Journal of Precision Teaching

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Journal of Precision Teaching

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

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

Materials submitted for publication should meet the following criteria:

- --be written in plain English
- --contain a narrative that is brief, to the point, and easy to read
- --use the *Journal of Precision Teaching* Standard Glossary and Charting Conventions
- --format references according to the *Publication Manual of the American Psychological Association*
- --contain data displayed or displayable on the Standard Celeration Chart to justify conclusions made

Articles which are not data-based and do not include data displayed on Standard Celeration Charts may be included. These articles should substantially contribute to the development or dissemination of Precision Teaching/Learning.

To encourage rapid dissemination of Precision Teaching research and successes, only one reviewer need recommend publication for a manuscript to be included. Reviewers are encouraged to provide direct instruction to the author(s) to improve the article to ready it for publication.

The *Journal of Precision Teaching* is published bi-annually in April and October by the Jacksonville State University Foundation. Annual subscription rates are $20.00 for libraries and agencies, $16.00 for individuals, and $12.00 for full-time students. Advertising rates are available on request. Any article is the personal expression of the author(s); any advertisement, the responsibility of the advertiser. Neither necessarily carries *Journal* endorsement.

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Editor's Comments

by

Claudia E. McDade

As the first issue of Volume VIII of the *Journal of Precision Teaching* goes to press, I am struck with the variety of issues that Precision Teachers are concerned about, as reflected here. First, we care about sharing our experiences with frequency based learning because we are so committed to reinforcing each other for our successes and sharing our amazing instructional technology with others. As we progress, discussing better ways to present our effects on Standard Celeration Charts, trying Precision Teaching interventions in new areas, and working to influence others with our data's effectiveness, we remember our roots. In "Thank You, Grandpa Fred!" and "Skinner's Impact on Education" the founder of Precision Teaching, Ogden Lindsley, reminds us of the debt we owe to the founder of Behavior Analysis. Six major scientific journals and three major professional organizations were developed on the basis of Skinner's research.

A major defining characteristic of Precision Teachers is our almost evangelical zeal for our field. We share our ideas wherever, whenever we can. For the 9th International Precision Teaching Conference in Boston, Carl Binder, Jim Pollard and other organizers recruited several novices to discover Precision Teaching. Michael Connolly and Diane Hendrickson provide a real treat to seasoned Precision Teachers--an evaluation of the Precision Teaching movement, as seen at the International Conference, from the perspective of novices who specialize in planning and marketing consulting. This is just the first of their articles to assist us in promoting our instructional technology more effectively.

To encourage more submissions to the *Journal of Precision Teaching* Owen White wrote guidelines for chart-sharing in the *Journal* and for a new column to encourage those of us who have data to share it with those of us who need data. Each of these additions to the *Journal* publication guidelines is designed to encourage brief submissions--single Standard Celeration Charts with no more than a one page explanation or "Data Wanted" ads and "Data Shared" responses. Of course, formal experimental studies and teacher generated strategy manuscripts will continue to form the bulk of the *Journal*' s articles.

Possible ways to present multiple baseline data on Standard Celeration Charts which are compatible with established Chart Conventions are presented to the Precision Teaching community for discussion by John Cooper and John Eshleman.

Precision Teaching enhancements of reading skills in two divergent populations--severe behavior handicapped students 11--12 years old and college freshmen--are described in the current issue. One uses repeated readings of the same passages until prescribed fluency is reached (Carroll, McCormick, and Cooper), while the other uses novel passages to encourage greater fluency (the Center for Individualized Instruction group). Both simple techniques improved students' reading skills and could be readily applied by teachers across disciplines and ages.

Abigail Calkin contributed six years worth of administrative data indicating the change in student attendance when a new facility opened. She reminds administrators that counting and charting the kind of variables related to attendance provide much more information than simple percentages alone. A group of special educators from Albuquerque (Trott, Maechtlen, and Bienarz) remind us all that the classroom can be organized effectively with Precision Teaching interventions and Standard Celeration Charts to provide quality, individualized instruction.

CALL FOR MANUSCRIPTS

The *Journal of Precision Teaching* was founded to provide a mechanism of communication among Precision Practitioners--teachers, administrators, rehabilitation specialists, special educators, etc. Every person reading the *Journal* also has something to contribute to it. Send us your "Charticles"--formal reports with Standard Celeration Charts, "Chart Shares", "Data Wanted" ads for "Notes from Below the Floor", or less formal experiences with Precision Teaching. Each will be considered for inclusion in the *Journal* and forwarded for review.

Review in the *Journal of Precision Teaching* is open with both the reviewers and the authors knowing the others' identities. Twelve people serve as consulting editors to the *Journal of Precision Teaching* for one to three year terms. These include:

Consulting Editor	Term	Consulting Editor	Term	Consulting Editor	Term
Felix Billingsley	90--92	Carl Binder	90--93	Abigail Calkin	90--91
John Cooper	90--92	John Eshleman	90--93	Tom McCrudden	90--91
Charles Merbitz	90--93	Malcolm Neely	90--92	Susan Peterson	90--92
Owen White	90--93	William Wolking	90--91	Richard Young	90--91

Editor Emeritus
Ogden Lindsley

Many others have offered to serve as guest reviewers. All Precision Teachers are encouraged to become guest reviewers by writing the *Journal of Precision Teaching*, Center for Individualized Instruction, Jacksonville State University, Jacksonville, AL 36265.

Claudia E. McDade

SEND US A CHART-SHARE!!

People wishing to share interesting charts without writing lengthy "articles" are encouraged to submit a Standard Celeration *Chart-share*. Each *Chart-share* is limited to two pages in length--one Chart and a maximum of one page of explanatory text. The Chart and accompanying text will be printed on reverse sides of the same page to ensure they will not be separated or removed from the *Journal* for copying.

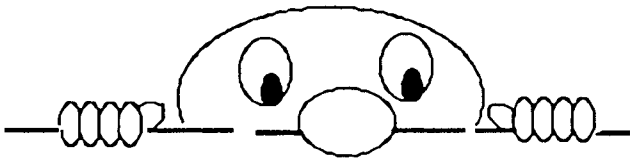
The Chart: The Chart should be as self-explanatory as possible. All the information at the bottom of the Chart (i.e., Supervisor, Adviser, Manager, etc.) should be completed as descriptively as possible. All charting conventions should be followed. If additional symbols or extensions of the conventions are required, they should be explained in an appropriate "Key." For example, if in addition to charting "words said correctly" with a • and "words said incorrectly" with an **x**, you wish to note "words omitted" with a Δ, that should be noted on the Chart. Each phase of a multi-phase project should be clearly labeled with brief but descriptive phrases. For example, instead of labeling phases, "Phase I, Phase II," etc., the phases might be labeled, "One minute of practice; teacher charts results," and "Same practice; learner charts results." Additional notes should be provided as necessary to explain the project, unplanned events which appeared to affect performances, and other features of interest.

The Back: The back of the Chart may be used to explain the project in more detail. At a minimum, try to provide the following:

1. title for the project;
2. your name and affiliation;
3. names and affilitations of other people involved in the project (first names, initials, or pseudonyms may be used to protect privacy, if necessary);
4. the purpose or goal of the project;
5. the specific measurement cycle(s) or target(s) being evaluated;
6. a brief statement of what you learned from the project.

Space permitting, you may add as much additional comment or discussion as you wish. If the submission exceeds the space available, the Journal editors will make whatever changes are necessary while trying to preserve the basic message of the Chart-share.

-- Owen R. White, Consulting Editor



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Notes from Below the Floor

The Journal of Precision Teaching is designed to help people with diverse interests share information (data, usually in the form of behavior frequencies) in a uniform format (the Standard Celeration Chart). Typically, a person with data submits it to the Journal in order to share it with people who might be interested. The purpose of *Notes From Below the Floor* is to reverse the process - people without data (and thus residing below the record floor) can use this column to find people who have the data they want, or to entice people into collecting some.

Submissions should generally take the form of "Data Wanted" advertisements which are brief, describe your interest, and provide your name, address, and telephone number. For example:

DATA WANTED
Concerning the Use of
Frequency-Based Decision Rules In
Computer-Based Instruction

I know of computer programs that accept frequency data and generate Standard Behavior Charts. I know of computer-based instructional programs that provide summaries of session frequencies for external charting and evaluation. I even have several megabytes of moment-to-moment response frequencies collected during computer-based instructional programs, but not used by those programs for making internal branching decisions.

As far as I can tell, however, existing computer-based instructional systems make internal branching decisions (e.g., provide remedial assistance; to move to a more advanced frame; to terminate the program after "mastery" has been reached) based solely on accuracy data. Does anyone have access to data generated by computer-based instructional programs that use moment-to-moment frequency data for internal branching decisions? It seems that the increased power of instructional decision based on such data would be tremendous. Anyone interested in sharing data or ideas?

Owen R. White, Director, Exp. Ed. Unit, WJ-10
University of Washington, Seattle, WA 98195
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Responses to the solicitations and issues presented in this column may take the form of responsive material submitted for publication in JPT. Regardless of publication, however, direct contact among interested parties is encouraged.

Remember

When you're down below the floor,
no-one knows you're really there,
So send a note to all above,
to let them know you really care!

Send a note today!

B. F. Skinner (1904-1990): Thank You, Grandpa Fred!

by

Ogden R. Lindsley

Why Grandpa?

In Cambridge, Massachusetts on Saturday afternoon, the 18th of August 1990, B. F. Skinner died. He had lived a marvelously productive, rational, full, and complete life. The details of his many contributions and of his final bouts with illness have been well described (Bennett, 1990; Division 25 Recorder, Fall 1990; Epstein, 1991; ABA Newsletter, Fall 1990; Salzinger, 1990; Vargas, 1990; and Vaughn, 1990). This article honors him and acknowledges his very special major gifts to us.

At first blush, this title may appear disrespectful. Its intent is exactly the opposite, conveying to B. F. Skinner the deep personal warmth that we in the family of Precision Teaching feel for him and his work. A strong tradition of honoring teaching by using parenting as the model exists within Precision Teaching.

Chart sharing began in the fifties with the early animal operant conditioners who shared their recently collected standard cumulative records at Harvard's monthly pigeon laboratory meetings. It continued with cumulative records displayed on the walls and beds of hotel rooms at Eastern Psychological Association Meetings and American Psychological Association meetings.

I continued the tradition in my Education 115 course, "Classroom Applications of Human Free-operant Conditioning," in 1965 at Kansas University Medical Center. The Standard Celeration Chart was developed so we could share more than the usual six or eight behavior modification projects in a three hour weekly class. With the Standard Charts, we set timers at two minutes per chart share. These two minute opportunities permitted each of the 30 students in the class to share at least one of their projects each week.

Standard Celeration Chart sharing sessions were first given formal recognition and space allocation on a convention program by Steve Graf, Harvey Sepler, and Carl Binder at the 6th annual ABA conference in May 1980 in Dearborn, Michigan. Chart shares at conventions now occur regularly and are open and voluntary. The main requirement is that all frequencies must be shared on a Standard Celeration Chart. These Chart shares are held in rooms with an overhead projecting on to a screen at the front. In the minutes before the scheduled session starts, those choosing to share Charts write their name in the first column and the name of their Chart parent in the second column on a sign-up transparency on the projector stage. The Chart parent is the person who taught the presenter to use the Standard Celeration Chart.

I have always written "Fred Skinner" on the list as my Chart parent. Usually, a number of sharers write my name as their Chart parent, making Fred Skinner their Chart grandparent. I suggested to several of my Precision Teaching Chart 'children' that they refer to Skinner as 'Grandfather', a choice more dignified and more 'New England'. However they voted unanimously for 'Grandpa', and their term titles this article.

After all have written their names on the program list, the Chart sharing begins with the coach (often times Steve Graf, Jim Pollard, Chuck Merbitz, or Abigail Calkin) setting a timer for two minutes and calling the first Chart sharer to the overhead projector. Sharing Charts and the Chart's significance continue down the list with each presenter limited to two minutes. Sharers recycle through the sign-up list until each has shared all the Charts he or she wishes.

The family metaphor for relationships within Precision Teaching was further elaborated by our inimitable Jim Pollard in his keynote address at the 8th International Precision Teaching Conference in San Diego. He touched with sincerity on our roots and with humor on our foibles and outings. In my own keynote address to the 9th International Precision Teaching Conference in Boston on November 1, 1990, celebrating 25 years of Precision Teaching, I shared the 123 Charts that taught us the most over the past 25 years. I shared 2.5 charts per minute.

Our family tradition of timed Chart sharing has continued at annual conventions of the Association for Behavior Analysis and Precision Teaching

conferences over the past ten years. Monthly Chart shares in cities, universities and schools around North America have nurtured and maintained the Chart parent tradition. So Fred Skinner is truly a Chart grandparent, great-grandparent, or great-great-grandparent to most Precision Teachers and Standard Celeration Charters.

Thank you for what?

Thank you for our Chart sharing tradition described above. Thank you for frequency, for standard slope charts, for self-charting, for double-view charting, for functional charting, for data-up induction, for the "child knows best", for our humor, and for our warmth. Most of these topics I have described in articles on the foundations of Precision Teaching (Duncan, 1971a; Lindsley, 1971, 1990a); therefore, I will only briefly mention them here.

Thank you for frequency!

I have discussed in detail elsewhere the advantages of monitoring performance frequency and how Precision Teaching alone is keeping the rate of response measure alive in education (Lindsley, 1991).

In 1968, Richard Evans, a professor of Psychology at the University of Houston, interviewed Skinner, filmed the dialogue, and published it in book form. In this interview, Skinner called rate of response and the cumulative response record his two most important contributions.

> "EVANS: Dr. Skinner, of all the many intriguing and provocative contributions you have made to the field of psychology, many of which we have touched on in our discussion, which do you feel to be most significant?
>
> SKINNER: Let me preface my answer by saying that I have had a lot of luck in my scientific career. As I look back on it, it seems to me that two important things were the use of rate of responding as a basic datum and the so-called cumulative record which makes changes in rate conspicuous. ... A cumulative record makes visible at a glance changes in rate of responding over long periods of time. It permits an instantaneous analysis of behavior as an experiment proceeds" (Evans, 1968, p. 103).

Thank you for standard slope charts!

The cumulative response recorder automatically cumulated responses up the left of a sheet of paper to about 500 at which point it reset to the bottom of the record and started over again. The recording paper moved horizontally by a timer expressed in minutes. The pen drew a graph with cumulative responses up the left and minutes across the bottom. The slope or angle of the line was responses per minute or rate. All the recorders used with a species had standard response steppers and timing gears, so their slopes were standard. Fred Skinner designed standard grids. Fred's grids were like stamps with glue on their backs, so all you had to do was moisten one and stick it to your cumulative record for publication. Table 1 displays the angles in degrees of the lines on these grids and the responses per minute each angle measured.

Table 1

A Comparison of Cumulative Response Record Grids

Rat Speed (Skinner, 1938)		Human Speed (Lindsley, 1962)		Pigeon Speed (Ferster&Skinner,1957)	
Degrees	R/min	Degrees	R/min	Degrees	R/min
		80	80	79	180
64	8	64	40	60	60
45	4	45	20	42	30
27	2	27	10	24	15
15	1	15	5		

Note that the angular difference in degrees between the grid lines worked out to be about 18 degrees (a range of 12 to 19 degrees). These equal angular differences represented a doubling (x2) in response rate. What the cumulative recorder really did was to display response frequencies as slopes on a standard multiply scale (times 2).

Noting that cumulative response records were gradually disappearing from the *Journal of the Experimental Analysis of Behavior*, Skinner published an editorial entitled "Farewell, My LOVELY!"(Skinner, 1976). He missed the sensitivity in monitoring frequencies on standard slope records.

> "...Shall we never again see things as fascinating as the slight overshooting when

> a pigeon switches from the ratio to the interval phase of a mixed schedule, or learns to use a clock in timing a fixed interval, or 'sulks' for an hour after a short bout of fixed-ratio responding injected into a long variable-ratio performance, or slowly accelerates as it raps out 'just one more' large fixed ratio on a straining schedule? These 'molecular' changes in probability of responding are most immediately relevant to our own daily lives."

An interesting indication of the high value that Fred placed on the cumulative recorder was the personal diploma he sent me in the early seventies. It was an original smoked paper, kymograph driven record from the research published in *The Behavior of Organisms*. On the record Fred had scratched in the following:

TO: OGDEN R LINDSLEY
DOCTOR OF CUMULATIVE RECORDING
Signed: B. F. SKINNER, PRAESES
Attached was a brief note saying: "Og, I never sent you your diploma. Here it is. Fred."

However, it is only fair to point out that in an interview for the first issue of *Psychology Today*, Skinner agreed when prompted by Mary Harrington Hall, the interviewer, that schedules of reinforcement was his most important contribution.

> "HALL: If you could be remembered for just one contribution to psychology, would that be your analysis of contingencies?
>
> SKINNER: Yes, I suppose, if I am limited to just one thing, it would be the whole question of the contingencies of reinforcement arranged by schedules of reinforcement and their role in the analysis of operant behavior. It's a shame. Nobody pays much attention to it at all. It's an extremely interesting and complicated and fascinating field. I think it is my basic scientific contribution" (Hall, 1967).

And, even more recently, Skinner himself called *Verbal Behavior* his most important work:

> "A sabbatical term in the spring of 1955 enabled me to finish most of a book, which appeared in 1957 as *Verbal Behavior*. It will, I believe, prove to be my most important work" (Skinner, 1978, p. 122). From all this it is clear, that along with schedules and verbal behavior, Skinner considered rate of response and the cumulative recorder among his greatest contributions.

Thank you for self-charting!

A long-standing policy of Precision Teaching is self-charting by the learners. Our research has shown that learners learn more rapidly when they chart their own performance than when it is charted by other students or by their teachers. Also, they welcome much higher fluency aims when self-charting their progress.

Even more interesting is our early research on inner and outer behaviors in self-management. Self-charting of outer behaviors had more validity, even though the reliability may be in question. The reliability is often taken care of by the separation of daily bounce from the trends performed by the Standard Celeration Chart. Of course, inner behaviors must be self-counted and are best self-charted.

Self-charting has a long tradition in laboratory free-operant research, which began with the 1938 free-operant classic.

> "Records of this sort are easily classified and filed, and they provide a permanent first-hand account of the behavior. It may be noted that at no point does the experimenter intervene for purposes of interpretation. All the curves given in this book (except those obtained by averaging or those extending over a number of days) are photographic reproductions of records made directly by the rats themselves" (Skinner, 1938, p.60).

Thank you for double view charting!

In Standard Celeration Charting we sometimes monitor both daily changes on a daily Chart and weekly trends in the same performance on a weekly Chart at the same time. This gives us a double view--detailed and over all. This practice is directly traced back to early free-operant conditioning laboratory recording.

> "Occasionally, two recorders are used: one to provide measurements and easy inspection of details, and the other to provide a compact summary of the whole session" (Ferster & Skinner, 1957, p.24).

Thank you for functional charting!

One of our most sophisticated charting methods for interpersonal behavioral adjustment is functional charting. It is not a single behavior that is charted on one Chart, but that behavior only under special conditions. The same behavior under different conditions is charted on another Chart. For example, a husband attempting to accelerate pleasing his wife, charts successful attempts on one Chart when she gave him clues, and on a second Chart when his attempts are successful without any clues from her.

This functional recording was at the heart of our laboratory analysis of social behavior (Azrin & Lindsley, 1956; Cohen & Lindsley, 1964) and of discrimination and differentiation (Barrett & Lindsley, 1962). Functional charting is directly traceable to Ferster and Skinner's laboratory analysis of schedules of reinforcement.

> "In multiple schedules two or more recorders may be used, only one of which operates at any given time. Thus, the behaviors appropriate to several conditions may be automatically separated and cumulated for study" (Ferster & Skinner, 1957, p.24).

Thank you for data-up induction!

Precision Teaching follows Skinner's data-based laboratory research strategies. These researches were perhaps the richest bodies of inductive behavioral research conducted since Pavlov. We can assign numbers to the ratio of induction by dividing the number of records that were collected by the number that were published. The following table reports the induction ratio for Skinner's rat operant and pigeon schedules research along with those for Precision Teaching.

Note that the 123 Charts that I used at the 9th Precision Teaching Conference were selected in an induction ratio of 97 to 1. This ratio is close to the 78 to 1 induction ratio used in Ferster and Skinner's pigeon schedules of reinforcement research. This induction ratio quantifies the amount of data behind each conclusive chart. Using the ratio permits us to compare the degree of induction used by different scientists.

Thank you for the child knows best!

While a graduate student at Harvard, I once went to Fred Skinner with a cumulative record of a rat's lever pressing showing an extinction curve slightly different from those published in Skinner's book, The Behavior of Organisms. I expected some defensive comment like, "You didn't conduct the experiment right." What I heard was, "The book's wrong! The rat knows best! That's why we still have him in the experiment!"

Translated as "the child knows best" has become a Precision Teaching slogan. It has been supported with multitudes of classroom examples of child

Table 2

Number of Charts Collected for each Chart Published

Publication Date:	Research Title:	Years Taken:	Charts Collected:	Charts Published:	Induction Ratio:
1938	Beh. of Org. Skinner	6	4,000	99	40 / 1
1957	Schedules Ferster & Skinner	7	70,000	896	78 / 1
1971	Precise Behav Facts Lindsley, et. al.	5	12,000		
1990	PT Conf Keynote Lindsley	25	11,900	123	

selected procedures solving learning problems where teacher selected procedures had failed.

In the early Precision Teaching workshops, I would often be asked by a teacher, "What would you do for a child who cannot use his hands?" The most effective answer I had discovered to such questions was, "What is the child's name?" The asking teacher would usually mumble and say, "I don't know." At which point I would say, "You didn't make him up, did you? We have too many real children with real problems to deal with made-up children now. We will get to your made-up child after we have helped all the real ones." (Lindsley, 1971).

Thank you for our humor!

My wife, Nancy Hughes, with former students: April Gragert, Abigail Calkin and Ann Starlin Horner, arranged a gathering of former students in Lawrence to congratulate me on retiring from 25 years of university graduate teaching. Fred Skinner sent the following note:

HARVARD UNIVERSITY
DEPARTMENT OF PSYCHOLOGY
November 30, 1989

Dear Og,
Does this mean I won't have to sign any more of those semi-log records? Wonderful news!!

I can't believe you'll really stop doing things. What do you have in mind? You could always come back to Met State. There's lots of room out there now. The patients are sleeping in the streets and flophouses of Boston. Of course you wouldn't have any subjects, but there are pigeons all over the place, and you could trap a few rabbits. Nobody's tried rabbits yet.

