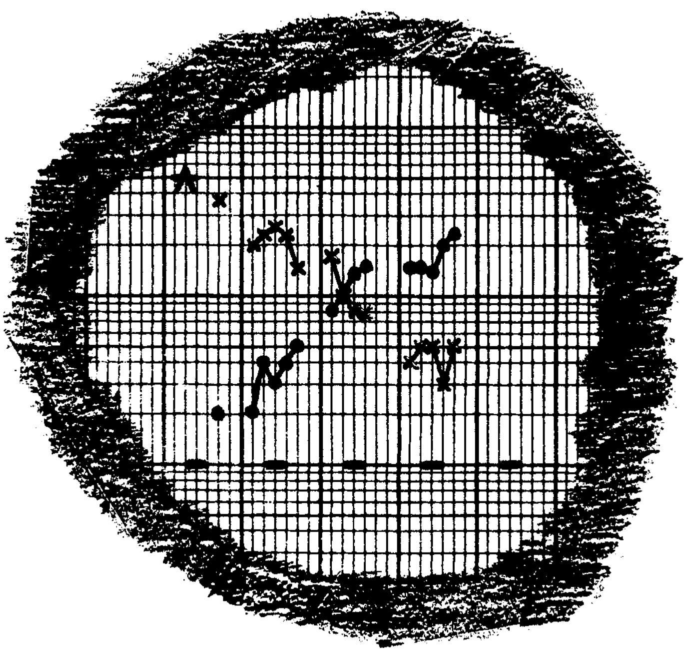
JOURNAL OF PRECISION TEACHING



VOLUME 1

The Journal of Precision Teaching is dedicated to the direct and continuous measurement of behavior, the recording of frequency and the representation of celeration on the Standard Behavior Chart and Chart-based decision-making. 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 data-sharing are encouraged.

Material submitted for publication should meet the following criteria: (1) be written in plain English, (2) be limited to eight typed, double-spaced pages of narrative, (3) use the Journal of Precision Teaching Standard Glossary and Charting Conventions, (4) contain data displayed on the Standard Behavior Chart, and (5) be submitted in triplicate to the editor. Each manuscript will be reviewed by the editor and one consulting editor, both of whom must approve it prior to publication.

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

Journal of Precision Teaching

Volume I October, 1980 Number 3

A LETTER FROM THE EDITOR

31 October 80

Dear Friends,

I would like to welcome 40 new subscribers to the Journal of Precision Teaching. A special welcome goes out to the libraries at Kansas State University, North Texas State University and Loyalist College. As of this issue (Volume I, Number 3), the Journal has 182 subscribers in 36 states, five provinces of Canada, England and Australia. The increase in subscriptions is directly attributable to your efforts and is greatly appreciated.

The Journal now has a Library of Congress ISSN number: 0271-8220. We are to receive a card catalog number soon.

The Journal and its editor have moved to larger quarters. Please note the new address:

Journal of Precision Teaching
Patrick McGreevy, Editor
3952 N.W. 82nd Street
Kansas City, Missouri 64151

Should you wish to reach me by phone, my office number at the University of Missouri is 816-276-1181.

We are trying a new cover and inside format in this issue. I would appreciate your comments and suggestions.

I hope all of you have a safe and happy holiday season.

Sincerely,

Patrick McGreevy
Editor

Practicing Practices: Learning by Activity

Dr. Eric Christian Haughton
Loyalist College

Abstract: This paper presents information on our lack of attention to three major performance variables: practice, proficiency and application. Due to our lack of appropriate criteria we are grossly underdeveloping learners' skills, therefore adversely affecting their knowledge and their applications to various challenges. Four factors related to appropriate practice conditions, specifically: (i) quality, (ii) proficiency goals, (iii) channels and matrixes, and (iv) durations and intervals, are analysed, exploring various practices and some programming implications. The point is made that without appropriate performance criteria we are allowing inadequate levels of performance to pass as acceptable. Learners face unfortunate consequences when they experience difficulties retaining, exhibiting endurance and attempting to apply skills and knowledge they've been evaluated as possessing, yet are well below essential performance levels. The paper points to a resolution of this crisis in learning based on critical quantity and quality criteria along with appropriate amounts of and combinations of practice.

