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Six Procedures for Showing Collections of Standard Celeration Charts

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We present procedures for making six classroom-friendly collection displays of individual performances. Four of the procedures provide collections of individual data revealing spreads of celerations and frequencies as they occurred in reference to calendar days. Two of the procedures provide collections of (a) frequency jumps and celeration turns, and (b) learning pictures which represent the general shapes of celerations and frequencies. We recommend that Precision Teachers consider making greater use of chart collections with some instructional decisions, as a supplement to serially viewing individual charts. A collection may provide an improved understanding of how instruction impacts a total program, and may assist in making class-wide interventions. Rules to guide the development of collections are suggested.

Lindsley, Calkin, and White (1993, March) identified a standard celeration chart collection as a group display of data from several independent performances. The group display must contain all the individual data in the collection to qualify as chart collection (e.g., all frequencies, all celerations, or all jumps and turns). A collection does not summarize, block, or change the character of these individual data. Lindsley et al. said, ". . . we want to see each datum in its rightful place in the collection." They compared the display of chart collections to collections presented by art and natural history museums. Lindsley et al. stressed that collections do not use statistical summing. For instance, a chart displaying a performance spread (i.e., the high frequency and low frequency) and a middle frequency obtained from several charts does not meet the above definition of a collection. This non-instance of a chart collection did not include all the individual data from the several available charts. Conversely, a group chart that highlighted the high, low, and middle frequencies, but also included all other frequencies from the several charts meets the definition of a standard celeration Chart Collection.

Even though most classroom teachers instruct groups of students, teachers still need to measure individual performances to assess the relative usefulness of their instruction with all students. It seems likely that most people, however, have difficulty understanding group effects from serially viewing many individual charts. Conversely, charted collections may facilitate the understanding of group effects.

In the beginning years of Precision Teaching, Precision Teachers learned often used chart collections to study learning. It appears that Precision Teachers now produce and use fewer classroom collections than they did during the late 1960s, 1970s, and 1980s. For example, Stromberg and Chappell (1990) observed the frequency of chart collections in Volumes 1 through 6 of the *Journal of Precision Teaching (JPT)*. They found that the overall celeration of collections published in JPT divided by 2.6. We extended Stromberg and Chappell's analysis to include all volumes of the *Journal of Precision Teaching and Celerarion (JPT& C)* through 1996, and found the overall celeration course of published collection charts divided by 1.6. We excluded Volumes 9(1) and 10(2) in our analysis because these volumes included several older chart collections, rather than collections accumulated since 1986. Including these older chart collections in our attempt to extend Stromberg and Chappell's analysis would have biased the overall collection celeration course through 1996. Chart 1 displays the collection *frequencies for all Volumes of JPT and JPT&C* through 1996, excluding Volumes 9(1) and 10(2). Appendix A references all chart collections published in *JPT & C* 1980 through 1996.

Table 1 introduces the data specimens we present below, the corresponding Table and Chart or Illustration numbers for the specimens, and the citations for our specimens. Tables 2 through 7 present procedures for making six classroom-friendly collection displays of individual performances. Charts 2 through 5 provide collections of individual data revealing spreads of celerations and frequencies as they occurred in reference to calendar days. Illustrations 1 and 2 provide collections of (a) frequency jumps and celeration turns and (b) learning pictures which represent the general shapes of celerations and frequencies. We use "illustrations" to name these "general shape" collections rather than identifying them as "chart collections" because they display the dynamics of individual data without reference to calendar time or frequencies.

A Collection of Frequencies

Chart 2 shows a frequency collection with 26 students in a Precision Teaching course at The Ohio State University. This working chart collection shows the group results from one-minute counting periods of think-to-free abbreviate key points from assigned readings and one counting period of practice placing dots on the Standard Celeration Chart.

A Collection of Frequencies with Correct and Incorrect Pairs

Chart 3 shows a frequency collection with correct and incorrect pairs. The collection presents before and after see-to-say "Learning Pictures" and "Psych Facts #2" flash-card performances of general psychology students attending Wayne State College (Bower & Orgel, 1981).

A Collection of Celerations

Chart 4 shows a celeration collection describing the silent reading performances of 76 students attending the Center for Individualized Instruction at Jacksonville State University (McDade, Cunningham, Brown, Boyd, & Olander, 1991).

A Collection of Celerations with Correct and Incorrect Pairs

Chart 5 shows a collection of celerations with correct and incorrect pairs of 79 K-12 students attending the Ohio State University Educational Clinic. All students experienced difficulty learning in their home school setting. The schools identified about half of the learners as academically at risk, and the other half received remedial reading instruction or special education services. This chart collection shows the group results from two sets of repeated oral readings during one-minute counting periods. One student reading silently produced the highest frequency celeration courses, although not the steepest celeration (namely, the outliner celeration course of Set A and Set B).

An Illustration of a Collection of Frequency Jumps and Celeration Turns

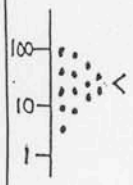
Illustration 1 shows the general shape collection of the frequency jumps and celeration turns that occurred with the two sets of 79 celerations shown in Chart 5, as the students progressed from Set A repeated readings to Set B repeated readings. This general shape collection shows (a) all individual patterns of jumps and turns found on the 79 individual charts, and (b) the number of charts that produced that pattern.

