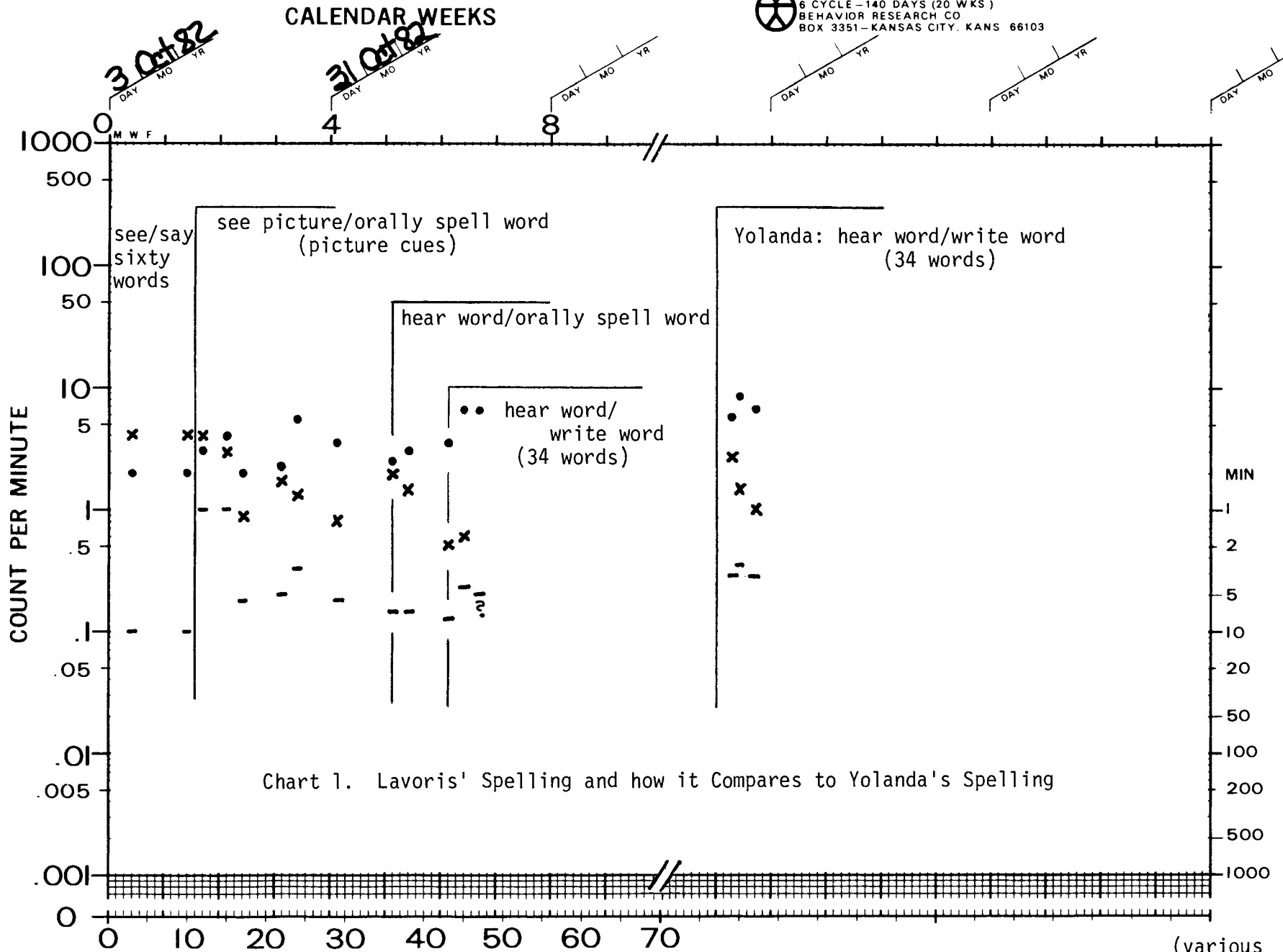


Chart 1. Lavioris' Spelling and how it Compares to Yolanda's Spelling

Wright, Denise M. We were spell bound. *Journal of Precision Teaching*, Volume IV, Number 1, Spring, 1983.

Rousseau	Koorland	D. Wright	SUCCESSIVE CALENDAR DAYS		Lavioris	12	(various spelling tasks)	
SUPERVISOR	ADVISER	MANAGER			BEHAVER	AGE	LABEL	COUNTED
Fairview Middle School			Wright	Wright/Lavioris	Lavioris			
DEPOSITOR	AGENCY		TIMER	COUNTER	CHARTER			

About PT

NOTES FROM THE EDITOR

Patrick McGreevy

Welcome to Volume IV of the **Journal**. If you are a new subscriber, a special welcome goes out to you.

The **Journal** needs manuscripts and chart-sharing articles. Don't be hesitant to submit your material.