Introduction

Our practical and research attention to improving behavioural management focused on the importance of stimulus and consequence management for the last quarter century (Lindsley, 1964, 1972). Thus we, like much of our society, have overlooked the crucial importance of establishing effective practice conditions to thoroughly develop essential quantities of quality behaviour. For example, during much of our efforts during the programmed instruction phase, a few accurate responses counted as adequate for performance development. An unspecified amount of "reinforcement" in the form of accuracy feedback was supposed to cement information gains. Later, the field turned its attention toward the benefits of various contingent reinforcing conditions (Haughton, 1967). During these concentrations of professional perspective reflected in our practical and research efforts, we acknowledged the crucial importance of, yet neglected, intensive practice.

We all know the old saying, "Practice makes perfect." Now, with our refined concerns, we might rewrite this to a updated "Efficient practice develops proficiency." While previous concerns related to a student becoming "perfect," we now realize that a skillful, competent or proficient person is in better shape than one striving for some absolute notion of perfection. Perhaps we have learned, as did Jonathon Livingstone Seagull, that attaining "perfection" is a process rather than an end? Therefore, we strive to improve our own skills and knowledge or to establish appropriate conditions for others to achieve proficiencies.

Appropriate practice conditions include proper stimulus and consequence management, yet, while these are necessary conditions, they aren't sufficient conditions. An enormous amount of appropriate practice, often including thousands of repetitions, is a condition for effective skill development.

When conditions of practice, our practising practices, are insufficient, the performer fails to reach appropriate levels of performance and may suffer various consequences. While numerous aspects of this complex issue could be explored, we will briefly check three significant implications of inadequate practice.

One important consequence of inadequate practice lies in the person's failure to retain adequate quantity and/or quality performance during periods of non-use. Having learned a skill or behaviour pattern, then failing to use it for a extended period, you could be in serious difficulty upon finding yourself needing the performance but discovering you've forgotten how to act. Once skilled in swimming, for example, you would be in serious trouble when boating and discovering that you've forgotten how to swim. This could happen if the skill was inadequately established originally, in part due to inadequate practice. While there may be fairly rapid relearning, it is inefficient (or even dangerous) to lack a previously held performance.

Secondly, we know there is a relationship between quantity of performance and endurance (Binder, 1980; Higdon, 1980). Higdon's article analysed the beneficial consequences of marathon runners logging over 180 km per week while training for marathons. Binder analysed the relationship between levels of performance and capacity to maintain performance over extended periods. In general, he found that higher levels of performance sustained performance levels, whereas lower performance related to greatly decreasing performance over time. Therefore, we need to ensure that learners experience enough of the right types of practices to meet the dual requirements of sufficient performance levels along with performance durations to ensure useable performance endurance.

The third aspect lacks a thorough data base, so my hope is that further field and theoretical work will continue to explore the relationship between capacity to apply skills and knowledge, and several levels of skill acquisition. There appears to be a differential effect when we study the consequences of shifting from a simple task to one that is more complex. Low quantity on the simpler skill will result in lower performance on more complex tasks (Barrett, 1979; Haring & Gentry, 1976; Haughton, 1972). My "Aims" article illustrated the decrements in more complex tasks caused by two types of inappropriate decision making: (a) too low basic skill performance illustrated by Robert's performance, and (b) Mikal and Ronald's data showing some consequences of too low performance aims. The Haring and Gentry data show the differential effects of low basic skills as curriculum demands increase. Barrett's data graphically compares the rates of three groups of people in 16 basic skills. State school students experiencing developmental delay perform somewhat below regular 5- to 7-year olds and adults. The effects of low prerequisite skills are clearly differential, being related to lower complex skill performance. For example, regular adults wrote ones (Think/Write 1"s) at a middle frequency of about 210 per minute, writing fours (Think/Write 4's) at about 100 per minute. This divide by 2.1 decrement can be compared to a performance loss of divide by 12 for institutionalized people aged 12 to 54 who performed Think/Write 1's at 60/minute and Think/Write 4's at 5/minute. These three examples illustate the differential effect of low correct frequencies on prerequisites. Even greater differences are measurable when comparing performance on more complex tasks.