How about going back to the old project to teach dogs to smell different kinds of diseases? If you want some samples, send bottles.

Why not go back to your old love of German literature? The classics always bear rereading and the Germans are writing new books I bet you haven't read.

Whatever you do, I'm sure you'll enjoy yourself,
Hope I've been of some help.

As Ever,

Fred

Our last visit

My last visit with Fred was on Sunday, 7 January 1990 from 10:00 to 11:45 AM at his home in Cambridge. Fred's wife, Eve, said the visit could only be for 1/2 hour and not to stand too close or touch him, for fear of spreading germs, since he had no white cells to combat infections. I washed my hands well beforehand.

Fred clasped my hand warmly before I could withdraw it, and we talked on. Eve entered and suggested we stop twice before we finally parted. We covered many topics. Towards the end of our conversation, I bluntly asked him several questions that had been with me for some time.

I asked whether he had any thoughts about the probability of life after death. Fred laughed and said, "You know me better than that, Og! Of course not! This is the only life there is!"

I said, "Remember Sherrington, the great British neurologist, returned to religion in his old age," and I asked Fred if he had any thoughts about religion. Fred laughed again, cocked his head and said, "Well, explaining behavior by religion isn't too far from explaining it by the nervous system, so Sherrington didn't have too far to go!"

I asked Fred if he was still a member of the Hemlock society, and would he follow their recommendations if necessary. Fred chuckled again and said, "Why of course, I always knew I was going to die sometime, and I certainly don't want to spend my last weeks in great pain or discomfort. And, if no one else would put me out of my misery, I suppose that I'd have to do it! I've lived a rational life so far, and there's no reason to change that now!"

I said that at times I thought I had wasted a major portion of my life trying to get education to apply more productive methods, that as long as teachers and Psychologists are paid by the hour, rather than by the learning they produce, the current inefficiency will go on. Fred smiled and said, "Og, we both know all this, and have talked about it many times before; let's dwell on more happy topics."

I said, "Well, at least we got rate of response into the classroom, proved it the most effective record there as it was in the lab, and discovered some laws of learning. Fred said, "Yes, you and your students have done a good job on that. Someday the methods will be widespread, but probably not

in our time."

Fred's closing comment was to tell me that I should get in touch with Temple Grandin, whom he had helped at Arizona State. Temple has found that cattle will walk easily down a winding chute with turns in it, when they balk at going into a straight chute. So ended my last visit with Fred wanting to help me with my cattle.

Thank you for your warmth!

While preparing to leave for the 1990 Association for Behavior Analysis convention, as I reviewed the program, I noted that B. F. Skinner's name was absent from the presenters' list for the first time. This moved me to send Fred the following letter:

Route 1 Box 157
Lawrence, KS 66044
25 May 1990

Dear Fred,

I am making last minute changes to my presentation for ABA. Nancy and I leave for Nashville in the morning. My thoughts of you have been accelerating as ABA draws near. This will be the 16th annual ABA convention, and the first without you.

It seems so final with your name missing from the program. I know you are still here, but you will not be there. It is wonderful that I can still write to you and let you know how I feel. I guess I am really shy because when we meet, I never say the things that I had planned to say.

I want you to know how much I value our relationship. You taught me that there can be a natural science of behavior, and gave me its measure...rate of response.

You and I both know that our culture is not yet ready for a science of psychology, psychiatry or education. There is just more money in slowly healing and educating than in the rapid improvements that our science of behavior produces. When the culture is ready, rate will be its measure.

I have spent 37 years recording and analyzing human behavior rates; I plan to spend my Emeritus years writing my results and conclusions.

Enclosed is a copy of my handout for my ABA presentation this year. People (even Dick Malott) still fall into the statistical ratio probability trap. Its entrance is enticing and its logical walls so slippery that few get out.

As ever,
Og

In spite of his severe anemia condition, Fred sent me the following prompt reply:

11 Old Dee Road
Cambridge, MA 02138
June 11, 1990

Dear Og,

Thanks for your letter. I can reciprocate for your nice remarks by telling you how much I appreciate your loyalty and help over the years.

I am sorry not to be attending any more meetings of ABA, but the last one was really a very good farewell party.

Best to you both.
As ever,
Fred

How can we thank you for all these gifts?

Thank you, Grandpa Fred for all these gifts! But, most of all, thank you for your biggest gift, our Chart vertical, our ordinate. The noblest way to give thanks for a gift is to use it.

Every frequency dot you drop on a Standard Celeration Chart honors your Grandpa Fred. He gave us frequency and standard slopes. So, above all, chart, chart, chart, chart! Chart for your Grandpa Fred!

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B. F. Skinner (1904 - 1990)

Professor Emeritus Ogden Lindsley of the University of Kansas was the first to apply Skinner's principles to humans. He worked with schizophrenics at Metropolitan State Hospital, referenced by Skinner in his congratulatory retirement note to Lindsley. Reprints of this article are available from the School of Education, University of Kansas, Lawrence, KS 66045.

Commentary on the 9th International Precision Teaching Conference

by

Michael Connolly and Diane Hendrickson

Purpose

As newcomers, we were introduced to Precision Teaching in the usual business networking way. We had personal contacts with Precision Teachers who instilled us with a curiosity and excitement in a proven but revolutionary method of teaching. We were both anxious to attend the conference since we thought it would be an excellent and thorough learning experience. We weren't disappointed.

After spending four busy days with our eyes wide open to the newness and power of this educational technology, we were engaged enough to become active participants in this "movement." By contributing our expertise in communication, new product marketing, and strategic planning, we hope this commentary helps bring the benefits of Precision Teaching to market more rapidly. Specifically, we would like to offer a thumbnail "audit" of the Precision Teaching field, discuss how to market innovative products and services, outline some challenges facing Precision Teaching in promoting innovation, and suggest possible action steps. This article is the first in a series.

Impressions

First of all, the Boston conference was well organized and carefully planned - a remarkable job considering the scope and magnitude of the events spread over four days. What struck us immediately was the extraordinary energy, intelligence, and camaraderie of both speakers and attendees. This energy was harnessed and magnified not only by the wide range of hands-on presentations, but also by the Cracker Barrel sessions, the Special Presentation of the Terry Harris Story, and the Celebratory Luncheon with surprise "info-tainment."

We also noticed the scarcity of newcomers, outsiders, suppliers, and "customers": the kind of diverse audience who attend conferences and trade shows of more "mature" technologies - some of which may even be younger than PT. Given the impressive amount of information and expertise shared at this conference, this was a surprise and disappointment.

Most importantly, the conference confirmed our belief that Precision Teaching is a powerful, revolutionary technology that offers the potential for quantum leaps in learning, productivity, and social harmony. However, because PT appears to discard so many traditional notions about motivation, aptitude, responsibility, and achievement, potential consumers or "adoptees" will require very careful cultivation and much time in order to "sign on."

Great Moments

Over one hundred presenters showed how Precision Teaching can be applied to students in any classroom to produce the most effective learning experience. The conference involved dozens of exceptional presentations. However, we highlight just a few great moments. These PT "success stories" would appeal directly to people from all walks of life and could be used in marketing PT products and services.

* Dr. Ogden Lindsley, founder of Precision Teaching, discussed over 100 key charts which have challenged his preconceptions and led to discovery over the past 25 years.

While the details of the charts were outstanding, Dr. Lindsley also presented several key issues relating to educational policy. Among them is the dramatic result that students can double their performance on a given skill each week and allow them to master skills and knowledge at rapid rates. Initially, Precision Teachers aimed for a x1.25 (25%) increase weekly - already far higher than the norm. They then learned that when students were involved in their own decisions, they could average x 1.5 (50%) increases weekly. We also learned that if students leap far enough up a curriculum, where their errors exceed corrects by six to one, acceleration is steeper, and they've jumped over those time-wasting intermediate steps.

Other lessons were: the degree of bounce in a behavior is unrelated to the slope of the learning line. In other words, you don't have to first "stabilize" a behavior to accelerate or decelerate it. Also, the level of civil disturbances has gone up dramatically in the U.S. over the past 30 years, but have re-

mained stable abroad. Noting that only one in every ninety-seven charts produces enough insight to be worth publishing, he urges listeners to chart as much as possible, be prepared for surprises, and welcome them!

* The multimedia, personal presentation of the Terry Harris Story was a powerful testament to courage and triumph in the face of tremendous adversity. Through Precision Teaching, Terry Harris, his mother, and his teachers, Eric and Elizabeth Haughton, refuted the repeated dismal prognoses given by various experts to Terry, an infant with severe cerebral palsy. Today, he skis, is preparing for university, and presents eloquently to large groups.

* In Seattle, Kent Johnson's Morningside Academy has rocketed sixty-five semi-literate men (two dozen were homeless) from 4th to 10th grade performance levels in three months. And the results literally leapt off the chart! "No," Kent grinned, "It's not a mistake. The data's real." When one participant commented that the U.S. Department of Education (DOE) should be here, the representative from DOE raised his hand and said, "We are."

* P. Kenneth Komoski, Executive Director of the Educational Products Information Exchange (E.P.I.E.), startled attendees with data showing that fewer than one percent of educational materials are actually tested and validated with learners before publication. Textbooks contain huge amounts of extraneous material irrelevant to the objectives of the teacher. With the advent of electronic publishing, publishers can tailor textbooks to the needs of small groups quickly and economically. Precision Teachers can both contribute to and benefit from this flexible publishing technology.

* Bruce Griffin and Steven Kukic, top administrators in the Utah State Office of Education, urged the audience in the words of Martin Luther King, Jr., to avoid gradualism and challenge the status quo head on. Working with the country's smallest educational expenditure per student, Utah is expanding its statewide commitment to Precision Teaching. "Now is the time!" they said. "There's much to be done."

Reality Check

After two decades of spectacular, documented achievements with elementary school children, the disabled, homeless men, college students, corporate trainees, and many other student populations, Precision Teachers told us that they sometimes feel further than ever from their goal of influencing U. S. education. In accounting for this disappointment, it may be useful to consider perspectives from other disciplines, in particular a branch of marketing known as the Diffusion of Innovation (Rogers, 1962).

Precision Teaching has the feel of a young movement: a network of independent individuals who are enthusiastic about their technology. You share a special language and envision endless possibilities for Precision Teaching as did "techies" in other industries before you, such as developers of personal computers in the seventies or proponents of internal combustion in the nineteenth century. But, people buy concrete products and services not technologies, philosophies, or possibilities. They buy train tickets and automobiles, not internal combustion.

At this point, the basic technology has been proven. Developing effective and widely accepted applications now depends upon successful mastery of two marketing processes:

1. **The Product/Service Innovation Process, and**
2. **The Consumer Adoption Process.**

These processes are quite different from Precision Teaching's initial research and development phase.

The Product/Service Innovation Process

The first challenge in bringing a new technology to market is to create a well-defined product or service which satisfies the perceived need of a person or organization (Kotler, 1985). People can't tell you what internal combustion is, but they buy cars. Why? Among other things, they have a need to get places quickly, freely, and on short notice.

A corporate executive may tell you she wants her customer support staff to learn more, learn it faster, or remember it longer. Why? Because this would allow them to answer customer questions better and faster, while decreasing the cost of training and the risk of giving out inaccurate information. If you then tried to sell her on "fluency", you would not be addressing her need. However, a training package which promised a

faster, more effective learning experience, followed by measurably higher performance would respond to her need -- and would indeed be fluency based.

The truth is, there are only a few PT "applications" which offer clear benefits and deliverables at a stated cost, for example:

* learning centers: Morningside Academy, Ben Bronz Academy, Haughton Learning Center, The Quinte Learning Centre
* instructional software: Behavior Tech
* corporate training services: Precision Teaching and Management Systems, Inc.

The challenge is to continue to identify and develop appropriate applications in a timely fashion. Possible new Precision Teaching products or services might include:

* Precision Teacher training programs (such as Dr. Lindsley's Trainers Short Course)
* system-wide nursing and paramedical training in third world countries
* adult career assessment and development centers
* pilot flight training simulation programs
* weight reduction centers and
* technical training materials for CARE, OXFAM, and other organizations doing technical assistance abroad.

But wait! Designing good, relevant PT-based products and services is necessary but not sufficient to generate widespread adoption of this innovative technology. This brings us to phase two: the Consumer Adoption Process.

The Consumer Adoption Process

Successful innovative products or services spread through the marketplace in layers. The first layer, the Innovators, is composed of people willing to truly take a risk on products *they perceive* as promising but unproven (Rogers, 1962). Trend setters and opinion leaders, Early Adopters, follow, and then, once the market is established, the large mass market (layers three and four) follows.

Since the mass market is not yet educated about Precision Teaching, we must first focus on the Innovators' perceived wants and needs. In other markets, Innovators are venturesome. They have been at the forefront of their field. Their focus tends to be on possibilities and potentials; they are not strongly motivated by cost considerations or by guarantees. This explains why a money-back guarantee, a promise of security, is traditionally not an important factor in marketing to Innovators.

Moreover, Innovators are characteristically willing to invest in achieving their vision. For example, the first layer of consumers to adopt new electronic products (color TVs, calculators, quadraphonic stereo, VCRs, FAX machines) paid ten times what the mass market paid for those products several years later. Incidentally, for various reasons, some innovative products do not make it to the mass market--quad stereo, for example.

As a result, Precision Teaching products and services must appeal to the imagination of the Innovators. In order to appeal to Innovators, it will be necessary to find out what's meaningful to them and will require two-way communication in their language rather than the language of Precision Teaching.

Who are these risk takers, and how do we find them? To begin with, they are a small fragment of the marketplace. Broadly speaking, they are people and organizations who are, for some reason, unconstrained by tradition. They include those who have previously moved quickly to adopt educational innovations, or who are now disposed to do so.

Japanese and Swedish automotive manufacturers have spent heavily on progressive employee job design and training for years. In America, Polaroid was at the forefront of corporate human resource development training in the 1960's. Both could be potential Innovators. And the emergency medical technician (EMT) field, which is young and growing rapidly, is probably still unconstrained by tradition and might be willing to "bet" on PT.

In the next article of this series, we will explore these and other market possibilities.

Next Steps

If Precision Teaching technology is to be diffused successfully from the universities and learning centers into broader acceptance by society, the Precision Teaching movement must ensure its continued ability to train people in the basics of PT, while building its capacity for product development and marketing.

We offer some options, while underscoring that this will be a long term project.

- Preserve and enhance your numbers and your knowledge base by:
  - developing a trade or professional organization;
  - further developing and understanding teacher training and train-the-trainer programs.
- Understand the core of what Precision Teaching offers: to most customers, it will probably not be "precision" or "fluency" but speed of learning and retention.
- Start to develop and market PT products and services:
  - request articles and PT conference sessions on new product development and marketing;
  - study case histories of the adoption of educational, medical, and service industry innovations;
  - invite innovative organizations like Apple Computer to PT conferences;
  - recruit product development and marketing professionals;
  - publish articles about successful PT products and services in the *Journal of Precision Teaching,* in business media (e.g., *Inc., Wall Street Journal*), and leading newspapers.
- Search out innovative organizations and learn from them. Don't limit the search to North America!!

Summary

The importance of Precision Teaching as a powerful, effective tool was obvious to us as newcomers. We found the International Precision Teaching Conference to be an excellent learning forum. It also stands as an ongoing means of communicating and sharing work from the PT field.

However, to attract and maintain the attention of a nation in an educational crisis and to promote the widespread use of Precision Teaching, we have suggested the use of the Diffusion of Innovations model as a step toward successful adoption of PT practices.

By designing additional products or services that can offer clear benefits and deliverables at stated costs, and focusing on people and organizations who are already inclined to adopt educational innovations, the importance of Precision Teaching may be communicated to a larger and more receptive audience.

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Effects of a Modified Repeated Reading Procedure on Reading Fluency of Severely Disabled Readers

by

Cynthia L. Carroll, Sandra McCormick, John O. Cooper

A repeated readings with word drill procedure was evaluated as a method for increasing reading fluency of 4 elementary students having severe reading disabilities and severe behavior handicaps. Students read a passage repeatedly for 1 minute per session until they could read a minimum of 100 correct words per minute with no more than three incorrect words. Repeated reading frequencies were recorded and baseline passages at the same grade level were assessed for transfer of fluent reading. Students were assigned a new passage for repeated readings after achieving fluent reading on a previous passage. Repeated readings with word drill were functionally related to an increase in the number of words read correctly per minute and a decrease in the number of words read incorrectly per minute. However, three passages read to fluency were not sufficient to produce a transfer of fluent reading skills to new passages.

Fluency, a synchronization of accuracy and rate of response, is important to reading development for a number of reasons. First, fluent reading is a necessary prerequisite to the primary goal of reading--comprehension of text. Nonfluent reading, that is, reading which reflects excessive attention to individual words, makes it difficult for readers to assimilate the general significance of ideas presented in a selection (Smith, 1982). Research has shown the interrelatedness between comprehension and the component parts of fluency: word recognition accuracy is significantly related to rate of word recognition, and rate of word recognition is highly correlated with understanding of material read (McCormick & Samuels, 1979). Second, fluency has an influence on students' interest in reading. Grob (1968), for example, found that when students' reading rate improved, interest in the content increased because their reading sounded more coherent, and, therefore, made more sense to them. Third, fluent reading is a necessity if students are to accomplish reasonable rates for work time. When Grob (1970) demonstrated time needed to complete typical school tasks by readers using average versus slow reading rate, his data showed the near impossibility of succeeding in certain reading assignments if one is hampered by excessively nonfluent reading behaviors.

Although interest in reading accuracy and rate has had a long history (e.g., Buswell, 1920; Cason, 1943; Goldstein, 1940; Tinker, 1936; Tinker, 1958), recent attention to fluency has been a result, to some extent, of the influence of automaticity theory (LaBerge & Samuels, 1974). LaBerge and Samuels used the term automaticity to describe responses necessitating little attention or conscious effort. The premise of automaticity theory is that individuals have limited attention capacity, and it is, therefore, important to develop certain lower level skills (e.g., word recognition) to the automatic stage, so there is attention capacity available for higher level processes (e.g., reading comprehension). Samuels (1985) contends that the goal of instruction should be to assist readers in moving beyond accuracy to automaticity, as reflected by speed of response. For automaticity to be achieved, practice is required.

Allington (1984), Chomsky (1976) and others have described many low-achieving students as "word by word" readers whose oral reading behaviors are painfully slow with patterns exhibited that are similar to those of younger readers. They point out that while these students usually receive instruction on accuracy of word recognition, they seldom are given instruction on rate.

One reason for children's nonfluent reading is lack of a sufficiently large sight vocabulary, indicating that attention to word accuracy is a requisite for remediation of the problem. However, this appears to be a necessary, but not sufficient, condition. Samuels, Begy and Chen (1975-76) found that skilled and more skilled readers who recognized the same words were differentiated by response latency--less skilled readers had slower speeds of response. Another reason for nonfluent reading is lack of attention to task. Often attention can be aided by setting goals and measuring outcomes. In addition, certain students with long histories of reading problems have habits of markedly slow reading which persist due to practice effects (McCormick, 1987). Because of past difficulties with word identification, they had not been expected to read fluently, but even after

attaining fluent word recognition, continue in nonfluent rates, though no longer necessary.

Fluency can be improved through instruction (e.g., Braam & Berger, 1968; Carver & Hoffman, 1981; Dahl & Samuels, 1979; Himelstein & Greenberg, 1974; McGreevy, 1983; White & Haring, 1980). Techniques employed in fluency instruction previously have included use of timed exercises available from commercial publishers, mechanical devices (Sailor & Ball, 1975), and the neurological impress method (Heckelman, 1966). Recently, there has been interest in the technique of *repeated readings* (Chomsky, 1976; Samuels, 1985). Samuels (1979) first developed his version of repeated readings after considering how musicians and athletes become proficient at tasks in their fields and concluding that repeated practice on the same skill is facilitative. His program of repeated readings consists of having students orally read and reread the same passage of material for several trials, during which accuracy and rate are measured, until they have reached a pre-established criterion. The students then repeatedly read another passage until the criterion is accomplished, and so forth. This procedure is conducted until the fluency criterion is met on the first reading of a new passage. Students with mental retardation in Samuel's (1979) research successfully increased rate and decreased word errors as a result of this program of repeated readings.

To make large amounts of connected text available to subjects in her study (as opposed to focus on individual words), Chomsky (1976) had third-grade disabled readers repeatedly read while listening to the stories on cassette tapes until they could read the story unassisted and with fluency. Other researchers also have had positive results in using repeated readings to attain an acceptable standard of fluency with elementary school children in regular classrooms (Dowhower, 1987) and with high school students (Carver & Hoffman, 1981).

In the report of the Commission on Reading, *Becoming A Nation of Readers,* Anderson, Hiebert, Scott, and Wilkinson (1985), said: "Repeated reading deserves consideration as an alternative to the conventional practice of having children read aloud new material every day. No one would expect a novice pianist to sight read a new selection every day, but that is exactly what is expected of the beginning reader."

In the present study the repeated readings technique accompanied by word card practice was used to increase the reading fluency (accuracy and rate) of sixth-and seventh-grade students with severe behavior handicaps who also had severe reading disabilities.

Method

Participants.

Four male students from an elementary classroom for learners with severe behavior handicaps served as participants. Selection of students was based on students' individual need for improvement in reading fluency and sight reading as reflected by test scores from the Woodcock Reading Mastery Test (Woodcock, 1973). This test was administered to each student upon admission to the school. Grade level scores of the present subjects on the Woodcock ranged from 2.0 to 3.0 with a mean of 2.6. The students ranged from 11 years 1 months to 12 years 5 months in age. Range of IQ scores for students was between 73 and 111 on the full scale Wechsler Intelligence Scale for Children-Revised (Wechsler, 1974). Each student had been in at least three previous residential placements, ranging from treatment foster homes to psychiatric hospitals. Specific data on each student are shown in Table 1.

Table 1

Characteristics of Participants[a]

Student	Age (Yr/Mos)	Academic Level I.Q.	(Grade/Reading)	# of Residential Placements
1	11/1	92	5/2.6	7
2	12/5	87	6/3.0	5
3	11/8	73	5/2.0	3
4	11/11	111	5/2.8	4

[a]All participants were labeled as Severe Behavior Handicapped.

Setting.

All conditions of the study were conducted in the art room of the participants' residential facility for emotionally disturbed children. The first author, a graduate student in special education who served as the teacher, tutored each student individually. The art room was 14 by 20 meters with a

rectangular table and stools. Shelves lined one wall of the room, and the other wall had a sink and a pottery kiln. The setting was chosen because the art room was not used in the morning, and there was little distracting noise.