We will be experimenting with a few modifications to our review policy. The modifications are indicated in bold print. Each formal manuscript will be sent to a primary reviewer. This person, along with two others designated by her/him, will review the manuscript. The review process is "blind." Each reviewer will make suggested changes on the manuscript and select one of the three options: (1) I recommend publishing the manuscript "as is"; (2) I recommend publishing the manuscript after the suggested changes are made, or (3) I do not recommend publishing this manuscript. The primary reviewer will consolidate the reviews. If all three reviewers select option (1), the manuscript will be sent to the editor for publishing in the next available issue. If two or more reviewers select option (3), the manuscript will be rejected and will be returned to the author(s). If two reviewers select any combination of options (1) and (2), the primary reviewer will consolidate the suggested changes on one copy. **S/he will contact the editor and learn the identity of the author(s). The primary reviewer will then be responsible for working with the author(s) to see that these changes are understood and incorporated into a revision of the manuscript. Once this revision is approved by the primary reviewer, it will be sent to the editor for publishing in the next available issue.**

These modifications will continue to insure a "blind" review while increasing the important information that is shared in **JPT**. It will also help each of us become better Precision Teachers.

If articles that include the Standard Celeration Chart or make reference to Precision Teaching are published in other journals or books, please let us know so that we can pass the information along to our readers.

CURRICULUM

Marie Eaton

One of the interesting topics of discussion at the recent Precision Teaching Conference in Orlando was the use of SAFMEDS to teach adults and children basic content for a variety of courses. SAFMEDS are a variation on the old flashcards that we used to learn our math facts when we were in grade school. Ogden Lindsley coined the new term to avoid any old learned behaviors we may have retained in the use of flashcards and to remind us how to use the cards. SAFMEDS stands for **Say All Fast Minute Each Day Shuffled**. Ogden Lindsley, Bob Bower, Steve Graf and others have been using SAFMEDS for quite a while to help their students in college courses. During the discussion, some of the folks offered to share the SAFMEDS they have prepared with others who are teaching similar content.

Below is a listing of some of the SAFMEDS that those who were attending were interested in snaring. Others did not find the time at the conference to give me their lists. If you are using SAFMEDS at any level of curriculum and are willing to share them with others, please send a listing of the topic areas and the number of items you include. The items do not have to be in card format. Send them to: Marie Eaton, Department of Education, Western Washington University, Bellingham, WA 98225 and we'll list them in the next column.

Mada Kay Morehead
Washington School District
8610 N 19th Ave
Phoenix, AZ 85021

Probe Construction (100 items)
Formative Evaluation (120 items)
Direct Instruction (100 items)
Reading, Math, Spelling, Handwriting,
Language Sampling (100 items)

Jim Pollard
Merrimack Special Ed Collaborative
101 Mill Road
Chelmsford, MA 01824

Fractions, Decimals & Minute/
Second Equivalents
Teaching Self Care and Chaining
Skills (Back chaining, cueing,
prompting, practice, toileting)
Physical Therapy (how physically handicapping
conditions impact on instruction)
Orientation (the agency's policy manual)
National Electric Code
The Intel 8080 Microchip (CPU) Manual TSI
Personal Computer Manual

Claudia McDade
Chuck Olander
Center for Individualized Instruction
Jacksonville State University

SAFMEDS for the following courses:
Psy 300 Intro to Behavioral Statistics
Psy 335 Personality Theories
BY 360 Pathophysiology

Marie Eaton
Sheila Fox
Western Washington University
Bellingham, WA 98225

Precision Teaching Vocab (50 items)
Movement Cycle Vocab (45 items)
Probe Construction (40 items)
Learning Hierarchy (40 items)
Celeration - Read slopes
Celeration - draw slopes
Data Decisions
Is intervention needed? (40 items)
Data Decisions
Choose intervention (40 items)
Principles of Behavior (40 items)

COMPUTERS

Bill Wolking, Steve Graf & John Eshleman

Active exploration and debate typifies the interface between Precision Teaching and microcomputer technology. One thing is clear, Precision Teachers are not going to make an automatic, knee-jerk jump to microcomputer technology. They want to make sure that the benefits gained are not outweighed by liabilities, particularly in terms of constraints on free operant movements. Many microcomputer programs present tasks at rates which place severe limitations on the student's ability to respond fluently. However, some program-computer combinations are capable of presenting problems at well above 300 per minute--ample for the full development of fluency and its side benefits for many academic skills.