Hopefully, this brief overview of three issues relating to the importance of adequate practice will serve, allowing us to explore several dimensions of appropriate practice useful in avoiding these unfortunate performance consequences. Perhaps it is unnecessary to point out that there are a multitude of factors relating to performance development, so we will examine only a few. Those that will be discussed are: (i) adequate quality, (ii) proficiency goals and practice ranges, (iii) channels and matrixes, and (iv) durations or intervals. These topics cannot be divorced from our traditional topics of effective stimulus and consequence management, so although these won't be specifically discussed, you will understand that we assume effective handling of these programatic features. In this way we can isolate our discussion to the four intriguing topics just mentioned.

1. Adequate Performance Quality

We cannot develop performance without a base of moderate quality. Too much emphasis on quality, however, will reduce both the quantity produced and the rate of improvement. Therefore, much care must be exercised so that the learner is not intimidated by over-emphasizing quality criteria.

Although much contemporary evidence exists, I will refer to an old source, an antique penmanship booklet (Bailey, 1910) where it states:

> Speed is an important factor in the production of good writing. Slow writing, except when done by an expert script writer, is heavy, wavy, irregular and inaccurate. Fast writing is frequently illegible. Between these two there should, therefore, be a happy medium. That rate of speed which enables one to make two hundred down strokes per minute in a movement exercise is the rate that will produce those light, even, accurate lines that people admire so much in the penmanship of the master artists. All work should be done at the same speed if you expect to become a good penman. Do not have one speed for movement exercises and another for letters and words. When you have cultivated a smooth movement and an even speed, your writing will be both pleasing and legible.

Furthermore, coaching instructions in art, dance, acting, music and various athletics encourage the initial development of relatively high frequency acts before requiring refinement of the desired movements. Often these directions include warnings that too much attention to quality, early in performance building or acquisition, will inhibit performance development.

2. Proficiency Goals and Practice Ranges

For some time, those of us involved in Precision Teaching and some segments of Applied Behaviour Analysis delighted in producing change as well as improved learning patterns. Our use of frequency or rate as our form of data did not involve searching for relevant criteria levels of performance related to such critical factors as retaining, enduring and applying skills and knowledge. We were, however, by the 1970's (Haughton, 1972; Kunzelmann, 1970) collecting some suggestive data indicating that certain levels of performance in one topic related to success in other areas. Certainly the data are not all in; much more work will be done furthering our awareness and our understanding of this complex issue. A growing realization that we are dealing with several inter-related factors such as retention, endurance and application, each implying different levels of competent activity, expands our sensitivity to this challenging topic.

We now know that relatively low frequencies support retention of high degrees of accuracy. For example, when we studied the effect of a summer of disuse on the quality of arithmetic performance, we found that computational accuracy stayed high independent of performance frequency. We had anticipated that there would be a differential effect with higher performance losing less than lower performance, but this was not substantiated over July and August, 1976 (Haughton, 1976).

Some of the best published data relating to required performance quantity comes from a landmark article by Wood, Burke, Kunzelmann and Koenig (1978). This article delineates quantity requirements for the application of performance in forty topics in fundamental mathematics skills. In this article they also document performance quantities related to failure in math programs at the grade eight level. One aspect evident in this study is that the ratio between disabled and unsuccessful students is similar to that of the relationship between unsuccessful students and the community median. Now we have a dramatic focus on the consequences to students when an educational system fails to set relevant quantity expectations for its clients. To select only one example, the relationship of a basic addition performance is that disabled students are divide by 1.6, while unsuccessful to community is divide by 1.5, creating a gap of divide by 2.5 between disabled and community users of regular mathematics.