Response Definition and Data Collection.
The unit of analysis for the dependent variable was number of correct and incorrect words read orally on a previously unread passage from the Science Research Associates (SRA) Reading Series (Parker & Scannell, 1973). Choice of reading levels for the passages used was based on the assessment from the Woodcock Reading Mastery Test, sometimes modified by the classroom teacher's current reading level recommendation.

Each school day each student was given a passage card from the SRA Reading Series and asked to begin reading orally as the teacher simultaneously activated a stopwatch and audio tape recorder. As the student read, the teacher recorded correct and incorrect words on a copy of the passage. At the end of one minute, the teacher said "Stop reading" and simultaneously stopped the stopwatch. Then the teacher scored the passage by recording the number of correct and incorrect words. If a student self-corrected a word initially read incorrectly, the word was scored as correct.

The following is an illustration of the recording procedure:

will
"The boy and girl ~~walked~~ to the l store
to buy some (bread) and milk."

The score from the illustration above would be 12 correctly read words and two incorrectly read words. "Walked" was not read correctly, so it was crossed out and the incorrectly substituted word written above it. Parentheses around a word, such as with "(bread)," indicated that the student did not attempt the word (i.e., the word was omitted). The slash mark between words indicated a pause in oral reading of more than one second that interrupted fluency. Pauses were recorded to indicate gaps in fluency but were not reported as incorrect responses.

Experimental Design.
A multiple probe design (Horner & Baer, 1978) across same-grade-level typed passage cards was used to assess the effects of repeated readings with word drill on increased reading fluency. In multiple probe designs, a number of responses are identified and intermittently measured, or probed, over time to provide baselines for analyzing behavior change prior to the introduction of the independent variable. The independent variable was applied after baseline, first to one passage, then to a second passage, and then to a third.

Procedures.
Baseline. The student orally read different SRA passage cards from the same grade level; the number of correctly and incorrectly read words was then recorded for each. Each passage card from the SRA Reading Series was read only once during baseline. At each baseline session, the experimenter handed the student a passage card. The student was told that the experimenter would tell him when to start and stop reading and that an audiotape and stopwatch would be started when he began reading and stopped when he ended reading. No specific verbal feedback on performance or response prompts was provided during baseline. After the student stopped reading, the experimenter gave nonspecific verbal praise such as "nice job," "very clear reading," "you were trying very hard." The experimenter did not correct any incorrect words or let the student finish reading the passage after the one minute of timed reading. The baseline conditions occurred for a minimum of five sessions or until steady responding occurred or a trend of decreasing fluency was established.

Immediately following each timed reading, the teacher charted the students' number of correctly and incorrectly read words while simultaneously explaining and demonstrating the graphing procedure. Following three sessions of demonstrations, the teacher instructed students to graph their own data which they continued to do in the intervention phase of the study.

Intervention (repeated readings with flash cards). Repeated readings of the SRA passages were used to develop fluency in reading. The same passage was read twice per session until the number of correctly read words increased, and the number of incorrectly read words decreased to meet the specified fluency criterion of 100 correct words with three or less incorrect words per minute. The fluency criterion was selected by timing oral reading of an individual who was judged to be a highly proficient reader. He read 123 words correctly in one minute with no errors. The fluency criterion of one hundred correct words with three or less incorrect words read per minute was set at 20 words less than that of a proficient reader and is consistent with fluency levels recommended by others (e.g., Koorland, Keel, &

Ueberhorst, 1990; Mercer & Mercer, 1985).
Along with the repeated readings of a passage, one additional instructional technique was used to teach individual words. After the first reading, the words read incorrectly were written on 7.6 cm by 12.7 cm cards. The teacher held up each card for three seconds and then went on to the next card. If a student missed a word, the teacher prompted by saying the initial sound of the word. If this response prompt was ineffective, the teacher pronounced the entire word and asked the student to repeat it orally; the card was then placed in a separate pile of words to be read again at the end of the session. These cards were practiced before each timed reading. After the card exercises, timed reading and self-recording occurred.

Transfer measure. To determine if any improved reading fluency would transfer to previously unread (independent, untrained) passages at equivalent reading levels, each student's oral reading fluency was analyzed (a) before repeated readings, (b) during repeated readings, and (c) following repeated readings instruction. When students read fluently with the intervention of repeated readings with word card drill, but fluency did not transfer to new passages, then a new passage was read repeatedly until fluency was achieved.

Accuracy and Interobserver Agreement of Measurement.

Accuracy. Audio tapes of students' reading were used to check the accuracy of measurement (Johnston & Pennypacker, 1980), for the number of correct and incorrect words per minute. Correct and incorrect words for each reading were independently measured twice. Accuracy was assessed by the first author who listened to the tape, recorded correct and incorrect words on a copy of the story, and compared this second measurement with the measurement taken during the session with the student. Accuracy of measurement was assessed for all sessions. Accuracy agreements from baseline verifications and intervention verifications were 100%.

Interobserver agreement. Audio tapes of the students' reading also were used to assess interobserver agreement on the durations of time students read. Durations of the taped readings were recorded with a stopwatch by a second observer to verify that the student read for exactly 60 seconds. These attempts at verification occurred for each passage read. Overall, interobserver agreement between the second observer and the first author on the durations of students' readings was 93%, with 100% agreement that students read for exactly 60 seconds on 151 of the 162 passages read.

Integrity of the Independent Variable.

To ensure the integrity of the independent variable, audio tapes from each session were monitored for adherence to and deviations from the prescribed baseline and repeated readings with word drill procedures. Integrity of the independent variable was monitored with the following procedures:

1. Checklists were developed from an outline of the baseline and repeated readings procedures.
2. An independent observer listened to the audio taped sessions and used the procedural checklist to verify consistency of implementation of the independent variable. Nine complete baseline sessions and nine complete sessions from the repeated readings/card phase were audio taped. The audio tapes included the teacher's directions, the card sessions, and the students' readings. Mean baseline percentage of procedural adherence was 91% (range = 78% to 100%), while mean repeated readings/flash card agreement was 97% (range = 85% to 100%).

Social Validity.

Repeated reading activities were assessed to determine if they were socially valid (Wolf, 1979) in developing oral reading fluency. Social validation was accomplished by examining the goals of the study, the social appropriateness of repeated reading, and the social importance of the results.

Appropriateness of repeated reading. Three of the four students who participated in the study were interviewed at the conclusion of the study to determine whether each student enjoyed reading orally, enjoyed the repeated readings, participated more because of charting the number of words read correctly and incorrectly and use of the 1-minute timings, thought the stories were too easy or too difficult, was ever bored with the reading program?

Importance of results. Four teachers were interviewed to determine what importance and relevance this study would have in daily classroom planning. During the interview, conducted by the first author, the teachers were asked to respond to the following: (a) Is oral reading skill important? (b) Is fluent reading rate important? (c) Is repeated readings an appropriate instructional technique to

improve reading fluency? (d) Will teachers, in general, teach for fluency and not just for acquisition? (e) Are one-minute timings to assess skill development helpful for students?

Results

Sample data obtained during baseline and repeated readings with word card drill conditions are presented as the number of words correctly and incorrectly read per minute in Charts 1 and 2. The number of correct and incorrect words per minute followed similar trends with session to session patterns of variability for all participants during each condition of the experiment. The baseline conditions, which included self-charting, were in steady state responding or showed a decreasing trend prior to the addition of repeated readings plus word card drill. Since self-charting was not associated with improved fluency, the treatment package was considered only repeated readings plus word card drill. Following introduction of the treatment package, all students, for each passage read, demonstrated a rapidly increasing trend in the number of correct words read per minute, and all showed a decrease in the number of incorrect words read. In addition, all students had either one or two untreated baselines for the duration of the experiment. Those untreated baselines maintained a steady state responding, or a slightly decreasing trend with the exception of Student 2; his last eight untreated baseline sessions were higher in correct words read per minute than his first six sessions. (See Chart 3.)

Table 2 presents the participants' low scores, high scores, and median scores by experimental condition for number of correctly and incorrectly read words per minute from each passage.

Transfer measure. Each student's oral reading rate was analyzed (a) before instruction, (b) during repeated readings, and (c) following repeated reading instruction. For the participant group as a whole, correct reading fluency on previously unread passages during assessment of transfer effects decreased by a mean of four words per minute. The number of words read incorrectly remained virtually the same. These data indicate that fluent reading generated with repeated readings did not transfer to previously unread passages, since overall correct reading rates decreased slightly. Reading up to three passages (i.e., training three exemplars of the skill) at a fluency criterion of 100 correct words per minute with three or less incorrect words per minute was not sufficient to produce a transfer effect.

Table 2

Low, High, and Median Correct Words Per Minute by Experimental Conditions

	Baseline			Intervention		
Passages	Low	High	Median	Low	High	Median
			Participant 1			
A	47	73	68	70	105	90
B	64	87	70	76	104	91
C	59	87	71	65	95	88
D	55	75	64	---	---	---
			Participant 2			
A	39	91	55	94	123	110
B	45	83	70	80	115	101
C	58	95	74	77	115	95
D	39	96	82.5	---	---	---
			Participant 3			
A	12	40	32	21	75	64
B	13	33	26	39	74	58
C	14	41	27	---	---	---
D	15	43	32	---	---	---
			Participant 4			
A	57	91	78	89	117	104
B	53	83	69	66	104	87
C	39	89	73	---	---	---
D	57	87	74	---	---	---

Social validity. The results of the participants' interview used to gather social validity data indicated that one participant enjoyed reading orally in all settings and the other two students did not mind reading orally with the experimenter, but did not like oral reading in school. They both stated that oral reading in front of classmates was embarrassing and made them nervous. All three students liked engaging in the repeated reading activity with the experimenter and said it helped them to understand the story better. The charting of number of words read correctly and incorrectly and the the one-minute timed readings were important activities for participants. Students stated that they were eager to "beat their score" from the session before. All three students said that these procedures helped their reading skills on other passages and improved their sight word vocabulary. Two of the three students said that some of the passages were too difficult for them, but all three agreed that a majority of the stories were at an appropriate level. One student said the

DAILY BEHAVIOR CHART (DCM-9EN)
6 CYCLE – 140 DAYS (20 WKS)
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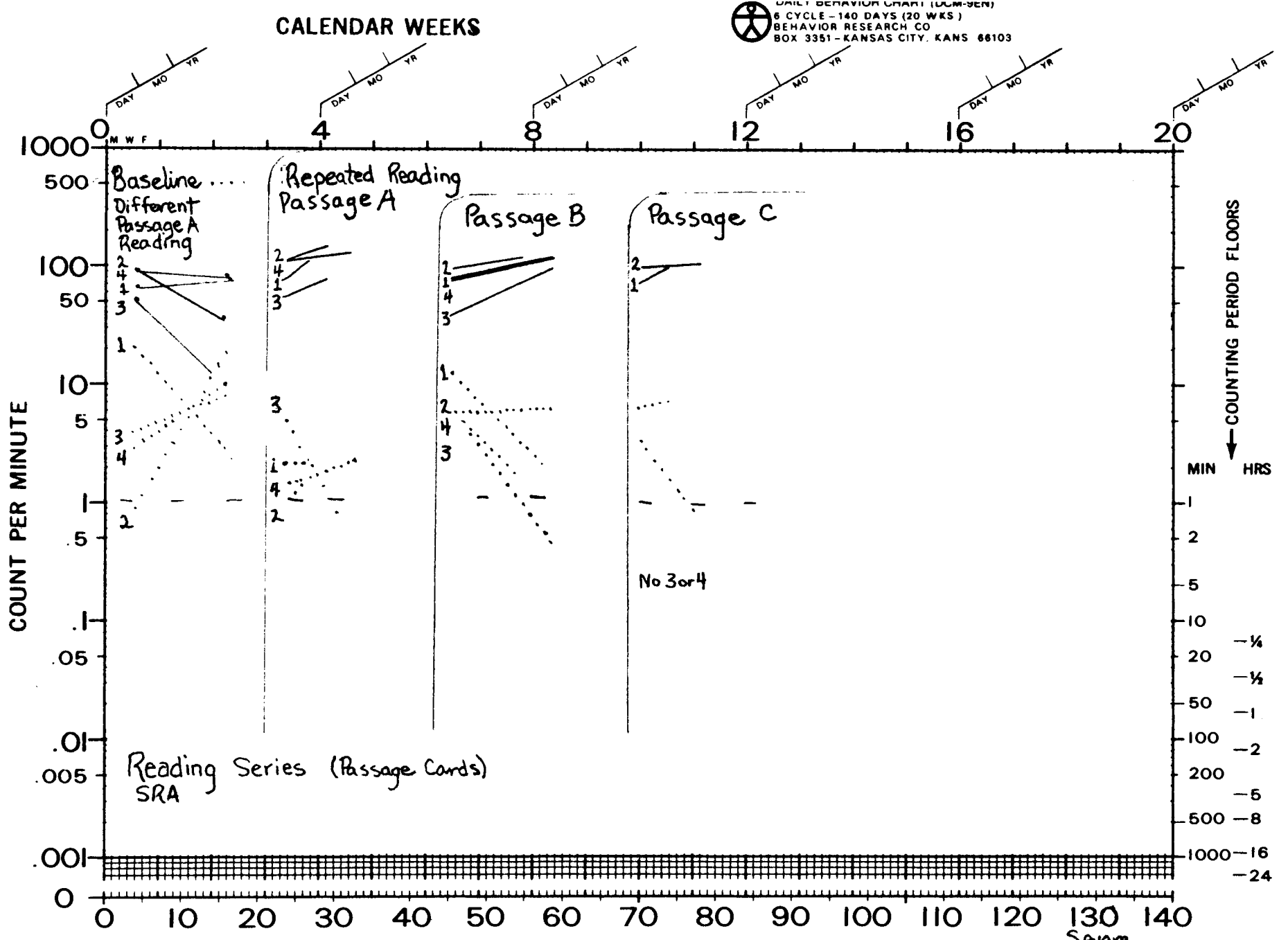

SUPERVISOR	McCormick ADVISER	Cooper MANAGER		Students 1-4 BEHAVER	11 to 12 AGE	Severe Behavior Handicap LABEL	Say Word COUNTED
DEPOSITOR	Hannah Neil Center AGENCY		TIMER	Carroll COUNTER	Cooper/Neely CHARTER		

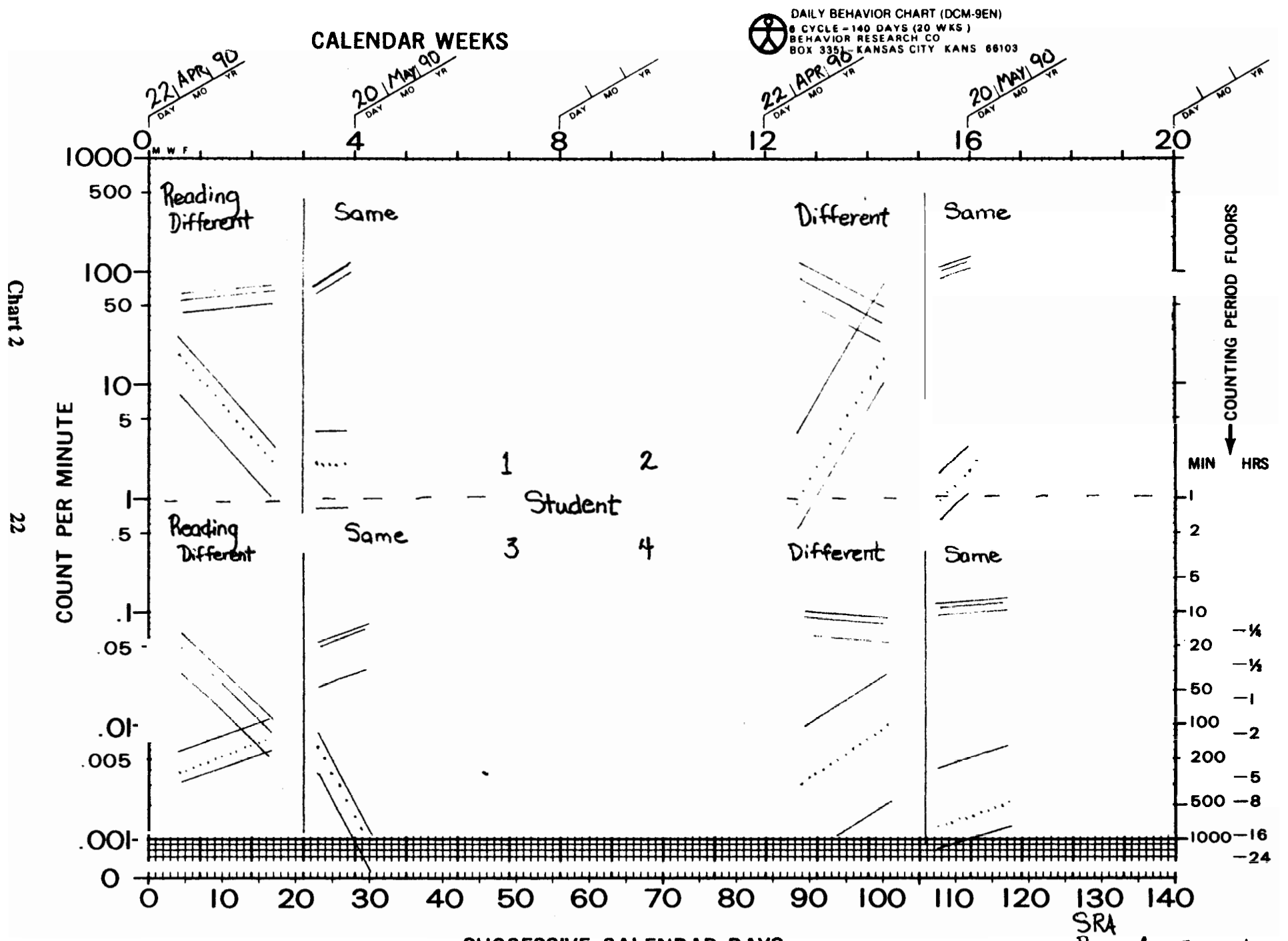

Chart 2

22

McCormick — SUPERVISOR
Cooper — ADVISER
MANAGER

Carroll — BEHAVER
11-12 — AGE
SRA Passage A — LABEL
Says Word — COUNTED

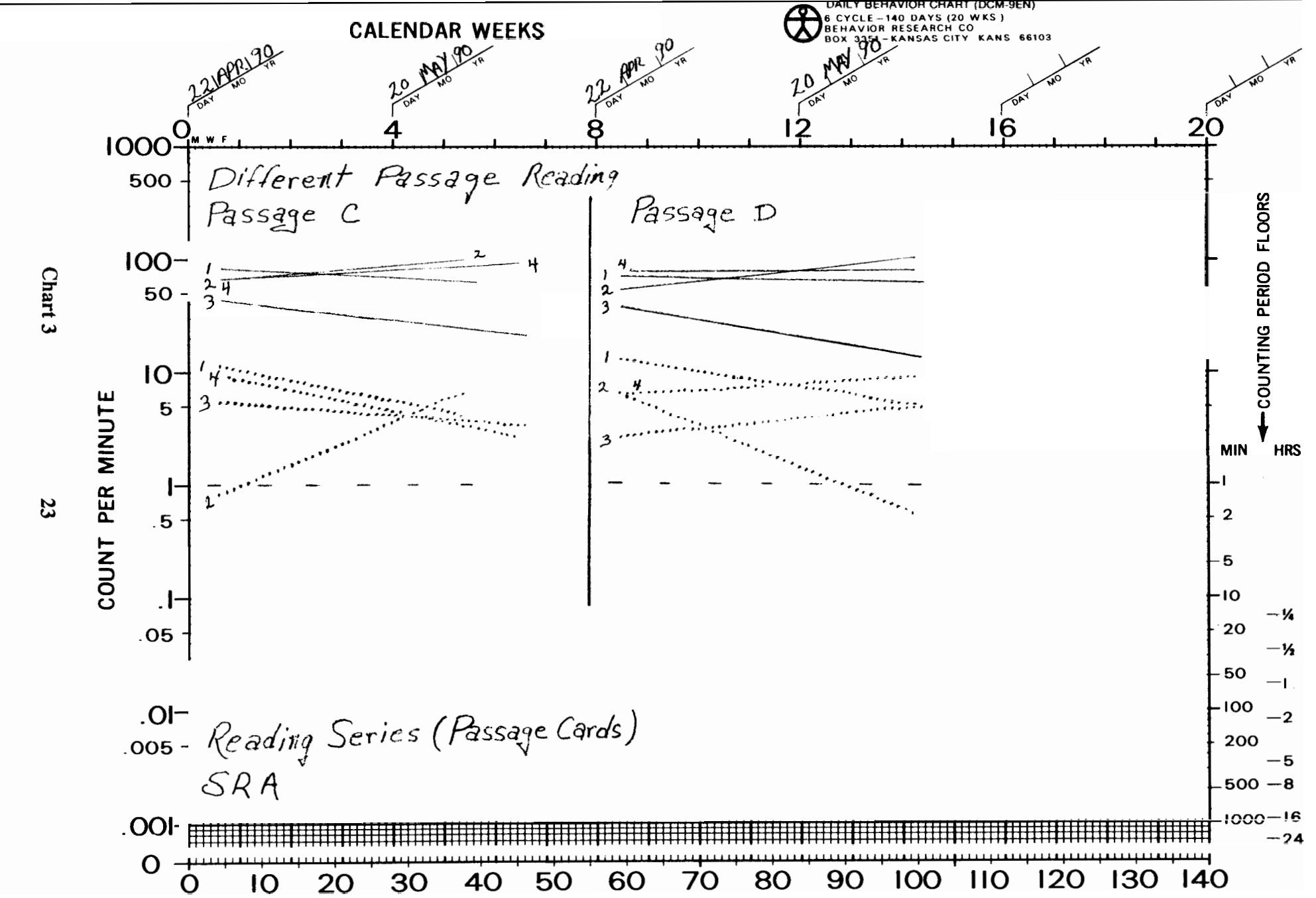

Chart 3

23

S.M Cormick — SUPERVISOR
J.O. Cooper — ADVISER
MANAGER
Hannah — DEPOSITOR
Neil Center — AGENCY
C. Carroll — TIMER
COUNTER
Pupils — BEHAVER
11 to 12 — AGE
SRD — SBH — LABEL
Says Word — COUNTED
J.O. Cooper — CHARTER
M D. Neely

repeated readings were boring at times. The other two participants believed the procedure was exciting and were never really bored.