An Illustration of a Collection of Learning Pictures

Illustration 2 presents a gnarl shape collection of the improving, maintaining, and worsening learning pictures of 10 junior high school students with developmental disabilities. The teacher recorded the number of the correct and incorrect delayed student retells two hours following three different conditions of audio-taped presentations--different listening, repeated listening, and repeated listening with immediate retells. The numbers below the improving, maintaining, or worsening learning pictures identify the individual students with that learning picture (e.g., student 1, student 2) (Brown, Dunne, & Cooper, 1996, p. 402).

Table 1

Developing a Collection of Frequencies

Form	Collection Type	Classroom Procedure	Construction	Comments
	Frequency	1. Display a standard celeration chart transparency on an overhead projector. 2. Teacher Charts: Students in rotation say their correct counts while the teacher places dots on the chart using a transparency pen. 3. Students Chart: Students, one at a time, go to the overhead and use a transparency pen to place their counts on the chart.	1. Mark the counting period floor. 2. Arrow the middle count of the distribution. 3. If the teacher or students chart with a non-permanent transparency pen, make a photo copy of the chart transparency to save the collection	1. Excellent collection display for single events of several students (e.g., pre-post testing, weekly Quizzes). 2. We suggest having students place their own dots in the collection when the group is small (e.g., 3 to 4 students). The teacher should chart for larger groups, because of long transition times required for the student production.

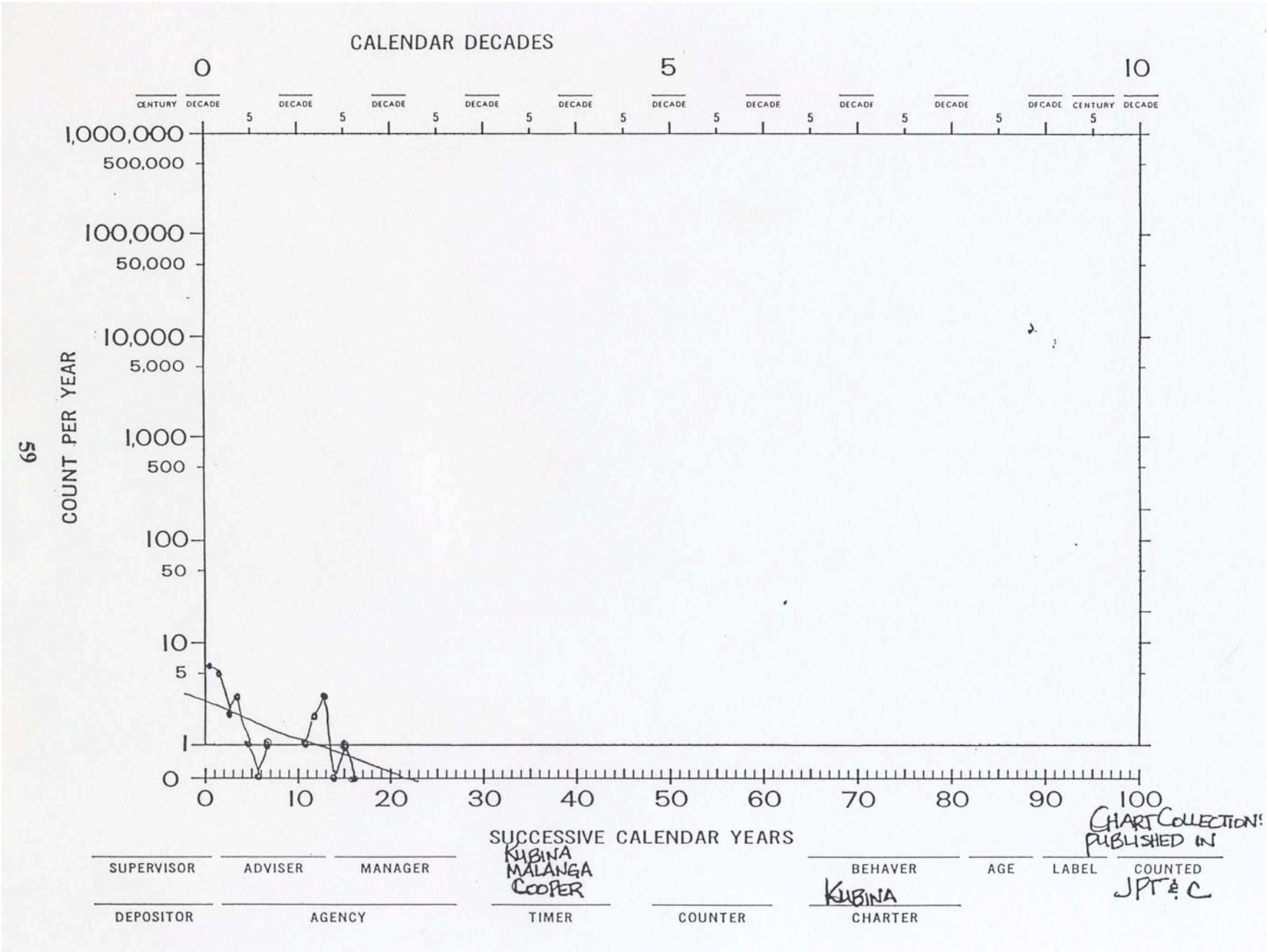
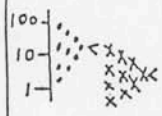