We easily understand why those labelled as disabled cannot expect to meet regular performance requirements when their deficiency is, in part, caused by lack of appropriate reference criteria to guide their teachers and their didactic sequences. A quote from a statement of instructional theory illustrates that this lack of criteria begins at an early age:

> The term "kindergarten" should be retained, since it describes the function of this introductory period and serves to resist pressure to apply the rigors of schooling too early to young children. (Hall-Dennis Report, 1968).

The importance of practising at different frequencies is often overlooked. Practice can occur below, at, or above competent or fluent performance levels. This deficiency in our planning is easily understood as a side effect of our lack of performance referencing criteria with which to assess or evaluate the adequacy of student activity.

Perhaps the area that is most seriously omitted is that some practice needs to occur at higher frequencies than the desired performance. For example, oral reading reaches competent levels in the 400 to 250 words correct per minute range. North American averages in the first three grades are in the 50 to 70 words per minute range. It is extremely difficult for a student to reach 250 words per minute when he receives direct experience at these low levels along with new selections to read daily. Therefore, we use poetry or short passages of ten to twenty words at first to ensure that the student will achieve over 300 words per minute during the first few weeks of his oral reading experiences. Not only does this experience improve the development of oral reading, it also establishes crucial prerequisite acts necessary for silent reading. Extended exposure to oral selections at inadequate levels in the 50 to 70 words per minute range fails to prepare a student adequately for either effective oral or silent reading. Furthermore, the student is actually practising the wrong behaviour when not reading orally at or about 250 words per minute or silent reading over 600 words per minute.

Teachers or other people trying to establish effective reading skills cannot be blamed for failing to program students to criteria levels when these aren't specified for teacher guidance and decision-making. An authority on reading, Dr. Elizabeth Thorn, suggests four criterion types of silent reading in her book, Strategies for Effective Reading (Thorn & Fagan, 1975). These are: scanning (very fast), skimming (fast), recreation (fast and slow), and study (slow). These descriptions are valuable, yet the author's failure to offer quantitative values as criteria leaves teachers and students groping for reasonable and effective levels. I suggest certain levels as guidelines in these areas: scanning 20,000 words per minute; skimming 5,000 words per minute; recreation 2,000 to 1,000 words per minute; and study 1,200 to 600 words per minute. Each of these estimated levels of word consumption needs to be paired with an excellent level of comprehension. Comprehension can be checked by the appropriate use of either oral or written answers, each performed at an appropriate level. Some competent level of reading words is crucial to both teachers' and learners' functioning.

To summarize, we need to become aware of and to set competency achievement goals, as well as to specify effective practice ranges ensuring proficiency development.

One way to offer experiences at high levels is to encourage the learner to recite (Think/Say) sequential materials, such as counting or the alphabet. Performance in the 600 to 400 per minute range develops both attention and muscle facility. Although my examples have come largely from reading, similar examples exist in typing, math, writing or musical performance. Following the suggestion by Bob Balabuck about high frequency exercises, Richard McManus practices his saxaphone scales at around 1,000 notes per minute (McManus, 1980). Bob Balabuck is a semi-professional banjo player in Thunder Bay, Ontario, who uses practice ranges in the 2,000 to 3,000 notes per minute to establish competent levels of performance (Balabuck, 1977). Bob uses high-paced practice to strengthen the performance of his young student proteges, who perform well during musical competitions.

Occasionally you also want to practice well below the competent range. This you do, especially when refining the quality of performance or to master a particularly difficult set of movements. The idea of a performance guideline for effective practice evolved after observing many young people struggling to practice at low frequencies. Our best estimate of an independent practice range, at the present time, is to take the low part of a fluency estimate and divide by 2. For example, oral reading becomes competent at about 250 words correct per minute. Therefore, an estimate of the level necessary for independent practice is about 125 words per minute. Independent practice levels are important, since at these levels learners can evaluate their own performance while quickly reaching competent levels. The guideline of "divide by 2" is only a rough approximation, so individual factors need to be taken into account, resulting in higher or lower reference points for an individual's independent practice range.