During their interviews, the teachers all stated that oral reading is an important skill for students to acquire because there are times in school and in the community when individuals are asked to read aloud. In addition, all four teachers believed that an efficient reading rate was essential for reading comprehension. The teachers agreed that repeated readings with word card drill was a useful way to improve fluency and also believed that this would produce a collateral development in reading comprehension. Two teachers said they teach for fluency after a student has acquired a skill. The other two believed that a number of teachers cease instruction after the acquisition phase of learning. All of the teachers had used timed learning trials on some skills, and all stated that timed trials help students become proficient. Three of the teachers believed that charting results from timed probes "motivate" students to compete against themselves and to become more fluent.

Discussion

A functional relationship between reading fluency (i.e., accuracy and the number of words read correctly per minute) and repeated readings with drills was demonstrated. The number of words read correctly per minute steadily increased during repeated readings, with the number of words read incorrectly per minute maintained at low frequencies during all phases of the study. These results support the increasing professional literature base that recommends repeated readings as an important instructional method for improving oral reading fluency (e.g., Anderson, 1981; Chomsky, 1978; Samuels, 1979; Scott, Wolking, Stoutimore, & Harris, 1990).

Chomsky (1978) and Kann (1982) reported that initially their participants disliked reading and avoided reading whenever possible; however, after the use of repeated readings, the participants enjoyed reading more and increased the amount of free time with personal reading. During the exit interview used in the social validity assessment, the statements of our students indicated similar outcomes as those reported by Chomsky and Kann. For instance, when we asked the students how they felt about the instruction, all said they viewed the instruction with repeated readings favorably, stating they felt more confident about their oral reading skills. They identified the timing of reading and the self-charting of correct and incorrect words read particularly enjoyable. Participants also believed that the fluency instruction not only improved their oral reading, but improved their sight word vocabulary and comprehension of the passages as well. It is suggested that future research analyze a number of variables to determine those functionally related to the transfer of fluent reading for this population. For example, study could focus on the effects of: (a) increasing number of sessions of fluent reading on a specific passage; (b) extending number of passages trained to the fluency criterion; (c) increasing criterion level or aim (i.e., frequency correct); and (d) varying level of passage difficulty. In addition, word drill accompanied standard repeated readings procedure in the present study; therefore, an analysis of word drill effects alone on the development of fluency is in order.

The present study reflects a growing interest in the role of Precision Teaching in the overall curriculum in regular and special education. Use of repeated readings for producing fluent reading is gaining wide acceptance in the educational community and is supported by this research. However, many questions related to the effects of repeated readings need to be resolved. Specifically crucial is the question of transfer of fluent reading to new passages. Nevertheless, even with many unanswered questions, the repeated readings technique appears to be an appropriate method for the development of fluency. Use of repeated readings has produced positive results in previous studies. The present data indicate this technique is a useful one with students often viewed as particularly difficult to teach--children, not only having severe reading disabilities, but severe behavior handicaps as well.

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Portions of this research were completed in partial fullfillment of the requirements for the degree of Master of Arts for Cynthia L. Carroll. Dr. Sandra McCormick is Professor of Educational Theory and Practice at The Ohio State University. Reprints may be obtained from Dr. John O. Cooper, who is Professor of Special Education, 356 Arps Hall, The Ohio State University, 1945 N. High Street, Columbus, Ohio 43210.

A Minute a Day to Enhanced Reading Skills

by

Claudia E. McDade, David B. Cunningham, John M. Brown, Barbara B. Boyd, and Charles P. Olander

Students in a study skills course at Jacksonville State University read novel passages for one minute daily, counted the number of words read per minute and plotted their results on the daily Standard Celeration Chart. Two separate studies indicated that when compared with control students, the Precision readers demonstrated greater gains in reading rate, vocabulary, and reading comprehension. These results support a simple, cost-effective mechanism for enhancing reading skills at any educational level.

Entering students in open admissions universities often present poorly developed reading skills which must be quickly remediated before students can successfully compete in college level courses. Many universities offer a freshman level study skills course which might be an appropriate place to assess and enhance student reading skills. Although individualized diagnoses and prescriptions supervised by a reading specialist have been developed in the Center for Individualized Instruction at Jacksonville State University (Alabama), a technique which could be applied in all freshman level study skills classes to enhance students' reading rate, comprehension, and vocabulary was deemed necessary.

The Center for Individualized Instruction relies heavily on Precision Teaching techniques in multiple disciplines (McDade & Olander, 1987), so the faculty decided to apply this powerful instructional technology to the problem of improving reading performance. Precision Teaching requires students to reach high levels of fluent, accurate performance and to record daily performance on the Standard Celeration Chart. A semi-log graph, the Standard Celeration Chart accommodates rate data and can be used to monitor daily performance and predict future performance. Before students can read proficiently, they must learn to decode material at high rates (Maloney, 1987; McGreevy, 1983). Thus, a simple precision learning intervention was implemented in several sections of a freshman level study skills course in an effort to improve student reading rate performance.

Method

All experimental students in the two studies were enrolled in Learning Skills 101: Academic Survival Skills, a one credit hour freshman level course in study techniques at Jacksonville State University. Although vocabulary improvement was taught in the course, reading enhancement was not part of the curriculum. The reading levels of the students were assessed at the beginning of the term with the Nelson-Denny Reading Pre-Evaluation, Form E. Students read novel reading passages daily for one minute and plotted their rates on Standard Celeration Charts. The readability of these passages became progressively more difficult, beginning at 9th grade equivalent and ending with 13th grade equivalent passages (Miller, 1977). Students read silently for one minute each day, counted the number of words read per minute, and plotted their rates on a daily Standard Celeration Chart. The class met two days weekly; however, students performed the same activity on non-class days. Instructors evaluated individual student progress weekly on the Standard Celeration Chart. At the conclusion of the intervention all students' reading levels were assessed on the Nelson-Denny Post-Reading Evaluation, Form F.

Study 1.

Twenty-seven students enrolled in LS 101 served as the experimental group, while 27 students enrolled in English 100: Basic English Skills who had never taken a Learning Skills course served as the control group. All students were randomly selected. Equivalence of the experimental and control groups was assessed on variables of grade point average, age, and sex.

Students in both groups were given the Nelson-Denny, Form E at the beginning of the semester. Those in the experimental group performed the daily reading intervention described above for eight weeks. No reading intervention was prescribed for students in the control group. Both groups were given the Nelson-Denny, Form F at the end of the semester. Comparisons were made between pretest and posttest scores in reading rate, vocabulary, and comprehension.

Study 2.

Seventy-six students enrolled in LS 101 formed an

experimental group performing the reading intervention described above for six weeks. A control group of 146 students enrolled in LS 101 did not receive any prescribed reading practice or instruction whatever. All students in the experimental group were taught by the same instructor, while students in the control group were taught by four different instructors. Again, all students were given the Nelson-Denny, Form E as a pretest and Form F as a posttest. In addition to the comparisons made in Study 1, a regression analysis was performed to determine if change in Nelson-Denny pretest/posttest score could be predicted from celeration in reading rate.

Results

Study 1.

The equivalence of experimental and control groups was confirmed on the variables of grade point average (Exp Gp Mean = 1.21, Con Gp Mean = 0.93 [3 pt. scale], F= 2.76 with 53 df, pr = .103), age (Exp Gp Mean = 20.56, Con Gp Mean = 21.74, F = 1.14 with 53 df, pr = .29), and sex (Chi-Square = .075, p = 0.78).

Two-factor repeated measures ANOVAs were used to compare pretest/posttest reading improvement scores on rate, vocabulary, and comprehension across the experimental and control groups. Table 1 summarizes these comparisons.

Table 1

Study 1: Summary of Two-Factor Repeated Measures ANOVAs

	Control (n=27)		Exp (n=27)		Gp	Repeated Meas
	Pre	Post	Pre	Post	F	F
Rate	203	209	244	381	24.82**	36.61**
Vocabulary	30	34	54	57	35.82**	8.00**
Comprehension	34	34	46	54	47.79**	11.32**

** p< .01

Although students in both groups improved their reading, those who participated in the reading intervention had significantly higher improvements in reading rates, vocabulary, and comprehension. Celerations for reading rates of students in the experimental group are summarized in Chart 1. Chart 2 indicates the comparison of changes in rate, vocabulary, and comprehension for the control and experimental groups.

Study 2.

A summary of the same two-factor repeated measures ANOVAs for Study 2 is presented in Table 2. Again, the experimental group had significantly higher improvements in reading rates, vocabulary, and comprehension even though improvements were also seen in the control group.

Fifty-four students had Standard Celeration Charts with all possible daily performances plotted for six weeks. Celerations of reading rates for the experimental group are seen in Chart 3, while the comparison of changes in rate, vocabulary, and comprehension for the control and experimental groups is shown in Chart 4. A simple regression analysis (F = 9.10, df = 53, pr = .004) resulted in the equation, Y = .65x + 33 where Y = predicted Nelson-Denny score and x = celeration over six weeks. Thus, the reading evaluation score could be predicted from change in the Standard Celeration Chart.

Table 2

Study 2: Summary of Two-Factor Repeated Measures ANOVAs

	Control (n=146)		Exp(n=76)		Gp	Repeated Meas
	Pre	Post	Pre	Post	F	F
Rate	245	269	197	339	1.01	112.65**
Vocabulary	46	49	39	42	8.93**	41.39**
Comprehension	43	47	37	43	12.77**	49.19**

** p< .01

Discussion

Demands of the freshman experience result in enhanced reading performance in first year college students. Daily timed readings charted by college freshmen result in even greater improvement in reading skills. This very simple and economical intervention, requiring no more than two minutes per day, can assist students in developing stronger reading skills, so they can more thoroughly comprehend college level textbooks.

There is no question that practice--simply reading--enhances students' reading performances. The effectiveness of this intervention is due to two components--daily practice and recording rate data on the Standard Celeration Chart. The Chart provides

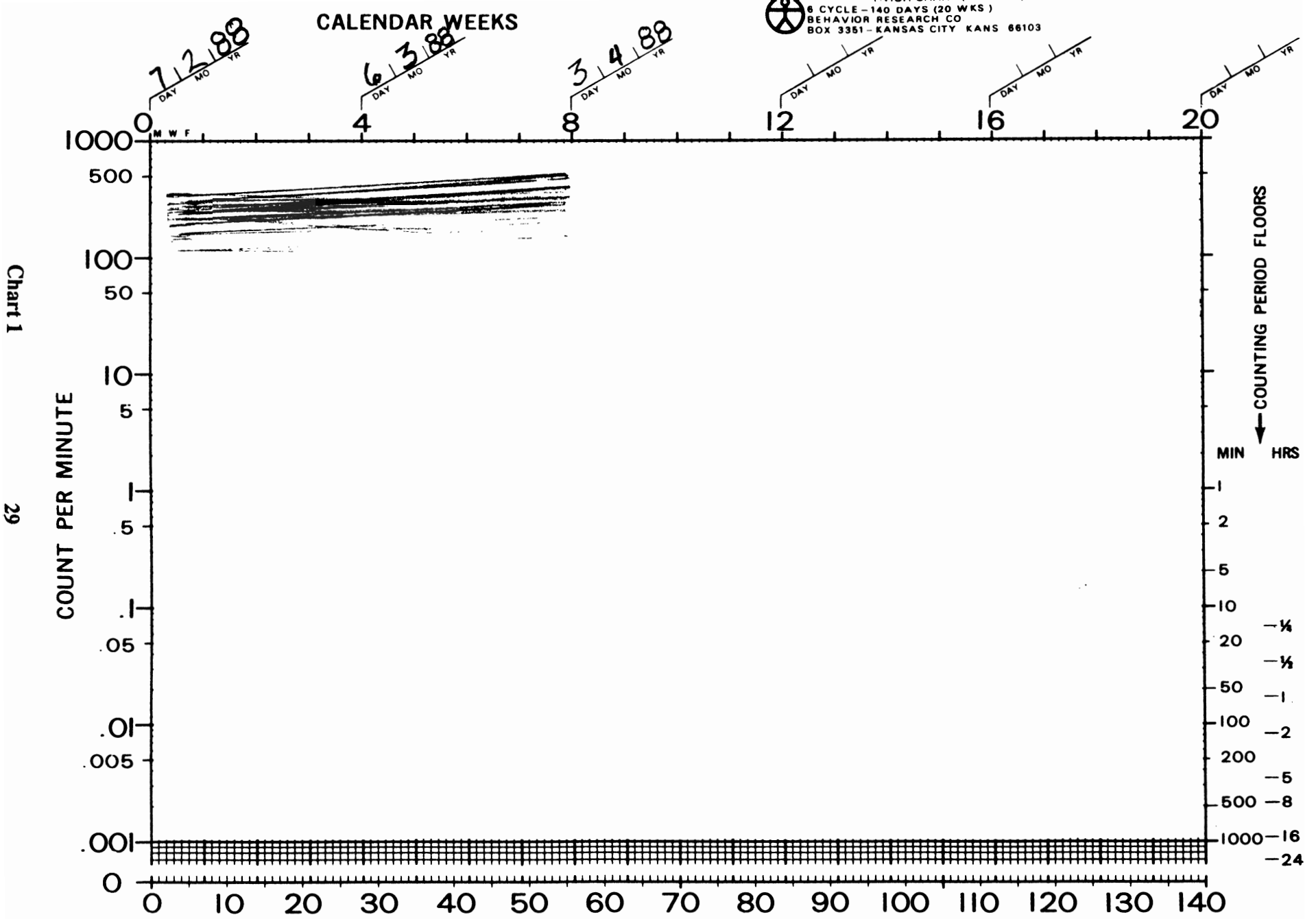


Chart 1

29

McDade	Olander	Cunningham	27 Learning Skills	101 Students Study1	Mcnas Read
SUPERVISOR	ADVISER	MANAGER	BEHAVER	AGE	LABEL COUNTED

CII	Jacksonville St. U.	Cunningham	Students	McDade
DEPOSITOR	AGENCY	TIMER	COUNTER	CHARTER

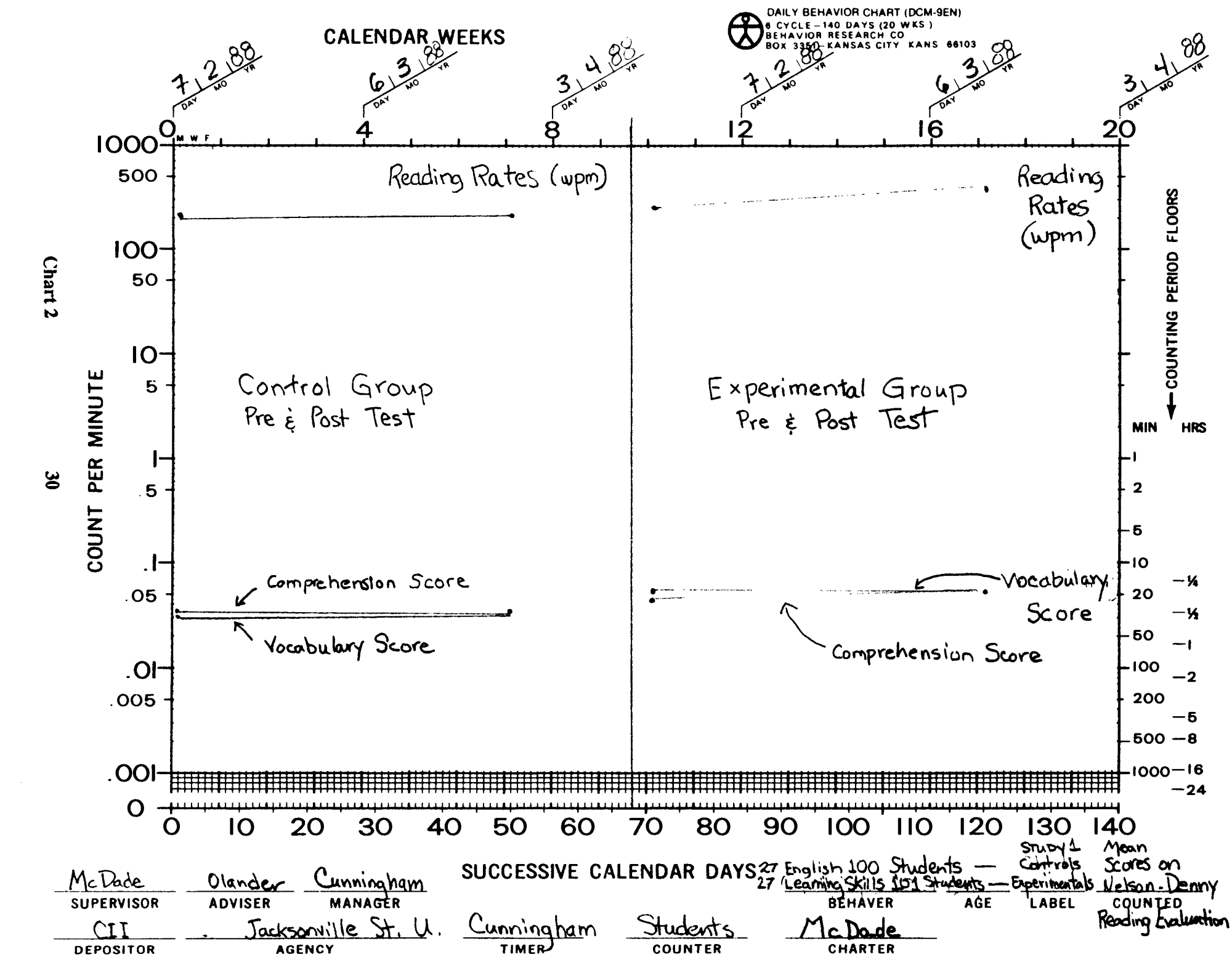
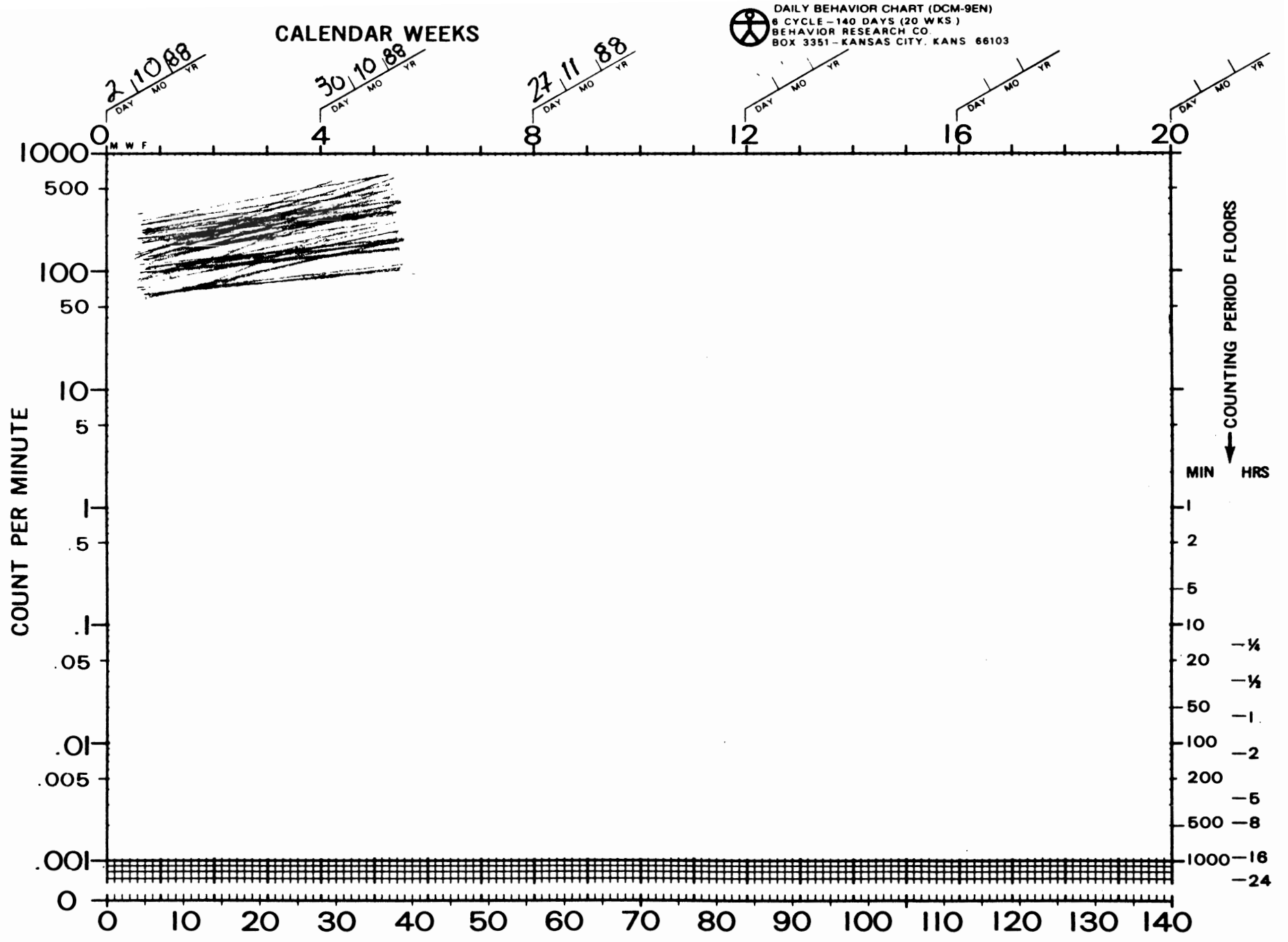

DAILY BEHAVIOR CHART (DCM-9EN)
6 CYCLE – 140 DAYS (20 WKS)
BEHAVIOR RESEARCH CO
BOX 3350 – KANSAS CITY KANS 66103
CALENDAR WEEKS
7 | 2 | 88 DAY MO YR
6 | 3 | 88 DAY MO YR
3 | 4 | 88 DAY MO YR
7 | 2 | 88 DAY MO YR
6 | 3 | 88 DAY MO YR
3 | 4 | 88 DAY MO YR
0 M W F 4 8 12 16 20
Reading Rates (wpm)
Reading Rates (wpm)
Control Group
Pre & Post Test
Experimental Group
Pre & Post Test
Comprehension Score
Vocabulary Score
Vocabulary Score
Comprehension Score
COUNT PER MINUTE
1000 500 100 50 10 5 1 .5 .1 .05 .01 .005 .001 0
COUNTING PERIOD FLOORS
MIN HRS
1 2 5 10 20 50 100 200 500 1000
—¼ —½ —1 —2 —5 —8 —16 —24
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
SUCCESSIVE CALENDAR DAYS
27 English 100 Students — Study 1
27 Learning Skills 101 Students — Controls / Experimentals
Mean Scores on Nelson-Denny Reading Evaluation
McDade SUPERVISOR
Olander ADVISER
Cunningham MANAGER
BEHAVER
AGE
LABEL
COUNTED
CII DEPOSITOR
Jacksonville St. U. AGENCY
Cunningham TIMER
Students COUNTER
McDade CHARTER