CALENDAR DECADES
0
5
10
CENTURY
DECADE
DECADE
DECADE
DECADE
DECADE
DECADE
DECADE
DECADE
DECADE
DECADE
CENTURY
DECADE
5
1,000,000
500,000
100,000
50,000
10,000
5,000
1,000
500
100
50
10
5
1
0
COUNT PER YEAR
0
10
20
30
40
50
60
70
80
90
100
SUCCESSIVE CALENDAR YEARS
SUPERVISOR
ADVISER
MANAGER
DEPOSITOR
AGENCY
TIMER
KUBINA
MALANGA
COOPER
COUNTER
BEHAVER
KUBINA
CHARTER
AGE
LABEL
COUNTED
CHART COLLECTION: PUBLISHED IN JPT & C

Table 2

Developing a Collection of Frequencies with Correct and Incorrect Pairs

Form	Collection Type	Classroom Procedure	Construction	Comments
	Frequency with correct and incorrect pairs.	1. Follow the same procedure as presented for the frequency collection in Table 1.	1. Use the same construction techniques as presented in Table 1. 2. Use a dot for correct responses and x for incorrect responses. 3. Do not stack the corrects and incorrects on the same day lines. Use one cluster of day lines for correct responses and another cluster of day lines for the incorrect responses.	1. The comments presented in Table 1 also apply for collections showing correct and incorrect frequencies.