More and more Precision Teachers showed an interest in, or use of, microcomputers at the 1983 Precision Teaching Winter Conference in Orlando. Og Linsley continued to promote the Apple II+ as the standard microcomputer for Precision Teachers. John Eshleman presented some stimulating work on a program capable of changing contingencies of reinforcement as a consequence of the student's performance and learning. Educational software which learns as a function of student performance is an important trend. Precision Teachers are probably the only

ones with measurement technology sophisticated enough to support the development of functional self-modifying instructional software. Steve Graf and Jack Auman presented the latest version of their program to enable teachers to practice data-based decisions in a greatly condensed time framework. Bill Wolking demonstrated the use of "visi-calc type" programs for analyzing and summarizing information on large quantities of Precision Teaching data. Student teaching outcome data can be conveniently digested by supervisors and used to set new contingencies for student teachers with this program.

Charles Olander and Claudia McDade presented their latest work applying direct, continuous and frequency-based measurement technology to a university learning center. Chuck Meritz showed how to rig a hand-held microcomputer to be the brains of a system for automatic data collection on movement frequencies and patterns for the physically disabled. Chuck's work demonstrates one more way to get sophisticated and relevant data on important problems in natural settings.

A popular event at the PT Winter Conference was a "microcomputer program share session." Ray Beck has an Apple II+ program to generate curriculum slices using either words, sentences or math facts. This program is easy to use and should be of great help to teachers who need to generate original curriculum slices for their students and eliminate memorized first rows. (Ray Beck, Director, Great Falls Precision Teaching Project, Box 2428, Great Falls, Montana 59401) Nearly 600 references on PT covering the years between 1964 and 1982 are available on an Apple II+ diskette from John Eshleman. Books, journal and newsletter articles are included. AppleWriter is used to print these files. (John Eshleman, Celerationware, 1064 VanVoorhis Rd., Morgantown, WV 26505) Michele Buss will share a TRS-80 (mod III) program that provides practice, timings and printed reports of progress in learning PT facts and names. About 350 terms and facts are included with the program. Add your own terms or use for other items. (Michele Buss, Special Education, Univ. of Florida, Gainesville, FL 32611)

There were games galore at the program share session. One girl was having a good time playing with Verb Vipers, a Developmental Learning Materials publication. This and other programs in the series combine the fun and speed of arcade games with educational skills content. See Chaffin, Maxwell & Thompson ARD-ED Curriculum, *Exceptional Children*, 1983, 49(2), 173-79. More on this series in future columns.

Happy microcomputing! Keep sending your latest info on PT and microcomputing to: Bill Wolking,

Special Education, Univ. of Florida, Gainesville, FL 32611.

REHABILITATION

Carl Binder and Charles Merbitz

Greetings to Precision Teachers in Rehabilitation! We have just finished the Third Annual Precision Teaching Winter Conference in Orlando, Florida (March 9-12, 1983), and as always it was exciting and instructive to meet. In addition to the presentations that were labelled "rehabilitation," Charted data from other contexts offered lessons for rehabilitation as well. The communication of the Standard Celeration Chart again vastly transcends the labels we use to divide people.

Coming up next is the Ninth Annual ABA convention, in Milwaukee. Let us see a lot of Precision Teaching presentations, symposia, and meetings at this ABA and even more at the next. Also, as long as you'll be in Milwaukee, why don't you come to Chicago a day before ABA and tour the Rehabilitation Institute? Call or write Chuck Merbitz if you could make a pre-ABA visit.

Finally, we want your suggestions, comments, and concepts for this column. You don't have to be formal--a postcard will do. Send material to either of us!

Carl Binder
Precision Teaching & Management Systems, Inc.
P.O. Box 169
Nonantum, MA 02195

Charles Merbitz
Room 981
Rehabilitation Institute of Chicago
345 East Superior
Chicago, IL 60611
(312) 649-6397

ADMINISTRATIVE CHARTS

Skip Berquam, with lots of help from Tom Anderson, of Port Angeles, Washington, Gary Meyerson, of Poway, California, and Abigail Calkin, somewhere in Kansas

The Third Annual (Final?) Precision Teaching Winter Conference in Orlando is history, and in the coming months I predict you will see the phrase "...at the Winter Conference in Orlando..." appear in these pages between 6 and 12 times (x2 is normal range, right Owen?), judging by the number of references made after the first two Winter Conferences (yes, Miss Buslee, that was all one sentence [Miss Buslee was my high school

English teacher (who wasn't 100% successful in teaching me composition and grammar)], which is a good indication that some worthwhile ideas were exchanged (I personally exchanged several of my own ideas), and that the Conference serves to promote communication. (I know, thank goodness for a period.) [I wouldn't touch that line with a ten foot pole (not to mention a seven foot Czech)]. Thanks to Ron and everyone in Orange County for a job well done, and for your kind thoughts and regards. I should be back to work in a month or so.

During the Conference I had the opportunity to visit with several precision administrators, to discuss administrative data, and countable behaviors (yes, I suppose all behaviors are countable). The following composite list of behaviors is the result of sharing by a number of people. I have tried, rather unsuccessfully to this point, to provide a structure or organization to the list. I'm sure that structure is a logical next step, and will be forthcoming. For now, I will merely relate the list we have to date.