Chart 2

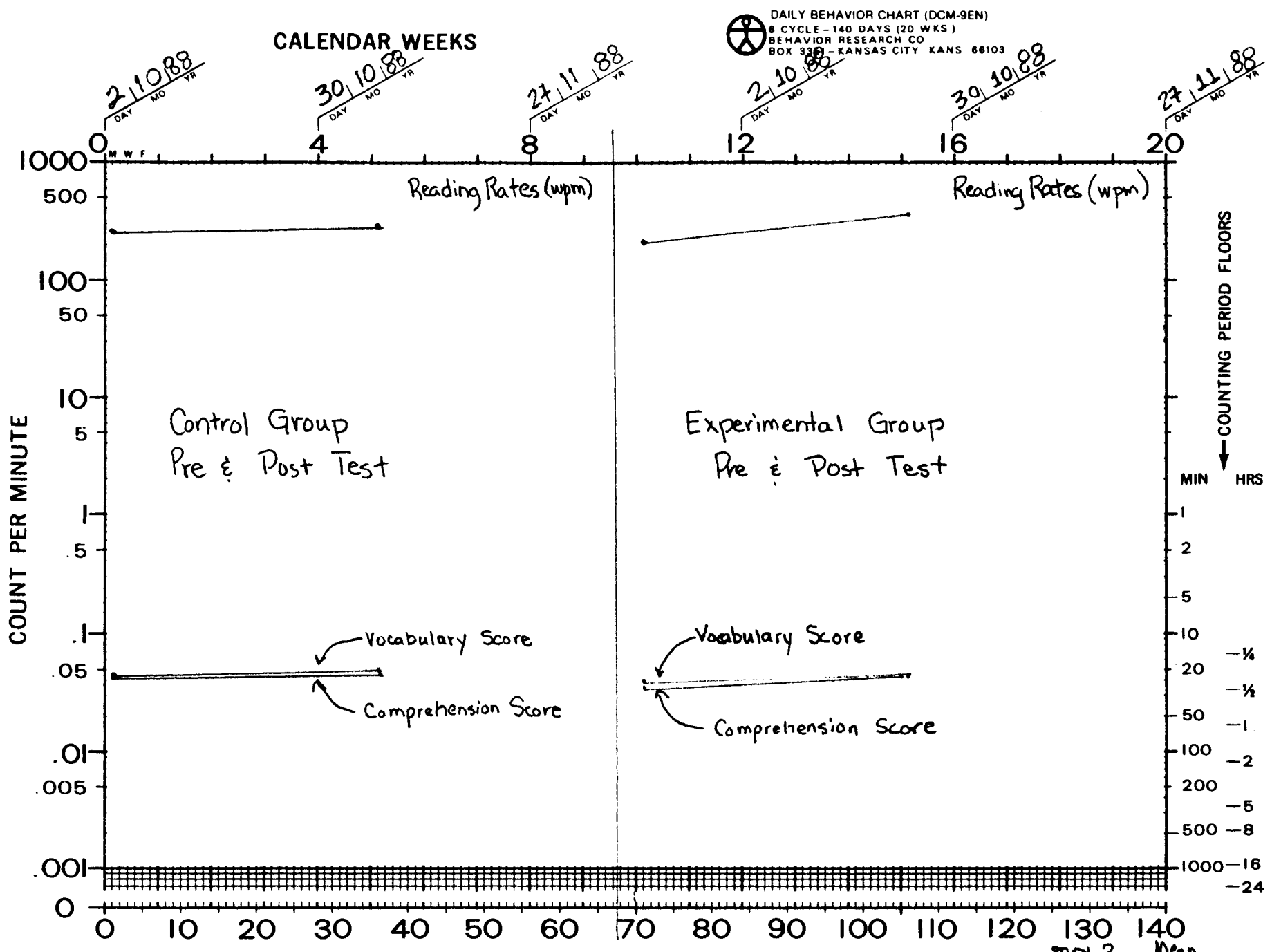
30



McDade | Olander | Boyd
SUPERVISOR | ADVISER | MANAGER

76 Learning Skills | 101 Students | Study 2 Words Read
BEHAVER | AGE | LABEL | COUNTED

CII | Jacksonville St. U. | Boyd | Students | McDade
DEPOSITOR | AGENCY | TIMER | COUNTER | CHARTER



McDade	Olander	Boyd			146 LS 101 Students ——		STUDY 2	Mean Scores on
SUPERVISOR	ADVISER	MANAGER			76 LS 101 Students ——		Controls	Nelson-Denny
					BEHAVER	AGE	Experimentals LABEL	COUNTED
CII	Jacksonville St. U.							Reading Evaluation
DEPOSITOR	AGENCY	TIMER	COUNTER	CHARTER				Form E, Form F

feedback to the individual student who can observe his/her celeration, as well as projection of future performance (White & Haring, 1980).

Due to the effectiveness of this simple reading enhancement technique, all students scheduling both study skills and developmental writing courses within the Center for Individualized Instruction are now required to perform daily timed readings which they plot on Standard Celeration Charts. Further interventions designed to enhance comprehension have been implemented and evaluated; these will be reported in a future article. Center staff strongly recommend that this technique be applied wherever applicable.

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This research formed the basis of the dissertation of Dr. Barbara Boyd, who is currently employed as Reading Director at Gadsden State Community College in Gadsden, Alabama. Initial piloting of Precision reading interventions was performed by David Cunningham when he taught LS 101 at Jacksonville State University. Currently, Mr. Cunningham is employed by the University of Alabama in Birmingham and is working on his dissertation at Auburn University. Dr. Claudia McDade is Director of the Center for Individualized Instruction and Professor of Psychology at Jacksonville State University, while Dr. Charles Olander is Professor of Biology at Jacksonville State University. Mr. John Brown is an instructor of developmental writing in the Department of Learning Skills at Jacksonville State University.

Organizing Your Special Education Classroom With Precision Teaching

by

Maryann C. Trott, Alice D. Maechtlen, and Sarah A. Bienarz

"How can I possibly make sure that all of these kids, with so many different needs, are going to get quality instruction every day?" This question represents one of the most significant and exciting challenges that special educators face as education in the least restrictive environment (LRE) becomes a reality. Madeline Will has suggested that placements based solely on category of handicapping condition do not comply with LRE (Will, 1986). If the placement is based on the unique educational needs of the students, it is possible for a teacher to have students with different handicapping conditions within the same classroom. It is not only possible, but also very rewarding, to serve children learning to read functional sight words and write personal data, with children learning to respond to peers and hold up their heads. Teachers respond to these challenges in many different ways, but all share a need to know if the students are receiving effective instruction and making progress. Precision Teaching allows teachers the freedom to take advantage of their own unique styles and still insure that students with a variety of needs are benefiting from their efforts.

Academic Applications

The most obvious applications of Precision Teaching techniques are in the academic areas. The progress of students at all levels of skill development can be monitored through the use of one minute timings and three cycle charts. Timings are easily done before or after instruction, and students practicing the same skills can be grouped together for timings or timed individually. An excellent way of providing feedback and reinforcement is to allow children to plot their own data. Students may also participate in making chart-based decisions when appropriate. In math, for example, students in the same class may be working on rote counting, naming numerals, and computing math facts. Instruction can be conducted in three, fifteen minute periods. The remaining fifteen minutes of a one hour math period can be devoted to timings, charting and decision making. Less time would be involved if both teacher and assistant participated in instructional activities.

Tool Skills

Through the use of suggested performance standards and effective decision making, Precision Teachers can help their students build the tool skills needed to perform more complex tasks. An excellent program for building tool skills is *Can-Do* by Betty Duvall (1979). Tasks are presented in small booklets that students can take home when they meet the minimum performance standards suggested in the manual. Tasks are presented in small sequential steps with easier skills, such as naming pictures and letters and making marks, presented first. Later booklets require more advanced reading, math and language skills.

Functional Skills

Less obvious, but equally effective applications of Precision Teaching are possible in classrooms serving children for whom academic skills are not practical. The development of skills such as sorting objects, reading survival signs, following directions, naming (or signing names of) objects can be effectively measured and recorded using Precision Teaching techniques. One minute timings are adequate and appropriate for some skills such as sorting or naming objects. Longer timings, and the use of six cycle paper, may be necessary for some other skills such as following directions, responding to greetings, and other tasks that are not appropriately measured in one minute timings. Teachers can use a variety of methods and materials for instruction and still use a consistent means of monitoring progress.

Social Skills

Often the greatest concern for teachers of students with more severe handicapping conditions is not the development of new skills, but the development of appropriate behaviors. Precision Teaching techniques are sometimes overlooked as teachers decide how best to replace inappropriate behavior with more acceptable behaviors. Hitting peers (Elrick and Maechtlen, 1983), grabbing

Figure 1

Page ____ of ____ Pages

Precision Teaching

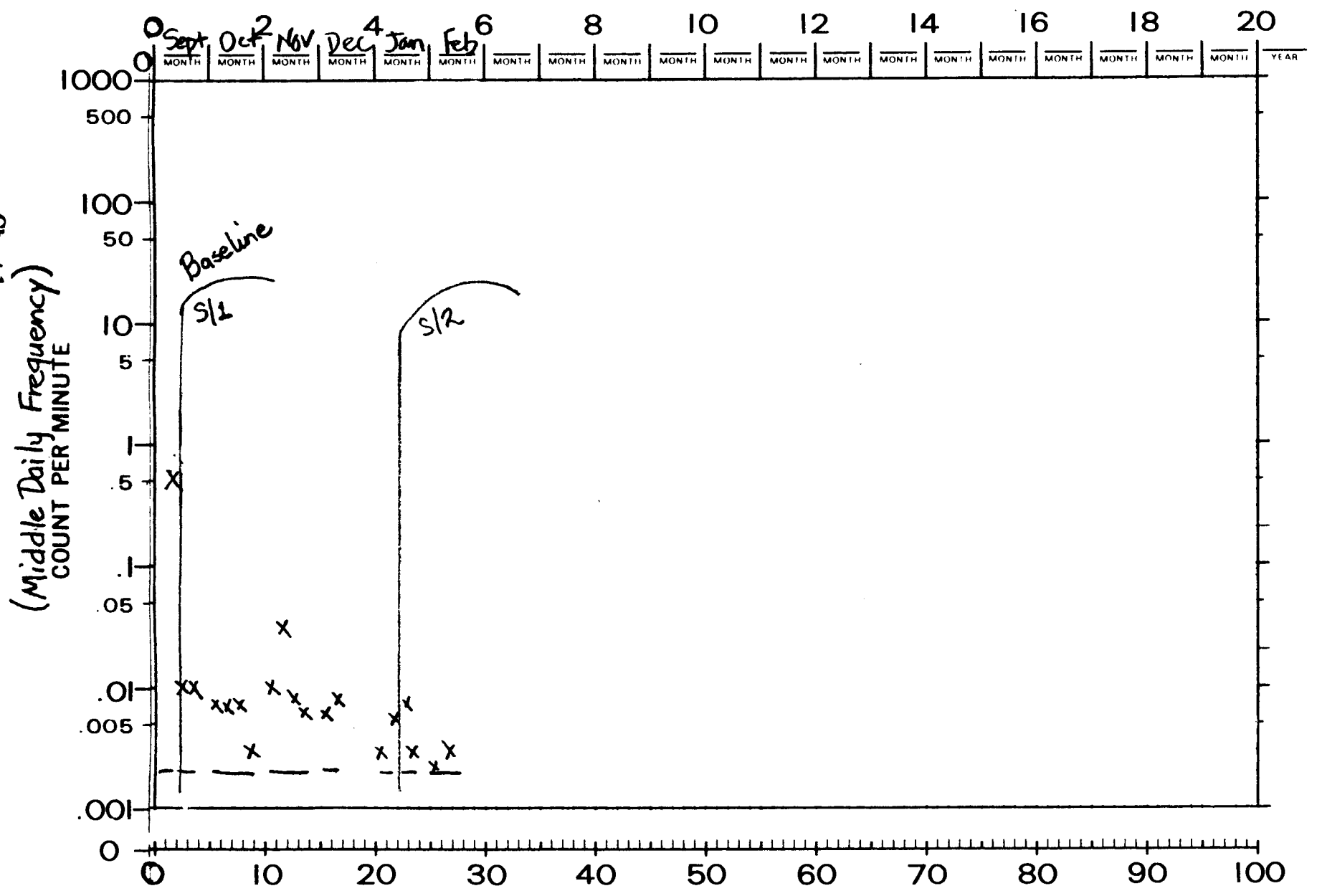
PRECISION TEACHING PLAN SHEET

Student (s) J. Teacher (T) _____

Pinpoint (objective) Decrease non-communication noise Goal Increased social skills

Program Step/ Materials	Decision/ Date	Program Procedure/ Timing Procedure	Behavior to Increase S Behavior	Behavior to Increase Consequence	Behavior to Decrease S Behavior	Behavior to Decrease Consequence	Aim
Timer Tally Sheet Step 1	9-19	During J's regular activities Teacher says,"No noises, J." Data collection: 2-15 minute periods during the day-total number of non-communication noises	1)Intelligible communication attempts 2)Quiet mouth when working	Verbal praise plus marble in jar	Non-Communication noise scream, grunts, hums	Touch S's face, T. moves within 6" of S and says "No noise."	Decrease noise by half
Step 2	1-17			Verbal praise only		T holds one finger up and says "No noise" quietly	

WEEKLY BEHAVIOR CHART (WCM-2EN)
6 CYCLES — 100 WEEKS (20 MONTHS)
BEHAVIOR RESEARCH CO.
BOX 3351 — KANSAS CITY, KANS. 66103



Trott	Maechtlen		J.	9	Room 6	Noises
SUPERVISOR	ADVISER	MANAGER	BEHAVER	AGE	LABEL	COUNTED
	Albuquerque Public Schools					
DEPOSITOR	AGENCY	TIMER	COUNTER	CHARTER		

peers, (Maechtlen and McDowell, 1984) drooling (Trott and Maechtlen, 1986), and making inappropriate noises are some unacceptable behaviors that have been reduced using various means of correction and reinforcement. Charting rate per minute and using that information to make decisions has proven to be an efficient means of evaluating the effect of procedures used. An example is the use of Precision Teaching to decrease non-communicative noises made by a student with severe mental retardation. (See Figure 1 and Chart 1.)

Increasing behaviors that occur at a low rate is another area in which Precision Teaching can be easily used to evaluate progress. The progress of students who are working on increasing the time that they hold eating utensils or hold heads up can be measured by charting the decrease in rate per minute of dropping utensils or putting heads down. Completing work can be measured by charting the increase in rate per minute of work items completed.

Counting behaviors to be increased or decreased can easily be done during other activities. It requires little effort for the teacher, assistant or trained volunteer to keep a tally of behaviors during a short (10 to 15 minutes) interval once or twice during the day when it is convenient or when the behavior is of particular concern. Charting and decision making can be quickly completed later in the day. This will ensure that the correction and reinforcement procedures carried out during the rest of the day are effective.

Organization

The use of Precision Teaching automatically imposes, to a certain extent, good classroom organization. Daily activities can be organized into fifteen, thirty or forty-five minute segments. The first portion of each time period is used for instructional activities. The last few minutes are used for timing and charting. (See Figure 2.)

The instructional program is further enhanced by some additional management techniques. Bienarz and Maechtlen (1984) suggest organizing plan sheets and charts by placing every child's chart for the same goal area on the same clipboard. Another method would be to have a separate clipboard with all plan sheets and charts for each student. Children who have learned to plot their own data enjoy keeping and decorating a folder with their own charts and plan sheets. If worksheets are to be used, they can be mounted on tagboard and laminated. Children can then mark them with grease pencil, dry erase marker or overhead pens.

Bienarz and Maechtlen (1984) further suggest limiting data collection to four or five objectives per student per day. Limiting the number of objectives makes it more likely that the teacher will be able to work with the student on each objective and collect data every day, and also prevents the frustration of not being able to get to everything. Objectives should be chosen according to what the child most needs to learn. An important point to emphasize is that the timed activity must remain consistent. The same worksheet, items to sort, etc. as well as verbal instructions, must be used for each timing. Teachers may, however, use all their creativity in planning numerous instructional activities that can and should change frequently. Timings will support the learning taking place through different instructional means. This will also facilitate the generalization of knowledge.

Precision Teaching makes a successful program in many ways. It provides an efficient vehicle for demonstrating accountability to parents, school administrators, school districts and state school boards. It allows teachers to communicate accurate information about their students at any time. It makes planning easier and fits in with any teaching style, method or material. Most importantly, it allows students to tell their teachers how they are learning and what they need. "We use a pre-post test to see how we have done. We use continuous measurement to see how we are doing. Your choice!" (Precision Teaching Project Training Manual, 1984).

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Duvall, B. (1979). *Can-do: A program for basic tool skills development.* Great Falls, Montana: Advanced Litho Printing.

Elrick, K. & Maechtlen, A. D. (1983). How Precision Teaching decelerated inappropriate physical contacts. *Journal of Precision Teaching, 4*, 40-42.

Precision Teaching in the Elementary Classroom
Sample Schedule

8:30 - 9:00	Breakfast and Bathroom
9:00 - 9:30	Gross Motor Activities (Physical therapy for some, classroom exercises for others).
9:30 - 10:00	Functional Academic and Fine Motor Skills
10:00 - 10:15	Recess
10:15 - 10:45	Functional Academics and Fine Motor Skills
10:45 - 11:00	Storytime
11:00 - 11:50	Play Skills and Other Social Skills
12:00 - 12:30	Lunch
12:30 - 1:15	Rest time and Self-Help Activities (this is a perfect time for working on brushing teeth, washing hands, etc. While some are working one-to-one on these skills, the others can be resting, listening to quiet records or looking at books. This is also a time when the students can go to the bathroom or have their diapers changed, if necessary.)
1:15 - 1:45	Physical Education
1:45 - 2:30	Communication (This is the time for the formal language programs that are practiced and reinforced throughout the day.)
2:30 - 2:45	Recess or active class game
2:45 - 3:15	Special activities (This is the time for group activities such as cooking, science or dramatics).
3:15 - 3:30	Snack or closing activity

FIGURE 2

Maechtlen, A. D.& McDowell, R. L. (1984). Reducing grabbing by a profoundly retarded boy in a public school. *Journal of Precision Teaching, 5,* 1-3.

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Trott, M. C. & Maechtlen, A. D. (1986). The use of over correction as a means to control drooling. *The American Journal of Occupational Therapy, 40,* 702-704.

Will, M. (1986). Clarifying the standards: Placement in the least restrictive environment. *Office of Special Education and Rehabilitative Service News in Print, 1.*

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School Attendance of Adolescent Unit Patients at Capital City Schools

by

Abigail B. Calkin

Capital City Schools, part of the Topeka Public School system, provides K-twelfth grade education to both residents of Topeka State Hospital and day students. Begun in 1955 with two teachers, the school had 53 certified teachers and a total staff of 75 by 1984.

In 1978, Standard Celeration Charting of organizational changes began at Capital City Schools. Of the seven different educational programs, the Adolescent Unit from Topeka State Hospital consisted of 12--18 year old children from five wards. With an upcoming move to a new school facility that would house almost all of the educational programs under one roof, school staff wanted to monitor the number of classes the hospital children attended.

Prior to the move to the Karl Menniger Educational and Activity Center in October 1982, the school was housed in 13 buildings. Adolescent Unit classrooms were housed in two of these 13 buildings with seven full-time teachers staffing these classrooms.

The accompanying monthly Standard Celeration Charts present six years of data: the first three years were during the use of the school's old facilities; the last three, in the Karl Menniger Educational and Activity Center. The vertical line indicates when the high school moved to the Menniger Center.

Since these charts are standard, it is possible to compare any change using the same technique. A growth of x1.0 indicates no change, that maintenance is occurring. An increase of x1.3 indicates a 30% increase; x1.5, a 50% increase, etc.over a six month period. A decrease of ÷1.3 indicates a 30% decrease; ÷1.5, a 50% decrease, etc. over a six month period.

Monitoring the educational program to ensure students' educational needs and rights with monthly Standard Celeration Charts required the following pinpoints:

Chart 1: Patients on the Adolescent Unit
Students in classes
Students not in any classes

Chart 2: Total class hours all students were enrolled

Chart 3: Unit classes offered
Students enrolled in Unit classes

Chart 4: High school classes Unit students were taking
Students enrolled in high school classes

Chart 5: For students enrolled in both Unit and high school classes,
Classes at the high school
Classes at the Unit

Chart 6: Total classes
Total students enrolled.

Chart 1 shows that the total number of patients on the Adolescent Unit increased to maximum capacity. There was a gradual increase in the number of students enrolled in class, so that all students were in at least one class within two weeks after entering the hospital. The number of students not enrolled in school showed a steady decrease from about 22 adolescent patients in the Fall of 1978 to all patients being enrolled during the Spring of 1984. A gradual decrease occurred prior to the move, showing a decrease of 30% per six months across the first four years of monitoring. Subsequent to the move, the decrease was 2.0, or 200%, effectively reducing students not enrolled to zero.

Chart 2 indicates the total number of student class hours increased by 10% every six months prior to the move. Subsequent to the move the increase in class hours was 15% every six months. The total number of class hours doubled from 110 in August 1978 to 240 in June 1984.