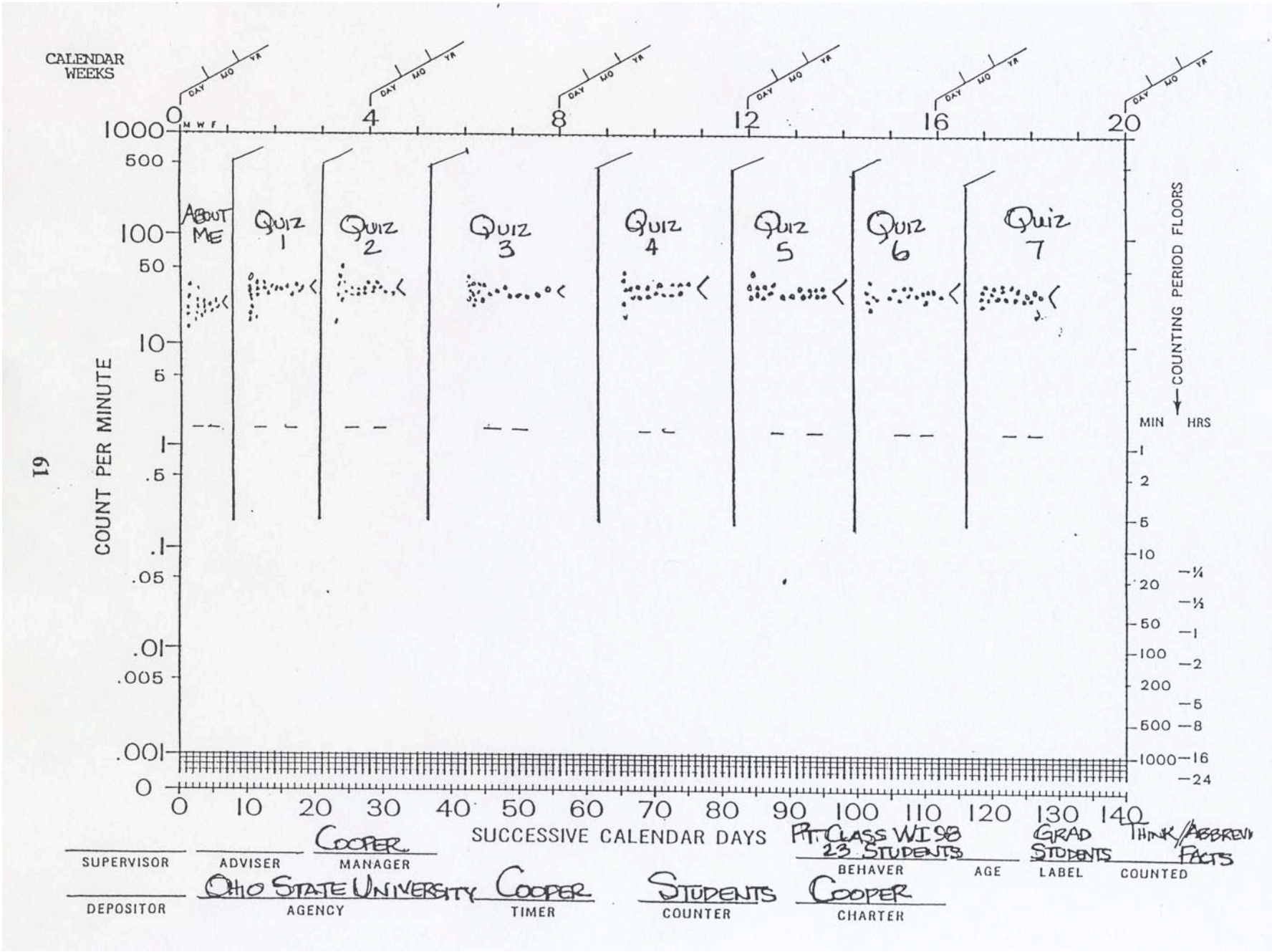

CALENDAR WEEKS
DAY MO YR
0 4 8 12 16 20
N W F
1000
500
100
50
10
5
1
.5
.1
.05
.01
.005
.001
0
COUNT PER MINUTE
ABOUT ME
QUIZ 1
QUIZ 2
QUIZ 3
QUIZ 4
QUIZ 5
QUIZ 6
QUIZ 7
COUNTING PERIOD FLOORS
MIN HRS
1
2
5
10
20
50
100
200
500
1000
¼
½
1
2
5
8
16
24
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
SUCCESSIVE CALENDAR DAYS
SUPERVISOR
ADVISER
COOPER
MANAGER
PIT CLASS WI 98
23 STUDENTS
BEHAVER
AGE
GRAD STUDENTS
LABEL
THINK/ABBREVI FACTS
COUNTED
DEPOSITOR
OHIO STATE UNIVERSITY
AGENCY
COOPER
TIMER
STUDENTS
COUNTER
COOPER
CHARTER

Table 3

Developing a Collection of Celerations

Form	Collection Type	Classroom Procedure	Construction	Comments
 7 charts in the collection	Celeration	1. Display a transparency of the horizontal and vertical axes of standard celeration chart on an overhead projector (i.e., a chart without day or frequency lines). 2. Students, one at a time go to the overhead, place their working chart under the transparency, and with a transparency pen trace their celeration course.	1. Mark the counting period floor. 2. Bold-face the middle celerations. 3. Report the number of individual charts included in the collection.	1. The students can draw their celeration courses during individual study time rather than as group activity when the class is large.