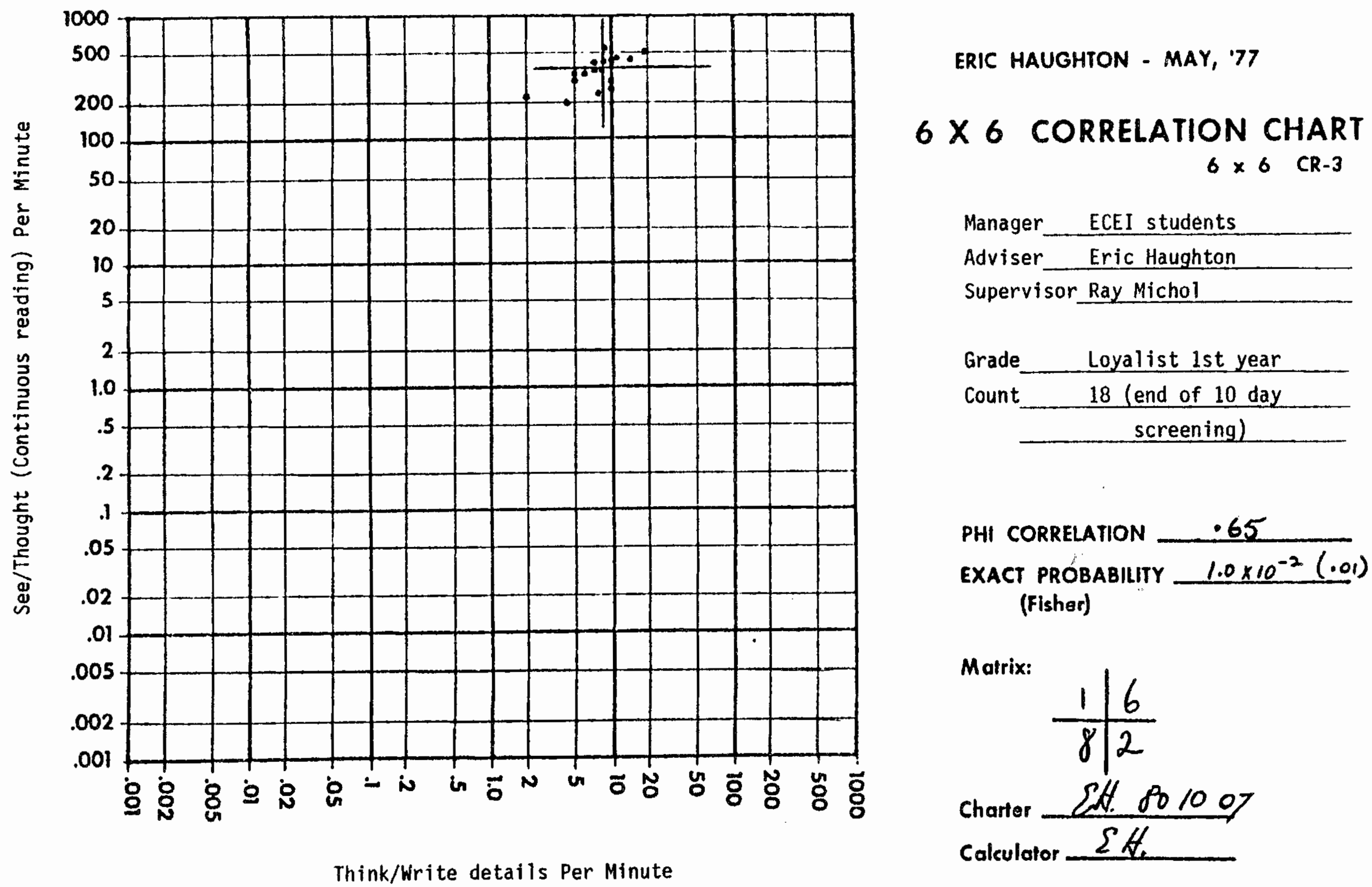