Charts 3 and 4 show students and classes for the Adolescent Unit children, both on the Unit and at the high school. The number of classes on the Unit increased gradually until three teachers moved to the new facility. The number of students enrolled in classes on the Unit showed a gradual, very slight decrease. That the two sets of lines are closer after the move indicates there were more

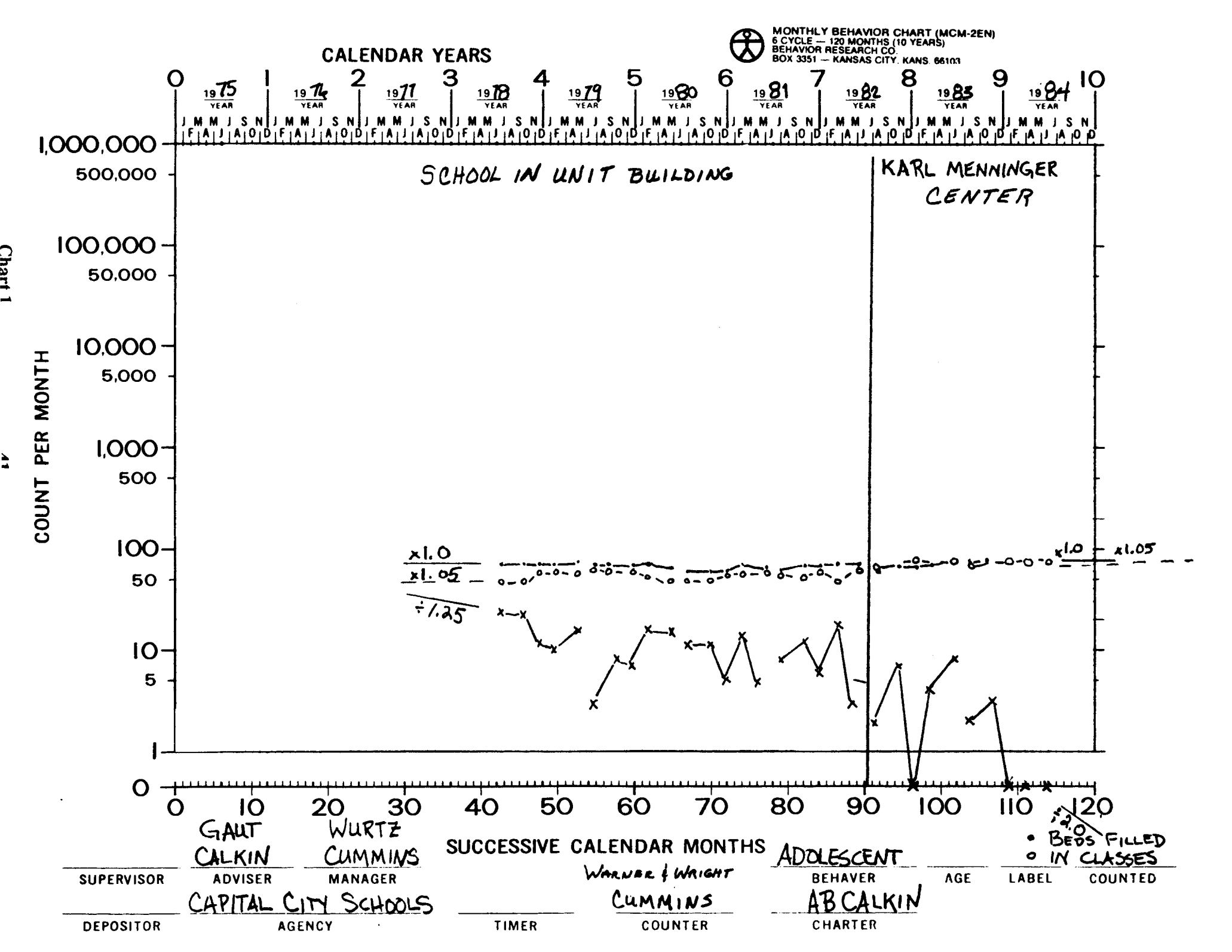
MONTHLY BEHAVIOR CHART (MCM-2EN)
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Chart 1

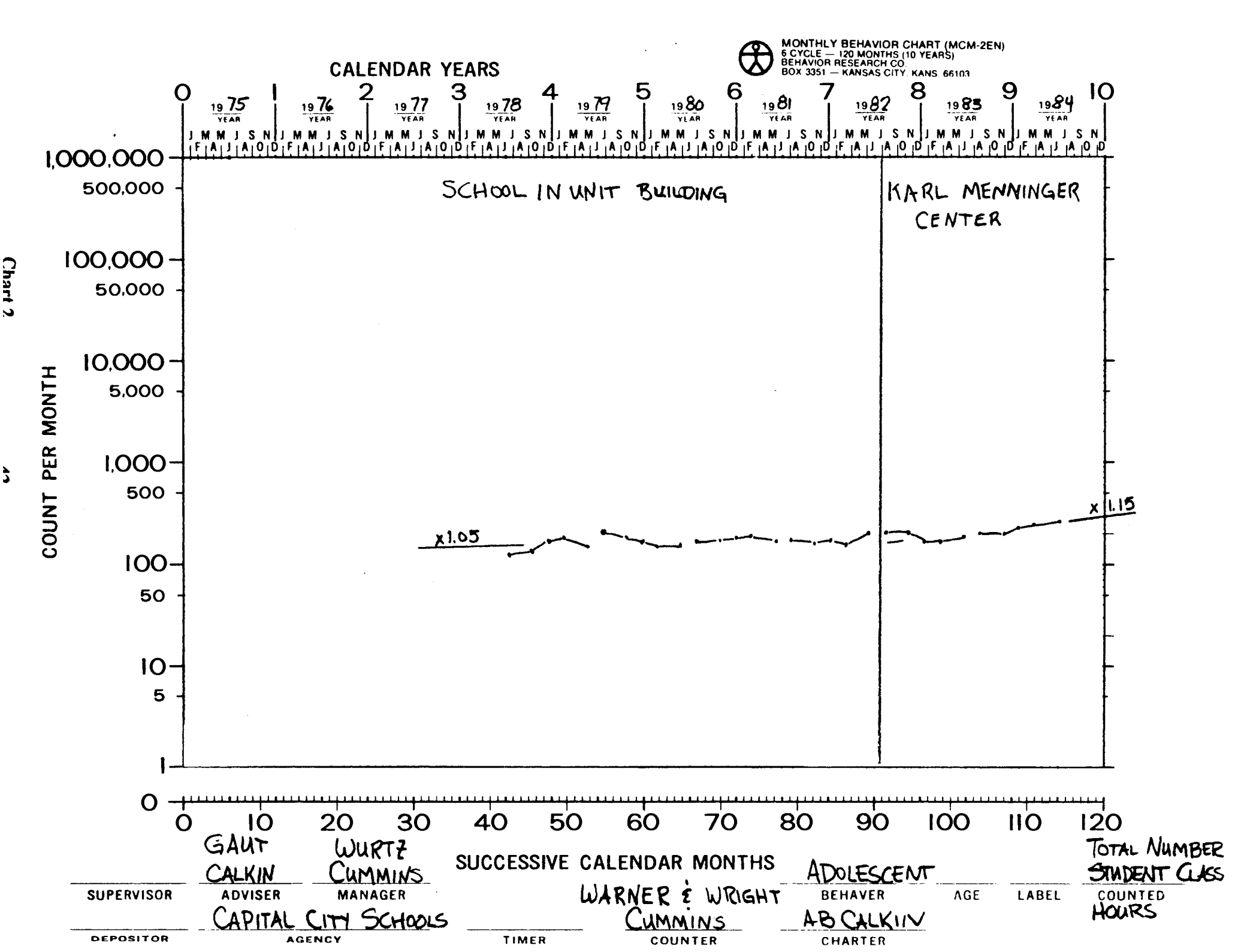
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Chart 2

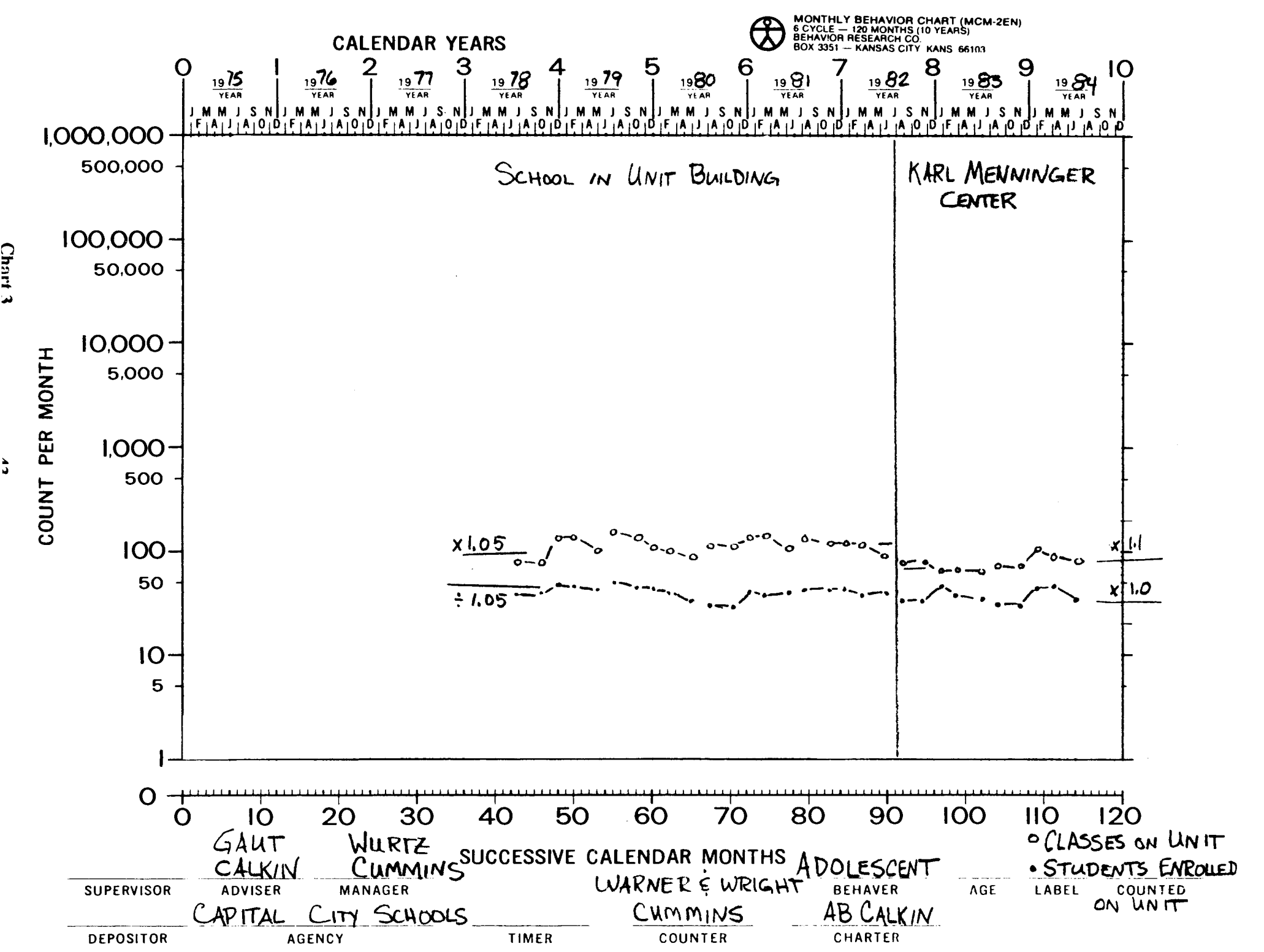
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Chart 3

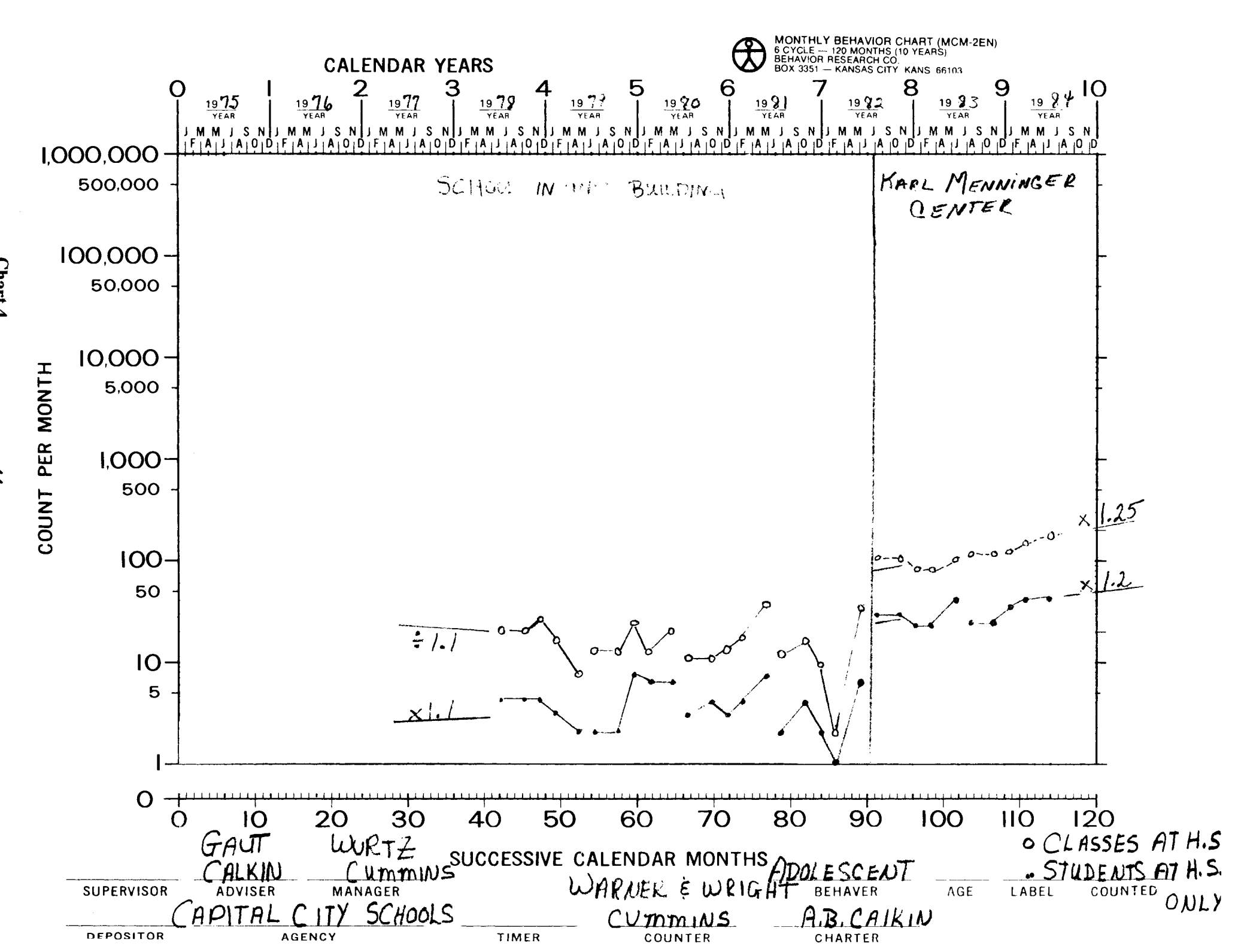
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Chart 4

children per class than were previously. This may be due to some reluctance to send students to the main high school. Chart 4 indicates a decrease prior to the move in the number of high school classes attended by Unit students while the same number of students attended classes (i.e., there were more students at the high school), but they took fewer classes. Subsequent to the move, there was a jump in frequency and a sharp increase in growth of the number of students in the high school. Before the move, about four children per quarter attended the high school from the Unit. After the move, this jumped to approximately 30 students per quarter. The number of students and classes attended since the move increased by 20% per six months during 1983 and 1984.

Charts 5 and 6 indicate attendance for students enrolled in both locations during any given semester. Chart 5 shows they attended about the same number of classes in each location, both before and after the move. It is difficult to determine what the trend is on these two charts because the data show so much variability.

In summarizing accomplishments, one can see three improvements which occurred as a result of the move to the Karl Menniger Building:

1. children were enrolled in school much more quickly than had previously occurred;
2. the total number of hours students attended school increased;
3. more students attended classes at the main high school building.

Areas still needing improvement included:

1. increased total student hours in school;
2. decreased class size on the Unit;
3. assessment of performance of students attending classes in both locations simultaneously.

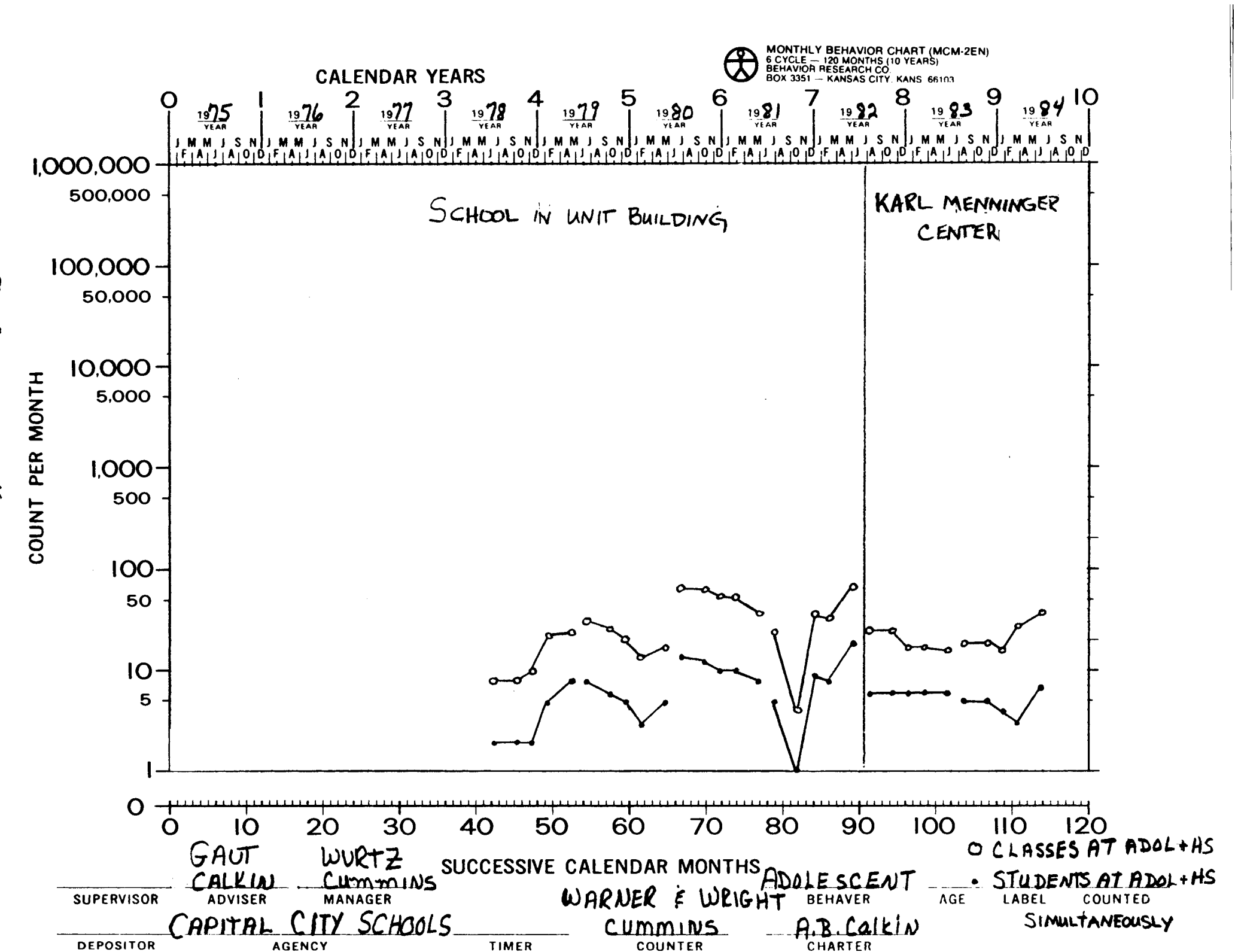
Increased total student hours in school.
Should all 72 Adolescent Unit patients be in school full time, the total number of student hours would be 432 which is only half of the June 1984 total. Interventions are necessary to increase student hours in school.

Decreased class size on the Unit.
The number of students per Unit class increased when the Menniger facility opened. The stated reason for this is that the children were too disturbed to leave the immediate area for school. Careful examination is necessary to determine whether it is the emotional state of the child or the habits of the clinical and school personnel on the Unit.

Effect of attending school in both locations.
It is unclear whether the variability of these data is due to changing leadership on the Unit (one psychologist for the first two years, another psychiatrist the second two years, and no section director the third two years) or the variability of the children themselves.
Perhaps keeping the number of students attending both sets of classrooms to a minimum is preferable.

Changes in organizational setting typically affect student behavior, but the effects are difficult to pinpoint. Standard Celeration Charting allows the administrator a mechanism to observe the effect of organizational change on student performance.

When this article was written, Dr. Abigail Calkin was Principal of Capital City Schools in Topeka, KS. Currently, she is Principal, Quinton Heights Elementary School, Topeka, KS. For further information, contact her at 631 Lane, Topeka, KS 66606.