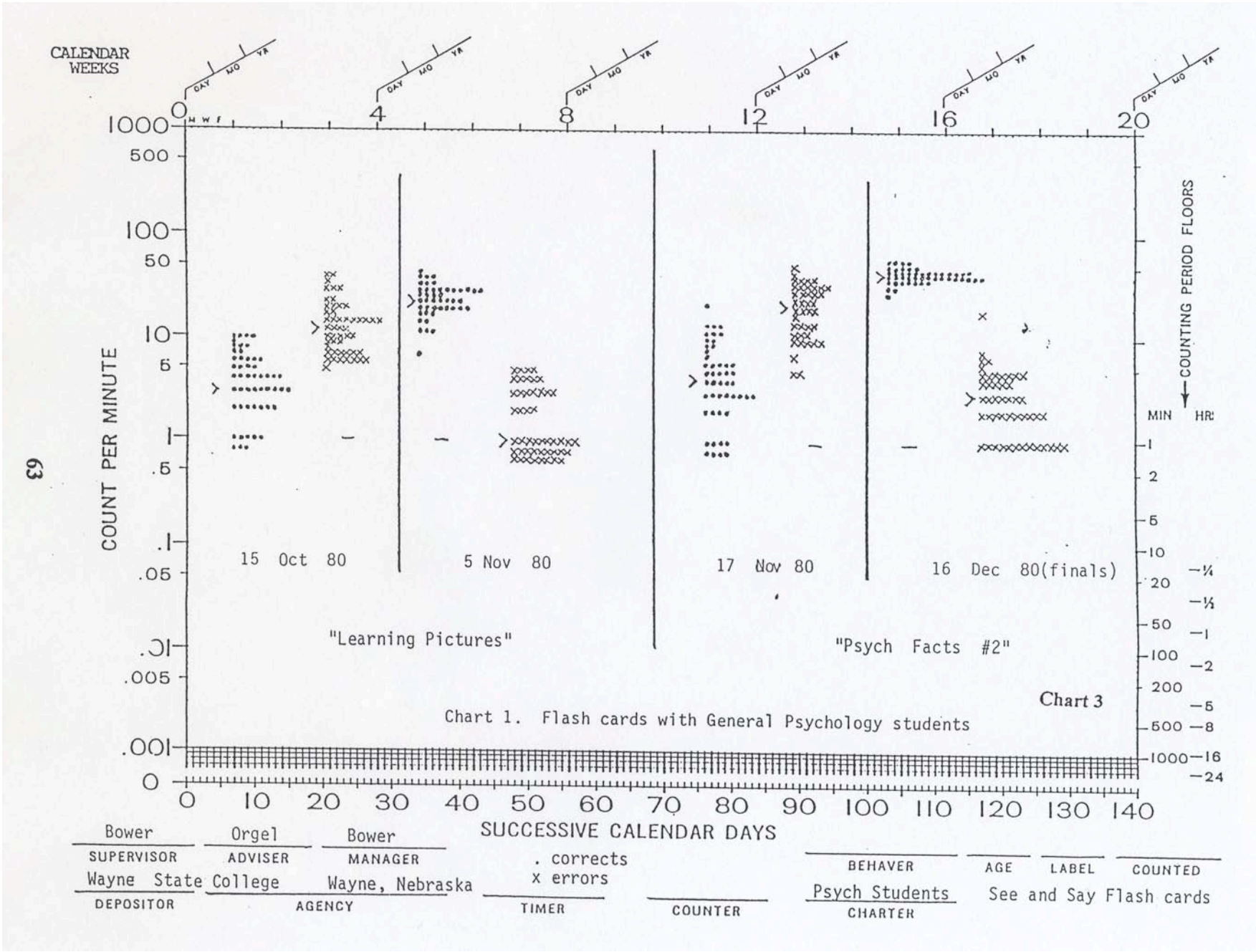


Chart 1. Flash cards with General Psychology students

SUPERVISOR	ADVISER	MANAGER	TIMER	BEHAVER	AGE	LABEL	COUNTED
Bower	Orgel	Bower	. corrects x errors	Psych Students			See and Say Flash cards