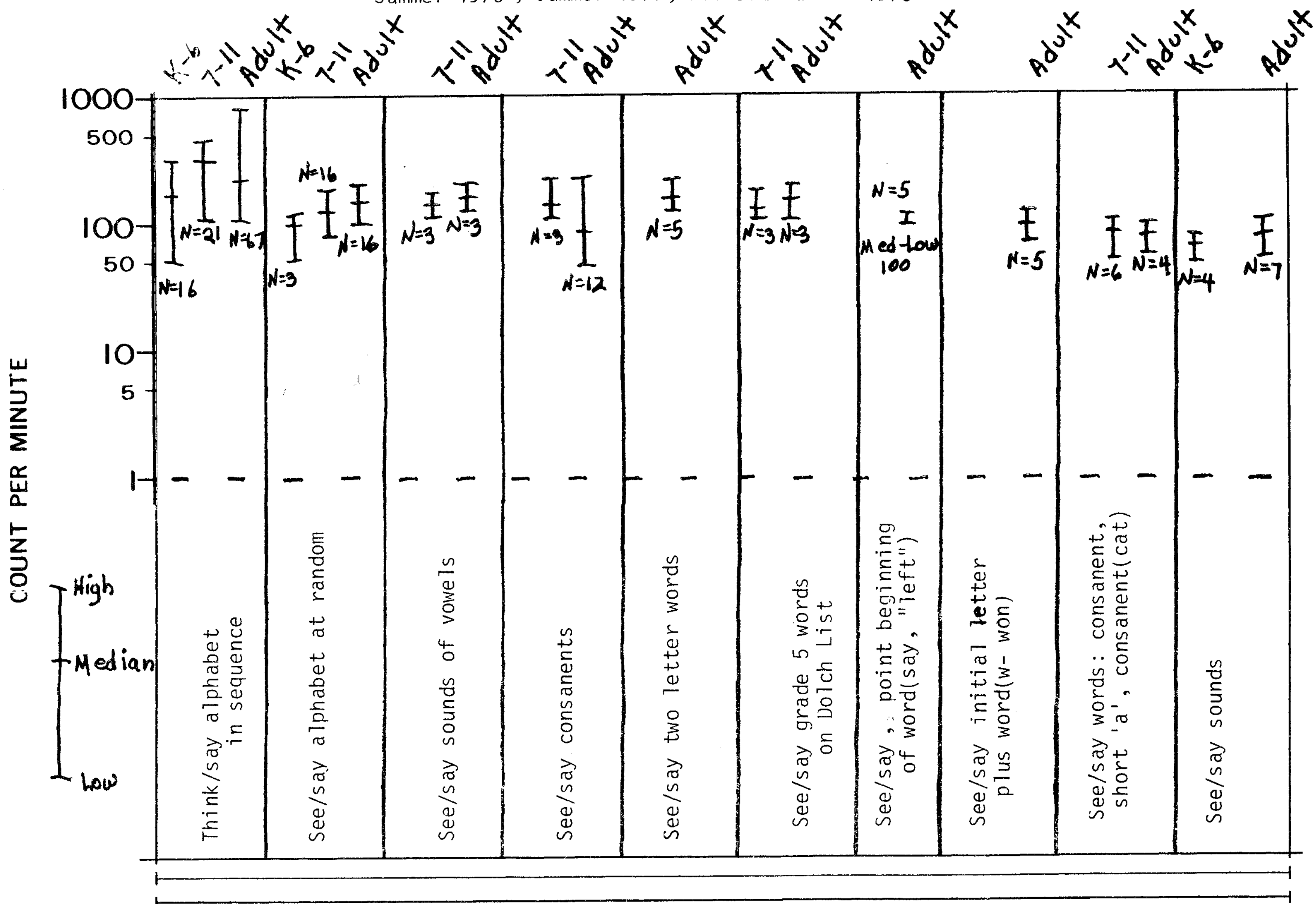