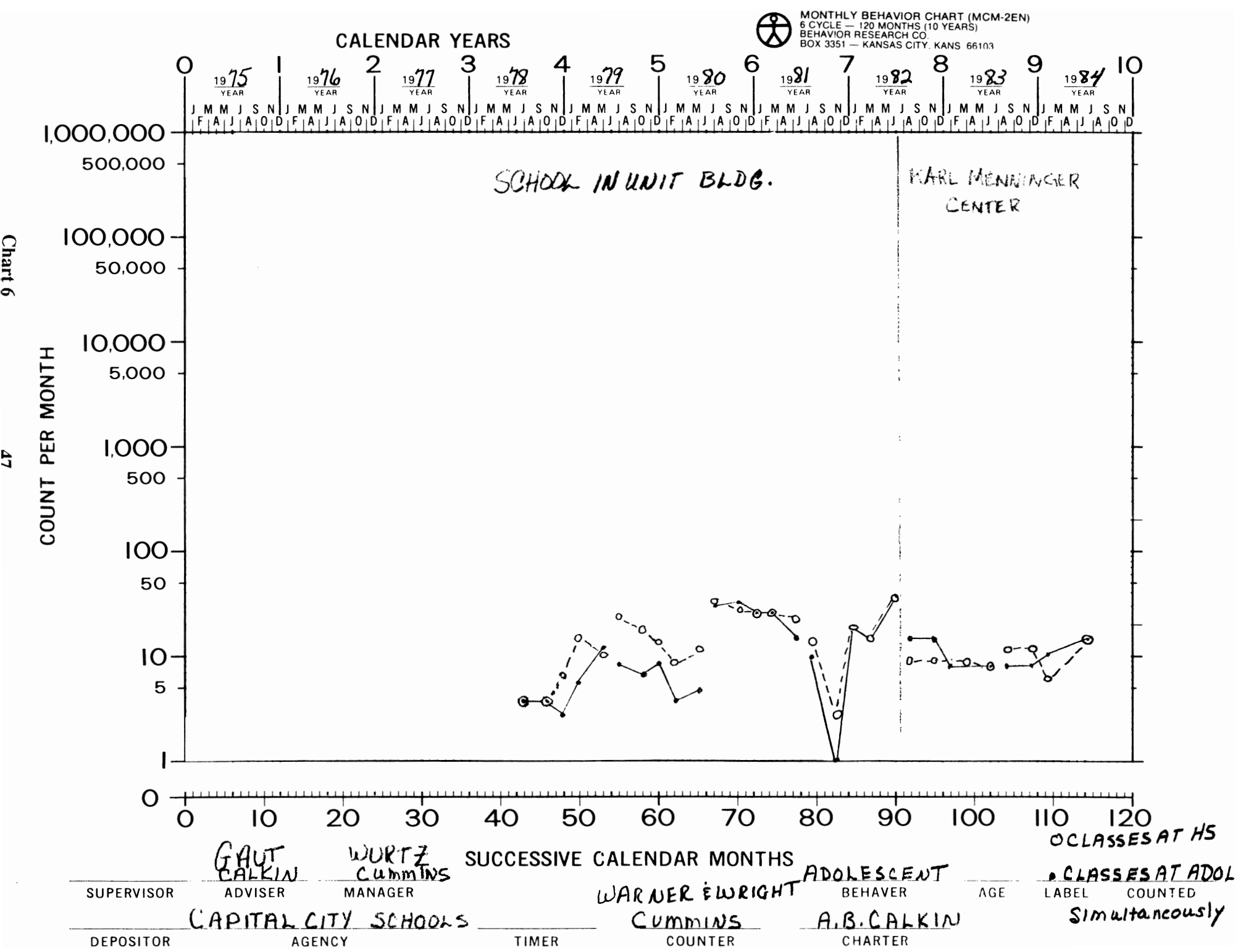
GAUT — WURTZ

CALKIN — Cummins — WARNER & WRIGHT — ADOLESCENT

SUPERVISOR — ADVISER — MANAGER — BEHAVER — AGE — LABEL — COUNTED

CAPITAL CITY SCHOOLS — Cummins — A.B. Calkin

DEPOSITOR — AGENCY — TIMER — COUNTER — CHARTER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CHARTER
A.B. CALKIN

Chart 6

Suggestions for Presenting Multiple Baseline Analyses on Standard Celeration Charts

by

John O. Cooper and John W. Eshleman

This article considers benefits for the use of single case experimental designs with Precision Teaching. It also describes and illustrates the multiple baseline design and suggests ways to show the design on Standard Celeration Charts. The suggestions do not alter the integrity of the Standard Celeration Chart. They are compatible with established chart conventions used by Precision Teachers.

Science is concerned with describing and explaining events. Measurement alone can give an accurate and reliable description of events. Events are best explained, however, when the scientist changes the events at will (i.e., does something to turn the events on then off, on again and off again and so on). This type of manipulation explains events as a function of something else. It is the search for functional relationships (e.g., "cause and effect"). For example, reading fluency is functionally related to short repeated practice. We call such event manipulation experimental design.

The study of experimental design has a scholarly history within behavioral psychology and education. Skinner's (1956) article, "A Case History in Scientific Method" is a significant source on experimental design from the behavioral view. Sidman (1960) and Johnston and Pennypacker (1980) further refined the behavioral experimental tradition.

When researchers study human events, exact control over the environment is not possible, desired or even permitted. The lack of environmental control makes the task of discovering functional relationships more difficult. Accordingly, single-subject experimental designs have evolved that permit explanations of functional relationships in the absence of tight laboratory environmental control (Hersen & Barlow, 1976). The exhaustive review by Johnston and Pennypacker (1980) summarizes all known experimental design considerations in behavior analysis. They differentiate single-subject designs from group designs.

Single-subject experimental designs pertain to individual behavior. The single-subject designs do not infer from a group down to an individual. Control groups rarely appear in the analysis of behavior. Rather, in single-subject research, experimental control is assessed by comparing the behavior of an individual against his or her own behavior under a different condition. The base rate of some behavior is recorded prior to an event manipulation. The events manipulated are independent variables. The measure of the behavior is the dependent variable. In behavior analysis, frequency of behavior is the most sensitive, productive, and informative dependent variable yet discovered (Pennypacker, Koenig, & Lindsley, 1972). Once a base measure of the behavior is predictable, the independent variable is introduced. The independent variable might be, for example, a change in consequences following behavior. Or it could be a change in events that precede behavior. For example, a teacher could add response prompts to written materials (e.g., Skinner, 1957, pp. 253-259). Or further, a teacher could change instructional methods or curricula. After the independent variable is applied, the behavior continues to be recorded.

The behavior may change with the occurrence of the independent variable. Some may believe the behavior changed because of the independent variable. Such a conclusion warrants caution and restraint. Hersen and Barlow (1976) argue the behavior change could have occurred anyway, regardless of the event manipulation by the experimenter. Recall that many variables lie beyond the researcher's control in much of human research.

Measurement during baseline and intervention (i.e., independent variable) is insufficient for demonstrating a functional relationship. Several ways exist to proceed past this insufficiency. One method would remove the independent variable once the behavior changed. Then we would observe whether the behavior returns to its former base rate. If it does, there is more reason to believe that the independent variable was related to the behavior change in the first place. However, as we will describe, in many cases the reintroduction of baseline conditions may not be possible or desirable. A second method known as the multiple-baseline design could be used to demonstrate functional relationships. This design will be discussed

in the remainder of this paper.

How does experimental design pertain to Precision Teaching? After all, teachers are not often considered scientists. They are not expected to demonstrate new functional relationships. Perhaps as a starting place, however, we believe teachers are in a unique position to make contributions to their profession as teacher-scientist. Greer (1986, May) said, teachers can become "strategic scientists" if outfitted with the tools that allow them to determine whether the changes they make in the classroom , teaching methods and materials, or curriculum are functionally related to the behavioral repertoires of their students. The teacher-scientists can contribute to the discovered knowledge of human behavior and the technology of teaching (Lindsley, 1990).

More broadly considered, some inclusion of Precision Teaching with experimental design, especially multiple baseline designs, has the following benefits:

(1) A more refined scientific rigor would become available to those interested in using Precision Teaching to expand our knowledge base and teaching technology. Although Precision Teaching's essential components (Standard Celeration Chart and frequency) already provide it with considerable rigor, Precision Teaching could be enhanced by multiple baseline designs.

(2) Greater integration could result between Precision Teaching (mostly educators) and applied behavior analysis (mostly Psychologists).

(3) Effects of working and sharing together could emerge. Applied behavior analysts may also use Standard Celeration Charting and frequency measurement if Precision Teachers demonstrate how the Chart can accommodate displays of experimental designs other than the ABAB (reversal) design (Tawney & Gast, 1984).

What Are Multiple Baseline Techniques?

Operation of the Multiple Baseline Design.
Multiple baseline designs have become the most frequently used experimental designs in applied behavior analysis (Cooper, Heron, & Heward, 1987). Baer, Wolf, and Risley (1968) first introduced and advanced multiple baseline designs as workable alternatives for the commonly used reversal (Baseline-1, Intervention-1, Baseline-2, Intervention-2) designs. The reversal design can present problems for teachers. Many school behaviors do not reverse in the second baseline condition. Other responses, such as aggressive behavior may not be suitable for reversal. Some teachers object to any reversal conditions. When these conditions are evident, the multiple baseline experimental design can be used, since this design does not need a reversal condition.

The multiple baseline design may be applied in three ways. First, a multiple baseline can be used across behaviors. This is an analysis of two or more different but similar behaviors of one student. Second, a multiple baseline can be applied across locations. This is an analysis of one student behavior occurring in at least two different locations. Finally, a multiple baseline can be taken across students. This is an analysis of one behavior of two or more students. In all three cases, the design is a set of baselines and interventions operating at the same time. But, the interventions are not introduced at the same time.

Multiple Baseline Across Behaviors Design.
With this design, the instructor measures at the same time two or more different behaviors of a given person. The independent variable is applied first on only one behavior following a baseline period. During this intervention, the other behaviors continue in baseline. After the behavior changes, the same teaching method is applied to the second behavior. Following behavior change of the second behavior, the teaching method is applied to the third behavior, and so on.

Multiple Baseline Across Locations Design.
In this design the instructor measures one behavior of one person in several different locations. Baselines are produced for each location. The locations, for example, could be home-school; lunchroom-playground; reading class - music class; morning-afternoon. Next, the teacher applies the intervention in only one of the locations. Meanwhile, baseline continues in the other locations. The same intervention may be applied in the second location. There are two conditions for deciding to apply it. First, the intervention is applied only after improvement in the first location. Second, the baseline celeration course in the second location should have remained unchanged.

Multiple Baseline Across Students Design.
In this design the teacher measures a single behavior of two or more individuals prior to intervention. That is, there is a baseline for each student. Next, the teacher implements the intervention for only one of the students. The other students are kept in baseline. Then, the intervention is used with another student following a behavior change

in the first student's behavior.

Figure 1 depicts a "stretch-to-fill" graphic prototype of a multiple baseline design. This is the type of figure typically seen in the applied behavior analysis literature.

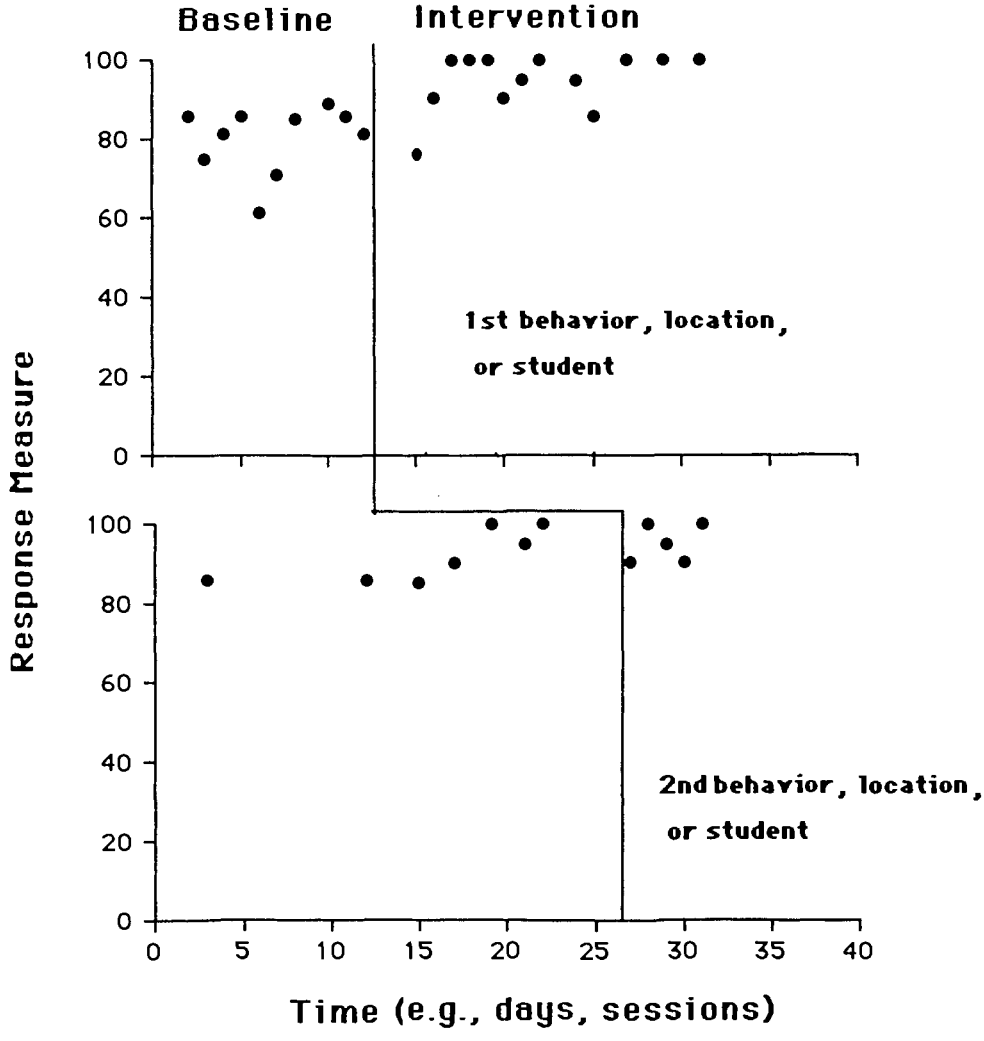
Consider the following points when using multiple baseline designs. First, when measuring two or more different behaviors of an individual, choose behaviors that are similar. For example, reading comprehension probably would make a more convincing second baseline for fluency of oral reading than frequency of sharing during cooperative play. The closer the similarity of behaviors among baselines, the more believable the succeeding functional relationship becomes. Second, begin data collection for all baselines close together in time. Starting all baselines on the same day at the same time is a sound policy.

Logic of the Multiple Baseline Experimental Design. Collecting baseline data establishes a basis for predicting future learning. The teacher may predict that learning will follow a similar Chart picture if no major changes occur during instruction or in the life of the student.

The remaining baselines confirm the first baseline prediction. Such confirmations occur only when these baselines remain unchanged. Moreover, these confirmations increase the believability that the behavior did not change due to variables uncontrolled by the teacher (i.e., did not occur "by chance").

Multiple baseline procedures provide for repetition of effect. A teaching method that produced only one effect would not be a major development. The important point is to demonstrate that the teaching method relates to the frequency of behavior. The staggered application of the intervention across behaviors, locations, or students makes repetition possible. As Sidman (1960) observed, the more times an effect is repeated, the greater the

FIGURE 1 Illustration of a multiple baseline design

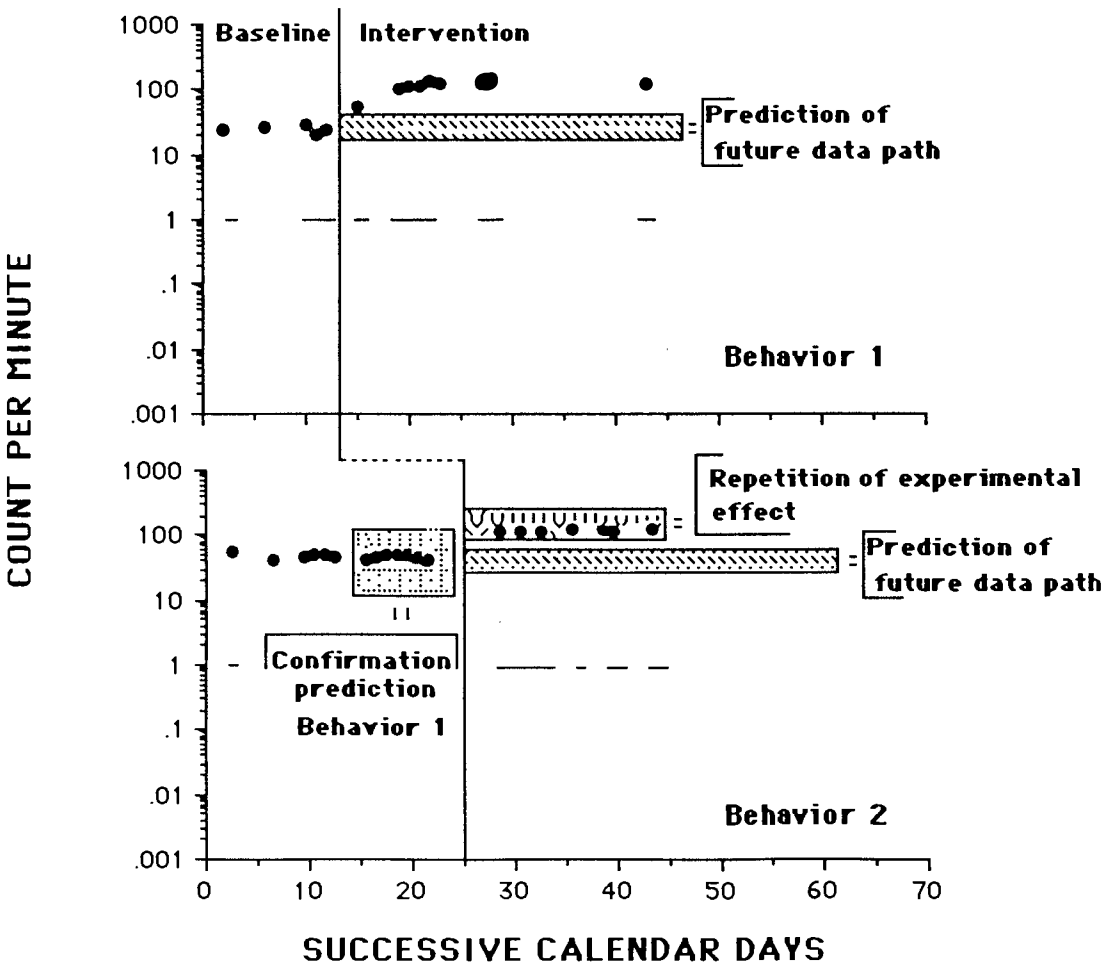


belief in a functional relationship. For instance, resulting behavior changes shown with six behaviors (or six locations, or six students) are more convincible than those shown with only two behaviors (or two locations, or two students).

Information from predictions, confirmations, and repetitions of effect are used to attribute a change in behavior to the teaching tactic. For example, if the intervention is applied to one behavior and affects not only that behavior but the other behaviors in baseline, we lose believability of a functional relationship. Similarly, if the first behavior changed, but the second and third behaviors remain unchanged when the intervention is applied to them, we also lose believability in a functional relationship. Figure 2 presents fictional data that illustrate prediction, confirmation, and repetition of effect with multiple baseline designs.

Presenting the Multiple Baseline Design on the Standard Celeration Chart. The Standard Celeration Chart is always used in Precision Teaching. It is also suited to present ABAB (reversal) experimental designs. However, as noted, reversal designs are not the most common in applied behavior analysis. Rather, multiple baseline designs are. The Standard Chart, unfortunately, does not lend itself to quick and easy display of multiple baselines on a single Chart paper. A number of conventions for displaying multiple baselines with the Standard Chart could be advanced. We suggest that the Precision Teaching community consider and use the following nine points. (Note: A Precision Teacher would handle these suggested conventions in conjunction with established charting conventions for the Standard Celeration Chart, e.g., McGreevy, 1981; White, 1986. Real data, presented in Charts 1 through 4, illustrate the suggestions we offer.)

FIGURE 2 Illustration of the use of prediction, confirmation, and repetition of effect with multiple baseline designs



Suggestions:

1) Vertical lines with arrow points at the end are used to separate conditions off the Chart grid (See Chart 1).

(2) A small vertical line at the end of the last condition line shows the last day of the analysis (See Chart 1).

(3) Include the number of baselines used and the order the intervention was applied to each baseline with the baseline label (See Chart 1). The note "(1 of 4)" means there are four baselines in the analysis and the baseline displayed on the Chart was the first to receive the intervention. "(2 of 3)" means that there are three baselines in the analysis, and the baseline shown on the Chart was the second to receive the intervention.

(4) Vertical lines with arrow points continue, beginning off the grid to the next Chart of the analysis (See Chart 2).

(5) A horizontal dashed line connecting the condition change line provides the number of calendar days this baseline is continued beyond the previous baseline (See Chart 2).

(6) If the multiple baseline design is across two or more behaviors, indicate the number of behaviors and the order of intervention under the Chart blank labeled "counted" [e.g., "(2 of 4)"]. (See Chart 2).

(7) If the multiple baseline design is across two or more locations, indicate the number of locations and order of intervention under the Chart blank that is labeled "Agency" [e.g., "(1 of 3)"]. List the different locations in the "Agency" blank (e.g., Central Elementary, resource room; Central Elementary, 3rd grade regular classroom; Central Elementary, band room).

(8) If the multiple baseline design is across the same behavior of two or more students, indicate the number of people and the order of intervention under the Chart blank labeled "Behaver" [e.g., "(2 of 3)"].

(9) The condition line for the last Chart of the analysis remains on the grid (See Chart 4).

Discussion

Multiple baseline designs permit a teacher to demonstrate a functional relationship between an instructional method and a behavior change. As such, the teacher could say why the behavior changed by relating it back to the event manipulation. This opens the door to further study of different aspects of the method, or other interventions. The overall result would be an inventory of what works and what does not work in education.

Our suggestions do not alter the basic integrity of the Standard Celeration Chart. This allegiance to Chart integrity played a critical role in the development of these suggestions. In its original form, the Standard Celeration Chart is not only scientifically powerful, it is a work of art. Tampering with its basic features leads to a "stretch-the-axes-to-fill-your-need" mentality and "bastard charts" (Pollard, 1988), as well as to weaker science.

Weak science does not find functional relationships very well, does not get us very far, and does not describe or explain very much.