DEPOSITOR	AGENCY	COUNTER	CHARTER
Wayne State	College Wayne, Nebraska		

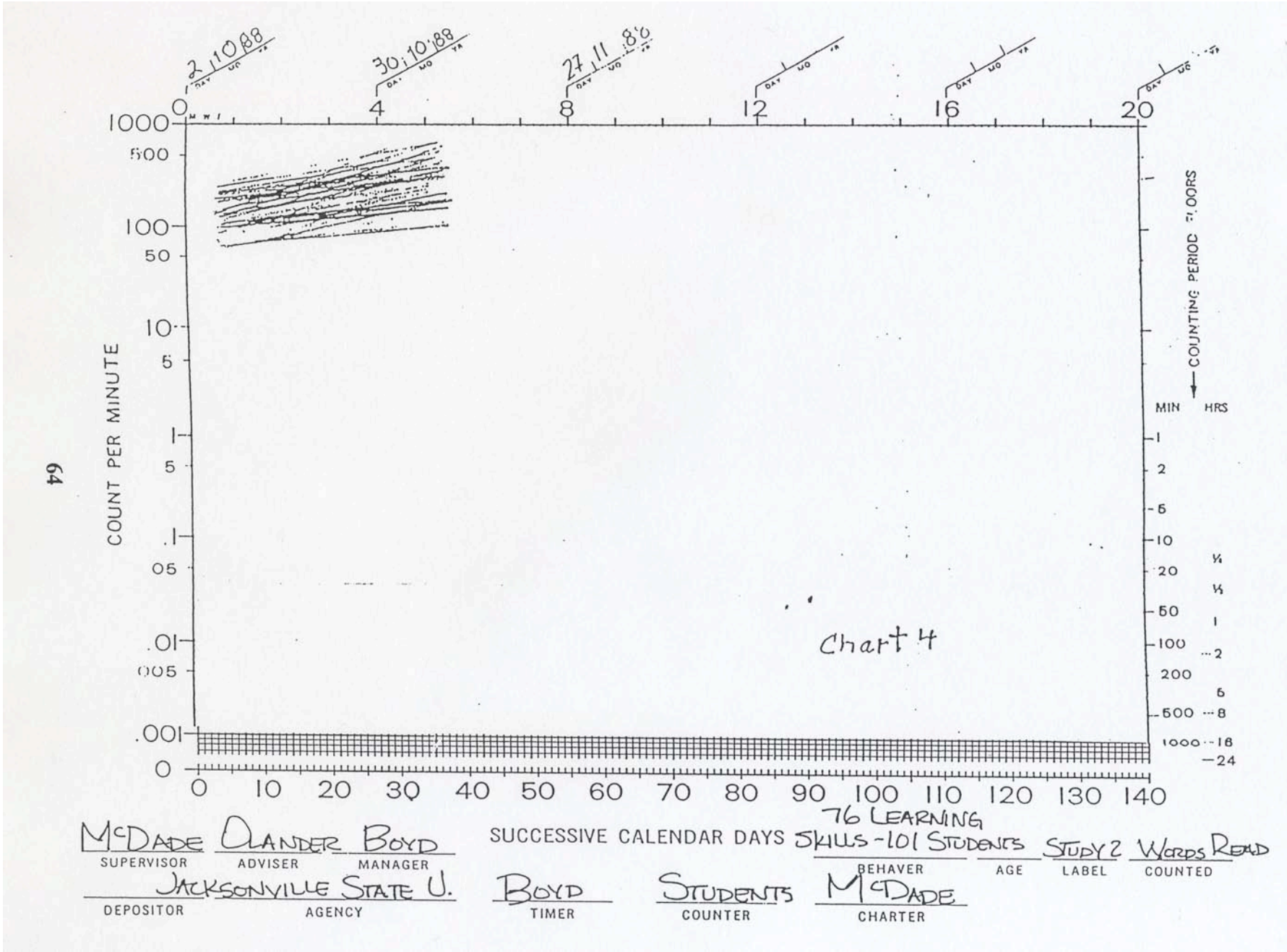

2.11.88
30.10.88
27.11.86
0
4
8
12
16
20
1000
500
100
50
10
5
1
5
.1
05
.01
005
.001
0
COUNT PER MINUTE
COUNTING PERIOD FLOORS
MIN
HRS
1
2
5
10
20
50
100
200
500
1000
½
½
1
2
5
8
16
24
Chart 4
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
SUCCESSIVE CALENDAR DAYS
76 LEARNING SKILLS - 101 STUDENTS
McDADE
SUPERVISOR
OLANDER
ADVISER
BOYD
MANAGER
BEHAVER
AGE
STUDY 2
LABEL
WORDS READ
COUNTED
JACKSONVILLE STATE U.
DEPOSITOR
AGENCY
BOYD
TIMER
STUDENTS
COUNTER
McDADE
CHARTER

Table 4

Developing a Collection of Celerations with Correct and Incorrect Pairs

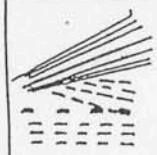
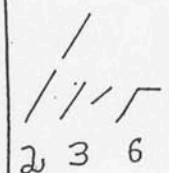
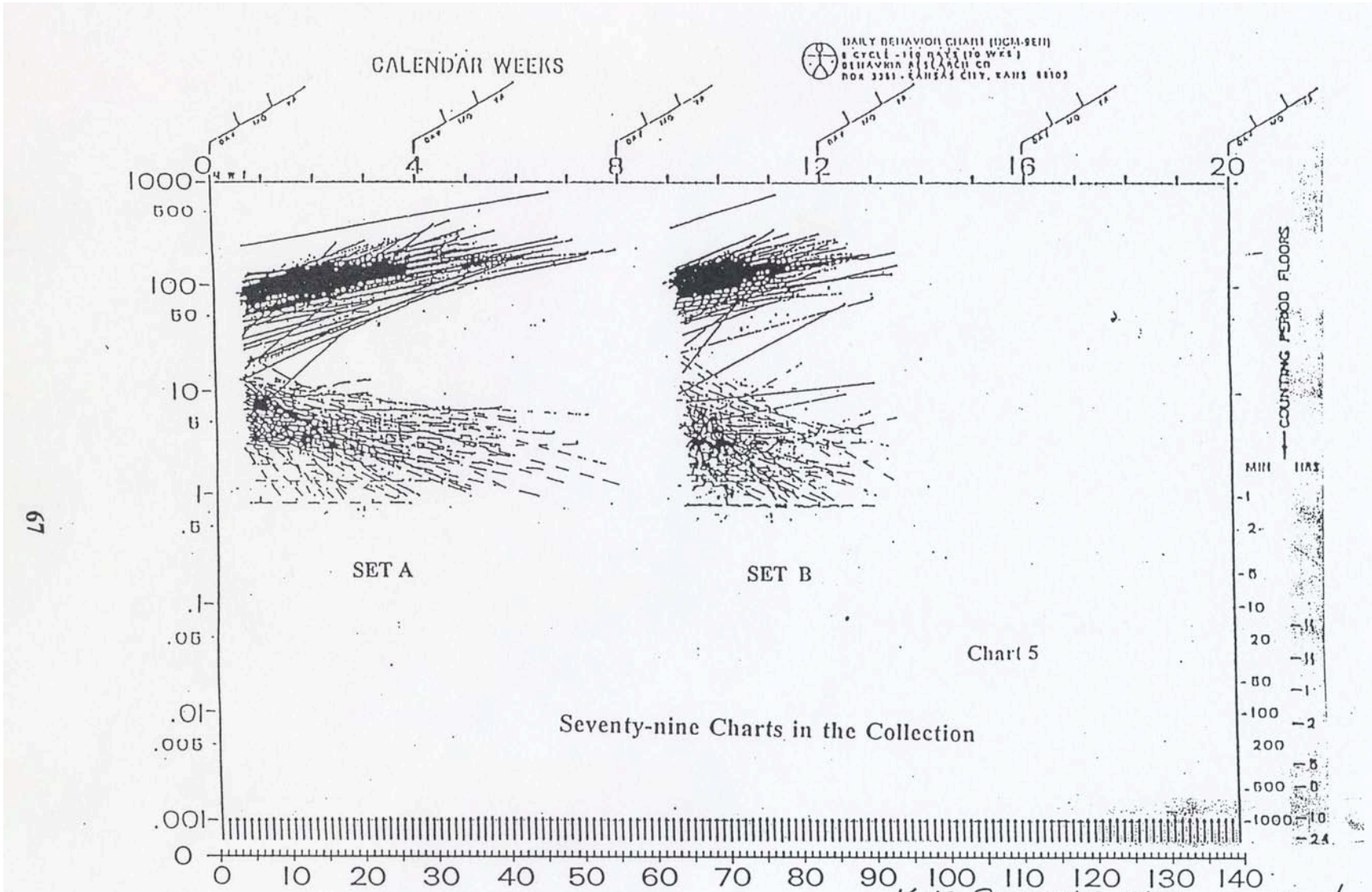
Form	Collection Type	Classroom Procedure	Construction	Comments
 7 charts in the collection	Celeration Correct and Incorrect	1. Follow the same procedure as presented for the Celeration collection in Table 3.	1. Use the same construction techniques as presented in Table 3 except use a solid line for correct responses and a dashed line for incorrect responses	1. This display gives the best understand of a learning picture for group performances.