1. Classrooms visited.
2. Student discipline contacts.
3. Parent contacts.
4. Teacher contacts.
5. Phone calls; number and duration.
6. Paperwork forms sent home.
7. Referrals for special help.
8. Parent conferences.
9. Number of teacher/administrator meetings.
10. Duration of meetings.
11. Administrative interruptions of classrooms.
12. Teacher absences.
13. Student absences.
14. Health/accident referrals.
15. Number of days with no discipline problems.
16. Hours/meetings for staff development.
17. Number/type of comments at staff meetings.
18. Parent/community visitors to school.
19. Volunteer hours.
20. Minutes per day spent on professional reading/writing.
21. Number of teachers charting.
22. Number of suggestions to try charting.
23. Number of non-mandated procedures or programs in use.
24. Positive/negative statements in teachers' workroom.
25. Lunch count, free lunch, cold lunch, etc.
26. Grade distributions.
27. Supply use, such as ditto paper, pencils, etc.
28. School bus riders, problems, distances.
29. Enrollments by grade, school, area, district.
30. Number of reports and memos.
31. Special activity participation; band, athletics, etc.
32. Testing data.
33. Budget data; accounting, projections.
34. Amount of copy paper (or other supplies)

used.

35. Amount of time spent at computer.
36. Number and type of decisions made.
37. Library use: Number of books checked out; number of users; overdue books; lost books; periodicals.
38. Birth rates and enrollment projections.

There are, of course, categories of administrator behavior that would group these pinpoints. As those categories are defined, they will elicit more pinpoints for each of them. Some of these pinpoints are a self management type of behavior. (See Carl Binder's Data Sharing Newsletter, and Abigail Calkin's work on inner behaviors for some excellent information on this topic.)

In choosing a pinpoint, it probably makes sense to identify the general area of concern. This will help specify the pinpoint. If, for example, home/school or community/school communication is of major concern, several pinpoints come to mind. Number of newsletters or reports, number of phone calls initiated, number of parent meetings scheduled, number of school visitors--each of these could help monitor communication.

One of the keys to making use of data is the way it is organized or sorted. In counting any of the above pinpoints or related behaviors, it may be very meaningful to keep track of things like positive or negative, time of day or day of week, subject being taught, weather conditions; details about the setting that could better describe the pinpoint should be recorded.

If you are a manager or administrator reading this column, presumably you are a data oriented person. How about sharing some of your ideas on counting? If you are a teacher or other professional with a supervisor who is not a "counter," start a project for your supervisor that illustrates the effectiveness of some direct data.

Next issue: Improving administrator behavior using the Standard Celeration Chart, a balance beam, and the Solunar Tables.

CALL FOR PAPERS

This is a request for submission of manuscripts to be considered for publication in a topical, edited volume on Precision Teaching. The topic for Volume I of this series concerns the general effects of a Precision Teaching model of instruction.

Data-based manuscripts concerning experimental studies or comparisons of results between a Precision Teaching model and other instructional

models will be considered. For the purposes of this volume, a Precision Teaching model is one which uses one or more of the following components:

- (1) Practice and measurement strategies based on frequency of response;
- (2) Chart-based monitoring and feedback;
- (3) High frequency performance;
- (4) High rate of growth.

Data concerning the following populations are of interest:

- (1) The mildly handicapped;
- (2) The more seriously handicapped;
- (3) Pre-school and public school classes;
- (4) Vocational settings;
- (5) College and graduate courses;
- (6) Adult education and training;
- (7) Technical training.

The following types of manuscripts would generally not be appropriate for the current volume:

- (1) Individual or small N studies, unless specific comparisons have been made between Precision Teaching components and other instructional strategies;
- (2) Studies using Precision Teaching methods to compare or evaluate the effects of different materials or procedures.

Please submit manuscripts or a prospectus with sample data to the editors of this monograph:

Marie D. Eaton, Ph.D.
Special Education
Western Washington University
Bellingham, Washington 98225

Skip Berquam, Ph.D.
1525 West Seventh
Port Angeles, Washington 98362

ANNOUNCEMENT

Researchers in Precision Teaching will present information on recent developments, including application with both mildly and severely handicapped populations. PRECISION TEACHING: COMPUTERS AND OTHER RECENT DEVELOPMENTS is a special workshop to be offered June 7-10, 1983, in Billings, Montana. Drs. Kathleen Liberty, Tom Lovitt and Ray Beck will be instructors. 3 credits available. Contact: Dr. Chris O'Connell-Mason, Institute for Habilitative Services, Eastern Montana College, 1500 N. 30th, Billings MT 59101-0298, (406) 657-2351. Registration \$60; continuing education credit \$90. Dorm space available at \$7/day.

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children, who, by sharing their
Charts, taught us what we know.