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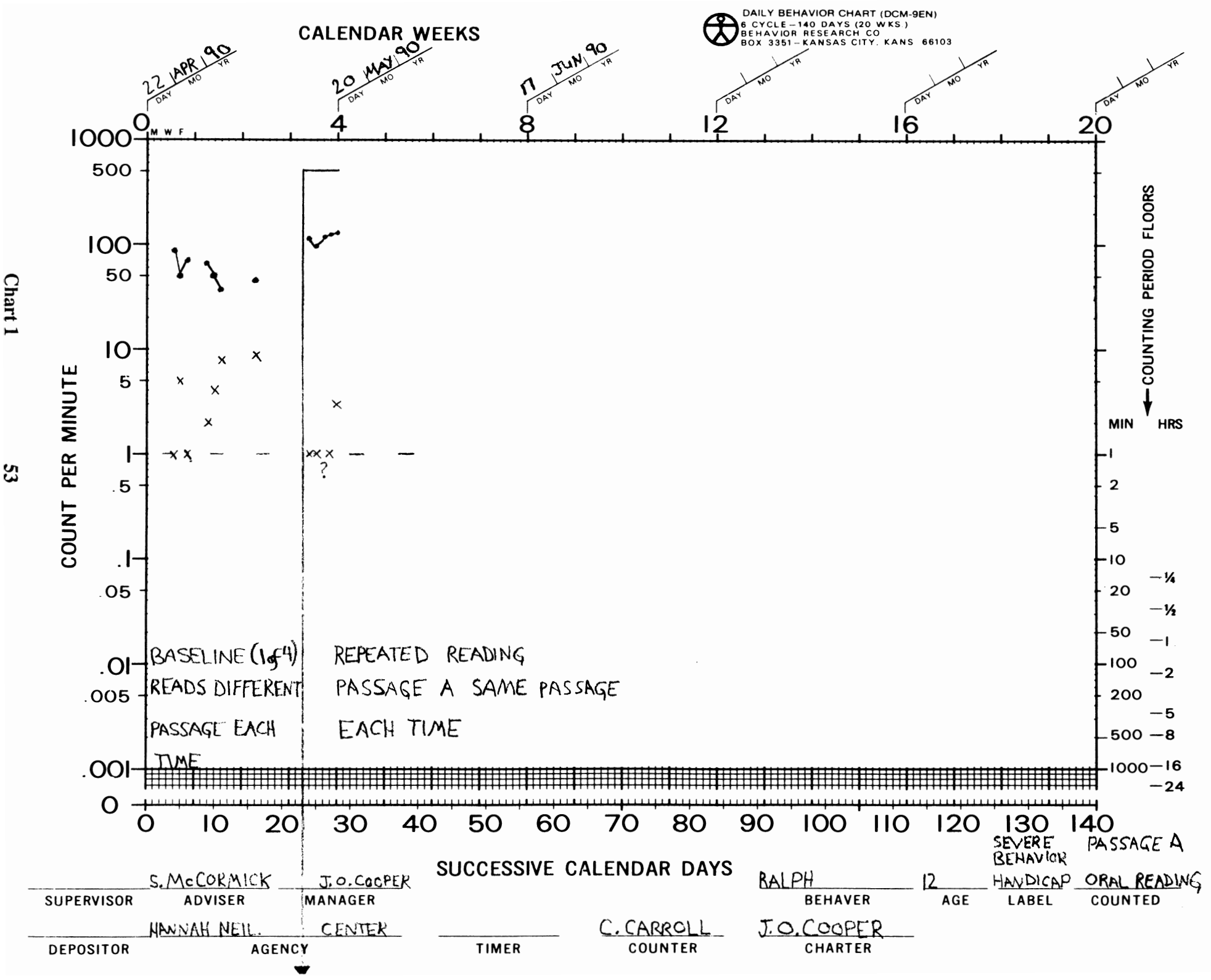
DAILY BEHAVIOR CHART (DCM-9EN)
6 CYCLE – 140 DAYS (20 WKS.)
BEHAVIOR RESEARCH CO
BOX 3351 – KANSAS CITY, KANS 66103
CALENDAR WEEKS
22 APR 90
20 MAY 90
17 JUN 90
DAY MO YR
0 4 8 12 16 20
M W F
COUNT PER MINUTE
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COUNTING PERIOD FLOORS
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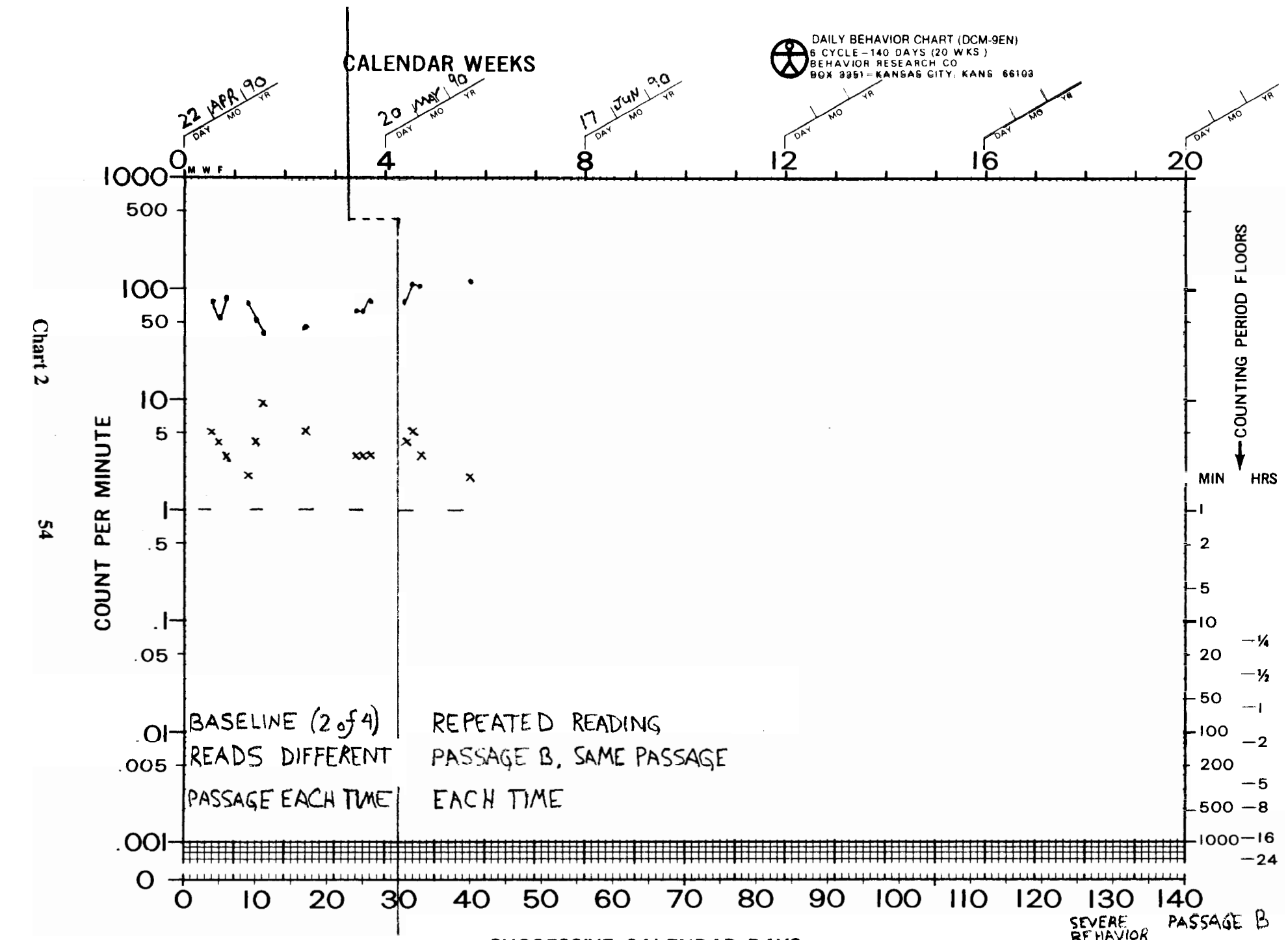
BASELINE (1 of 4)
READS DIFFERENT PASSAGE EACH TIME
REPEATED READING
PASSAGE A SAME PASSAGE EACH TIME
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
SUCCESSIVE CALENDAR DAYS
SEVERE BEHAVIOR
PASSAGE A
S. McCORMICK
SUPERVISOR
J.O. COOPER
ADVISER
MANAGER
RALPH
BEHAVER
12
AGE
HANDICAP
LABEL
ORAL READING
COUNTED
HANNAH NEIL
DEPOSITOR
CENTER
AGENCY
TIMER
C. CARROLL
COUNTER
J.O. COOPER
CHARTER

Chart 1



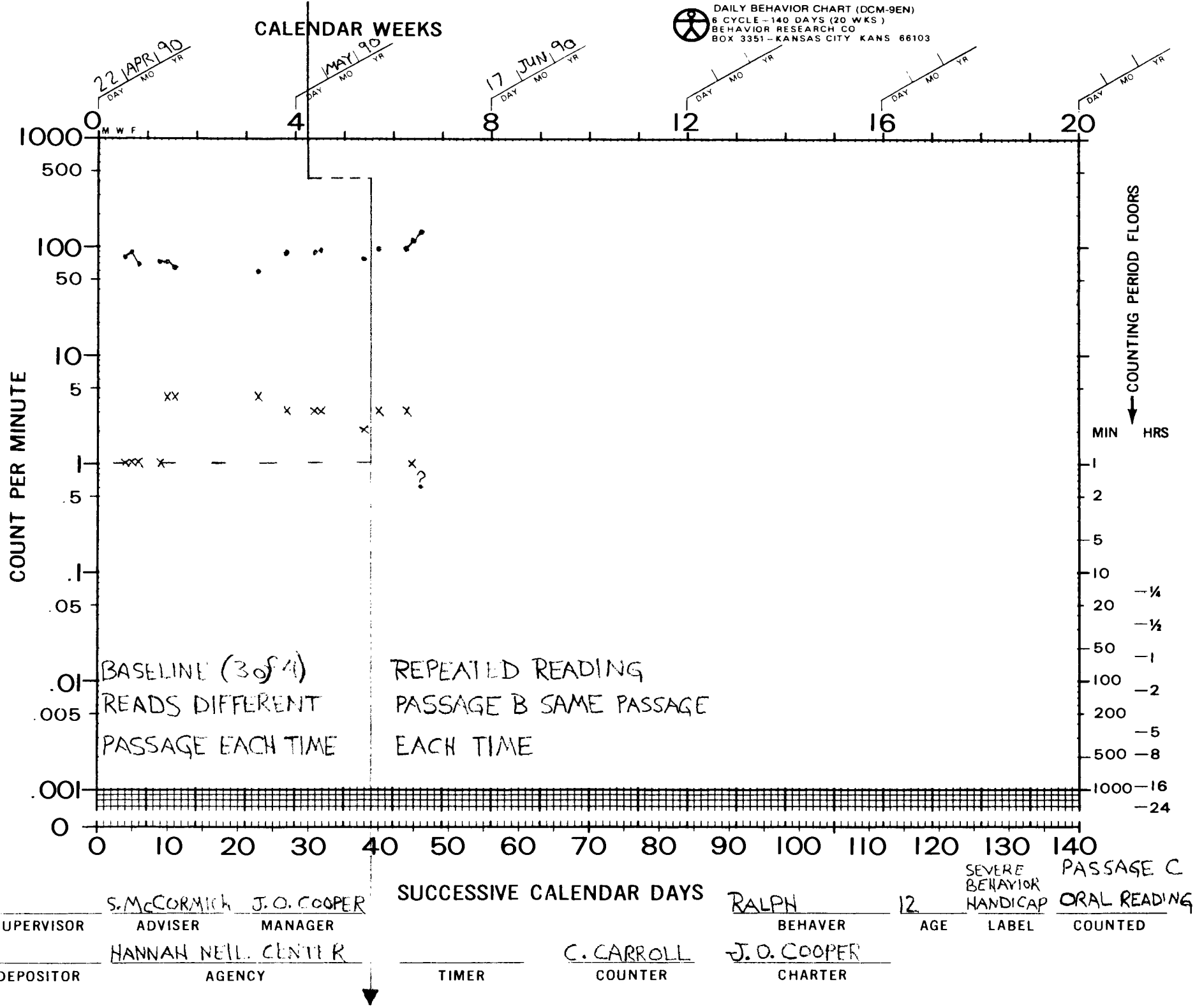
S. McCORMICK — SUPERVISOR
J. O. COOPER — ADVISER
MANAGER

HANNAH NEIL CENTER — AGENCY

C. CARROLL — TIMER
COUNTER

J. O. COOPER — CHARTER

RALPH — BEHAVER
12 — AGE
SEVERE BEHAVIOR HANDICAP — LABEL
PASSAGE B ORAL READING — COUNTED


DAILY BEHAVIOR CHART (DCM-9EN)
6 CYCLE – 140 DAYS (20 WKS)
BEHAVIOR RESEARCH CO
BOX 3351 – KANSAS CITY KANS 66103
CALENDAR WEEKS
22 APR 90
DAY MO YR
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COUNT PER MINUTE
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BASELINE (3 of 4)
READS DIFFERENT PASSAGE EACH TIME
REPEATED READING
PASSAGE B SAME PASSAGE EACH TIME
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
SUCCESSIVE CALENDAR DAYS
S. McCORMICH J. O. COOPER
SUPERVISOR ADVISER MANAGER
RALPH 12 SEVERE BEHAVIOR HANDICAP PASSAGE C
BEHAVER AGE LABEL COUNTED
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TIMER COUNTER
J. O. COOPER
CHARTER

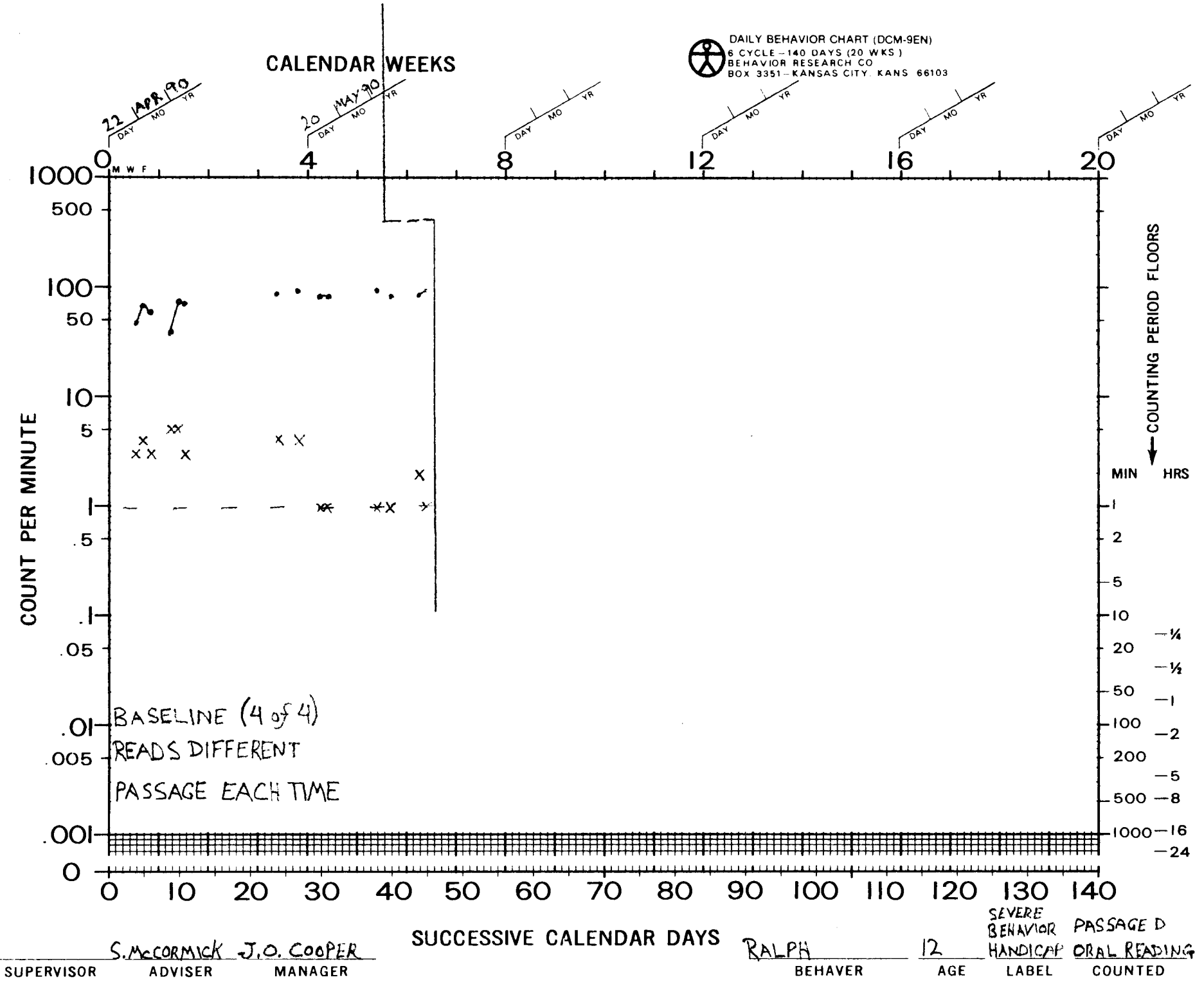

Chart 4

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HANNAH NEIL CENTER

RALPH 12 SEVERE BEHAVIOR HANDICAP PASSAGE D ORAL READING
BEHAVER AGE LABEL COUNTED

C. CARROL J.O. COOPER

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Skinner's Impact on Education

by

Ogden R. Lindsley

B. F. Skinner received his Bachelor's degree in English in 1926 from Hamilton, and his Ph.D In Experimental Psychology from Harvard in 1931. Even though completely researched and in final form, his dissertation was not accepted by the Psychology Department for over a year because of a hot debate over the appropriateness of its topic. Was it really Psychology, or should it instead be offered to the Biology Department?

During his early teaching career he was an Instructor from 1936 to 1937, an Assistant Professor from 1937 to 1939, and an Associate Professor from 1939 to 1945 at the University of Minnesota. While in Minneapolis he noticed the pigeons flying around the many elevators of the grain companies and decided they would be ideal to guide missiles and provide his contribution to the World War II effort. Fred along with two of his graduate students, Marion and Keller Breland, taught the pigeons to effectively guide missiles while strapped in a nose cone and pecking with their gold foil beaks on a glass image of a targeted enemy destroyer or U boat. This successful research was classified until the sixties under the code name "Pigeon in a Pelican."

The shaping methods developed to train the pigeons were successfully used in commercial animal training by the Brelands in Animal Behavior Enterprises of Arkansas. These methods are now used by Sea World and Marine Land to train their dolfins and whales, but credit is seldom given to Skinner for this remarkable teaching.

He was department chair briefly at Indiana University from 1945 to 1948. In 1948, Skinner accepted the Edgar Pierce Professorship in Psychology at Harvard and became Professor Emeritus in 1974.

In 1938, Skinner published the *Behavior of Organisms*, which many consider his classic.
In 1948, *Walden II* was published and stirred up a controversy over utopian ideals. Several experimental communities, which are still in vibrant existence, were founded on its principles.

I first met B.F. Skinner in 1951 when I was a graduate student in Physiological Psychology at Harvard. He asked me to assist in teaching Natural Sciences 114, mentioning that he was being undermined by teaching assistants who were telling the undergraduates, "I don't believe this behaviorism either, but just answer Skinner's questions with what a behaviorist will reinforce you for writing." Since I had a prior Master's degree from Brown and had studied with Walter Hunter, Carl Pfaffman, and Gregory Kimble, Skinner said I ought to be at least a behaviorist!

For a Natural Sciences 114 class demonstration, in only a few days I trained Samson Rat to lift 250% of his own body weight. (This greatly impressed me, with my New England farm background.) Through Skinner I had gained more control over a whole free-running rat than I ever had over a cathode ray oscilloscope and one small rat nerve (the chorda tympani). I never went back to my electrodes, and have been an operant conditioner ever since. As Fred has often said, " the rats make operant conditioners, I don't."

In 1953, *Science and Human Behavior* was published. We had been teaching from a mimeographed form of the book for several years. Only 10 out of 450 pages (2%) were dedicated to education. In the index education was referenced at five places, and teaching was not even indexed.

In 1953, Deborah Skinner, the youngest of Fred and Eve's two daughters, was doing poorly in math at Shady Hill School in Cambridge. In characteristic fashion Fred rolled up his sleeves, went into the laboratory and built something that would really teach math. In 1954, "The Science of Leaming and the Art of Teaching" was published in the *Harvard Educational Review*, picturing and describing two of the first teaching machines. In 1958,"Teaching Machines" was published in *Science*, picturing and describing the use of more advanced machines and giving examples of frames of programmed materials in elementary spelling and in high school physics. Here Skinner credited the earlier work of Sidney L. Pressey in the twenties and pictured a Pressey machine.

Among the many that helped in the Harvard

Robinson, James Holland, Charles Ferster, Susan Meyer Markle, Lloyd Homme, Wells Hively, Nathan Azrin, Matthew Israel and Douglas Porter. Others not at Harvard but equally active in the early days were Donald Bullock, Donald Cook, Francis Mechner, and Thomas Gilbert.

By 1962, teaching machines and Programmed Instruction were readily adopted by industry and the military. Surprisingly to us at the time, programmed instruction was successfully resisted by public primary, secondary and higher education. The first meeting of the National Society for Programmed Instruction met in San Antonio, the home of very large military training agencies.

In 1968, several earlier papers were reprinted and brought together in The Technology of Teaching which was fittingly dedicated to Skinner's most memorable teacher, Miss Mary I. Graves (1863-1922). In this book Skinner described the three major traditional theories of how we learn: "We learn by Doing," " We learn from Experience," and "We learn by Trial and Error." He pointed out that these are really incomplete descriptions of the three essential parts of any set of contingencies of reinforcement--the response, the occasion, and the consequences.

In 1969, Fred and Eve's older daughter, Julie, received her doctorate in Educational Psychology from the University of Pittsburg.

In 1974, the National Society for Programmed Instruction changed its name to the National Society for Performance and Instruction to represent its broadened interest in changing behavior by environmental engineering in addition to formal instruction, and to keep its initials (NSPI) intact. In 1987, the National Society for Performance and Instruction, now over 5000 members strong with 50% from industry and utilities, 25% consultants, 15% academic and 10% in government, the military, or medicine, had its 25th annual meeting in San Antonio. Note: there are very few public school or higher education professional educators in this association. Most public professional educators are either in the American Educational Research Association, serving rigid statistical research designs, or in the American Society for Curriculum Development, serving Bloom's taxonomy, cognitive theorists, and/or Piaget and A. S. Neil.

In 1977, the federally funded Project Follow Through reported its testing of 22 different educational models. The two models producing the most educational gain were Direct Instruction and Behavior Analysis. The cognitive and cognitive-affective models were found to produce even less gain than the regular public school control groups. In 1988, Cathy L. Watkins reported on Project Follow Through, "The educational establishment's vested interests have effectively prevented the largest experiment in history on instructional methods (costing almost one billion dollars) from having the impact on daily classroom practice that its results clearly warranted."

Professor Skinner's work has generated six major scientific journals:

- The *Journal of the Experimental Analysis of Behavior.*
- The *Journal of Applied Behavior Analysis.*
- *The Behavior Analyst.*
- *Performance & Instruction.*
- *Performance Improvement Quarterly.*
- The *Journal of Precision Teaching.*

Professor Skinner's work has generated three major professional organizations:

- The National Society for Performance and Instruction in 1962, now at 5000 members,
- The Division for the Experimental Analysis of Behavior of the APA in 1965, now at 1300 members,
- The Association for Behavior Analysis in 1977, now at 2000 members.

Professor Skinner's work has influenced four behavioral instructional methods that, although not universally adopted in public instruction, have proven to be the most productive yet evaluated. When combined they are even more powerful: too powerful for schools with institutionalized scope and sequence requirements, and too powerful for schools with learning allotments for each child for each year. These four overly productive instructional methods are:

- Programmed Instruction.
- Behavior Analysis.
- Direct Instruction.
- Precision Teaching.

I have long remembered and often quoted one of Fred's maxims. "When you ask for the salt correctly in French in French class you get an 'A'. When you ask for the salt correctly in French in France, you get the salt!"

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