Table 5

Developing a Collection of Frequency Jumps and Celeration Turns

Form	Collection Type	Classroom Procedure	Construction	Comments
	Jump and Turn Tally	1. Students draw or tally the picture of their frequency jump and celeration turn. 2. The first student draws the jump and turn picture shown on their working chart and puts one tally mark under the picture. 3. The second student also puts a tally mark under the picture if her chart shows the same jump and turn picture as displayed on the transparency. If the second student has a different picture than the first student, the second student draws the new picture and puts a tally mark under the added picture. 4. Continue process with all students.	1. Jumps and Turns occur with a minimum of one before condition and one after condition. 2. Report the number of students showing the same jump and turn picture. 3. With a small number of students, the teacher places student names or initials under corresponding pictures 3. Collections can display jumps and turns for both correct and incorrect responses.	



SUPERVISOR	ADVISER	MANAGER	BEHAVER	AGE	LABEL	COUNTED
	COOPER		K-12 STUDENTS WITH DIFFICULTY LEARNING IN SCHOOL		SEE/SAY	READING

DEPOSITOR	AGENCY	TIMER	COUNTER	CHARTER
	OHIO STATE CLINIC		HAERTEL/COOPER	

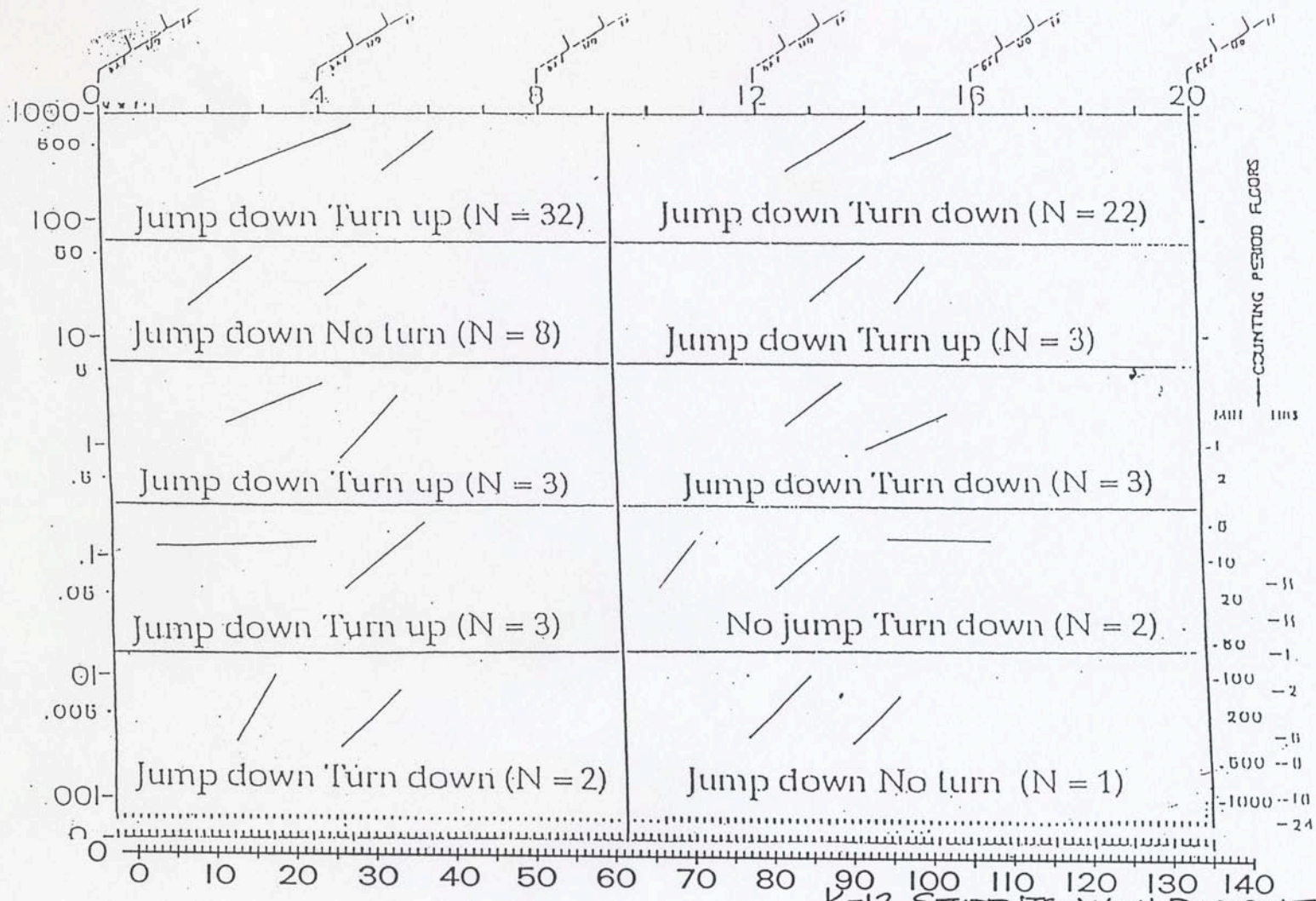


CHART 6

SUCCESSIVE CALENDAR DAYS

79 CHARTS IN THE COLLECTION

SUPERVISOR ADVISER MANAGER

OHIO STATE CLINIC

DEPOSITOR AGENCY TIMER COUNTER

COOPER

BEHAVER AGE LABEL

SEE/SAY

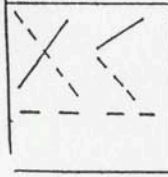
COUNTED

READING

CHARTER

Table 6

Developing a Collection of Learning Pictures

Form	Collection Type	Classroom Procedure	Construction	Comments
	Learning Pictures	1. Follow the same procedure as presented for the Jump and Turn collection in Table 5.	1. Use the same construction techniques as presented in Table 5.	

Improving, Maintaining, and Worsening Learning Pictures of Students by Experimental Conditions

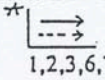
Experimental conditions	Learning pictures		
	Improving	Maintaining	Worsening
		Different Listening	
A	 a 4,5[b]  9  10	 1,2,3,6,7,8	
		Repeated listening	
B	 3  4  5,6,10	 2,7,9	 1,8,
	Repeated listening with immediate retells # 1		
C[1]	 1,4,  2,3,6,7,8,9,10  5		
	Repeated listening with immediate retells # 2		
C[2]	 1,4,6  2,5		

Chart 7

[a] —> = correct celeration —> = incorrect celeration

[b] Ten students identified by number

DISCUSSION

Stromberg and Chappell (1990) and this article report that published chart collections in JFT&C have decelerated from 1980 to 1996. Apparently, many Precision. Teachers rely increasingly on individual harts for making instructional decisions, or make decisions after serially viewing individual charts. We recommend that Precision Teachers consider making greater use of chart collections with some instructional decisions, as a supplement to serially viewing individual Charts. A collection may provide an improved understanding of how instruction impacts a total program, and may help identify what parts of a group instructional strategy ought to continue or change.

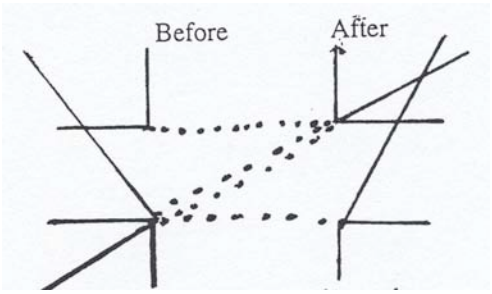
We presented two synchronization strategies to use with celeration collections. In the first, teachers can synchronize each celeration line to its starting day line by tracing over the lines wherever they appear on their original charts. In the second, teachers can synchronize the celeration lines to start on the same day line--synchronized to zero day. Merbitz (personal communication, February 6,1998) commented on these two strategies. He recommended using calendar day synchronization for classroom situations because if the lesson starts on one day, all the Charts will automatically synchronize fairly closely to the date the lesson started. Merbitz recommended that teachers consider using a zero day synchronization for clinical settings because the actual dates for beginning treatment may vary over the year. To develop the collection using a zero day synchronization, teachers can slide a transparency over each chart to the first day of treatment (or some designated day that makes sense) and instantly synchronize the collection to a common start day.

Merbitz also made important observations concerning the types of collections presented in this article. First, the Collection Charts 2 through 5 show at least parts of when and where the data appeared on their individual charts. For example, the celeration collections that we presented display more than just celeration lines. These celeration lines in the collections match the days and the spreads of frequencies that appear on the individual charts comprising the collection. Conversely, our illustrations of jump and turn collection and the learning picture collection show only the general shape of the frequencies and celerations in the collections. We compiled the jump and turn and learning picture general shape collections without reference to calendar time or frequencies. Merbitz notes that precision teachers could invent a tracing procedure that would preserve the when and where of the individual data (namely, the calendar time, frequency, and celeration).

Finally, Merbitz suggested three rules to guide the development of collections using real time, frequency, and collections that display general shape.

> Rule 1. Trace the frequency or celeration onto a transparency, keeping it in its original data and frequency. Note that a jump and turn picture is only two successive celerations while a learning picture is two simultaneous celerations and hence are covered by the rule.
>
> Rule 2. Synchronize the data to the same day line, such as for celeration collections. Use the next day line if data already appear on the selected day line, such as for frequency collections. Note that learning pictures could be synchronized to an aim date, and jumps and turns could then be-drawn as two stacks synchronized on the phase change line. The following representation uses a separated before-after change line to display jumps and turns in their original data and frequency.

The dots indicate no calendar time in the separated change line and show the frequency jumps.



Rule 3. Categorize the behavioral dynamics of a collection (e.g., learning pictures), draw a general shape of the dynamics, and count the number of cases that match each general shape, but don't call it a chart collection--call it a general shape collection.

We hope that our article for developing a collection will encourage others to chart collections. As Lindsley et al. (1993) said, "improving learning requires analyzing chart collections."

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APPENDIX A

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