Figure 1. College students who read their texts more rapidly also write more details during comprehension checks. In this case neither the silent reading(See/thought) nor the comprehension check(Think/write) is at competent levels, minimum estimated at 600 words per minute and 40 details per minute, respectively.

Summer 1976 , Summer 1977, revised Summer 1978



Haughton, Eric Christian. Practicing Practices: Learning by Activity. *Journal of Precision Teaching*, Volume 1, Number 3, October, 1980.

(These data are from snapshots, therefore, are quite low estimates of achievable levels with practice)

Chart 1. A sample of 10 pinpoints from the 271 Pinpoint booklet (Haughton, 1977). Note that young people perform at or about adult levels correctly on these topics.

(K-6)(7-11)(Adult) SNAPSHOT SUMMARY *READING

THUNDER BAY R. and S. Brown E. and E. Haughton

3. Channels and Matrixing

Recently we began refining our verbs describing student performance. Learning is an active verb. Yet, many traditional educational statements used vague descriptions such as "knows," "understands," and "is able." The move toward stating more clear-cut objectives introduced better verbs, such as: calculates, answers, writes, responds, outlines, summarizes or synthesizes. While these output verbs are more adequate, an explicit input/output descriptive system offers clarity along with stimulation to planning (Kunzelmann, 1970; Lindsley, 1964).

Therefore, many educators and psychologists now include channel references, such as See/Say to describe more precisely oral reading, or See/Write to define doing math calculations. Basic math problems can also be dictated, so Hear/Write becomes the channel or, if students answer orally, the channel is Hear/Say. Until recently we used lists of the useful channel components to help us, such as:

INPUT		OUTPUT	
See	(Se)	Say	(S)
Hear	(H)	Write	(W)
Think	(T)	Think	(T)
Feel	(F)	Point	(P)
Touch	(To)	Mark	(M)
		Do	(D)

While such lists served us well for the past few years, they suffer from several deficiencies. As usual in our contemporary programming, two major sensory inputs, sniff and taste, are lacking. Furthermore, few of us explored all of the combinations (30) implied by even our primitive list, nor is there any systematic order to such an arrangement since our list access is based on a more or less random thought processing. Ordered thinking performance rates are two to three times that of mixed order, so this fact in combination with a realization of potential channel complexities led me to set these topics into a matrix framework in June of 1980.

The first step in arranging the matrix format consisted of ordering the INPUTS. Starting with Feel (for emotions), then Hear, See, Sniff, Taste and Touch, we end up with the Think input mode. Ordered from bottom to top, this gives an arrangement of rows that is stable for many of our matrixes whether the matrix refers to mobility, emotions or other forms of expression. For example, we are now using a matrix that covers much of our Academic-Personal-Social development. It looks like this:

INPUTS	Aim (A)	Do (Do)	Draw (D)	Emote (E)	Mark (Mk)	Match (M)	Say (S)	Select (St)	Tap (Tp)	Thought (Tt)	Write (W)
Think (T)											
Touch (To)											
Taste (Ta)											
Sniff (Sn)											
See (Se)											
Hear (H)											
Feel (F)											

OUTPUTS

These 11 outputs are only a sample of the potential outputs that can form the columns of this matrix planning system.

Intersections formed by rows and columns are labelled channel sets. This is a technical term implying a large amount of data as in the cases of See/Say, See/Write, Hear/Write or Think/Say.

This paper will offer only a few of the potentially numerous applications of this conceptual framework. Based on our growing understanding of and awareness about trans- and inter-channel interactions, our capacity to serve learners will receive a great boost as we apply these matrixes to description, programming, summarizing, reporting and analysis.

Three examples of the matrix applied to: (i) an Orff music course offered to Loyalist Early Childhood Education students; (ii) preparation for teaching pre-school students about Community Services, specifically transportation; and (iii) information relevant to studying and learning about vegetables; are offered. Entries are condensed partly due to the small size of the channel set boxes.

Another matrix that is receiving attention with our recent growing interest in Activity Elements describes 63 channel sets with the outputs: Wave, Aim, Tap, Squeeze, and Get, along with Pump, Rub, Shake and Twist (formerly, the Big 6 + 6).

INPUTS	Wave (Wa)	Aim (A)	Tap (Tp)	Squeeze (Sq)	Get (G)	Pump (P)	Rub (R)	Shake (Sh)	Twist (Tw)
Think (T)									
Touch (To)									
Taste (Ta)									
Sniff (Sn)									
See (Se)									
Hear (H)									
Feel (F)									

OUTPUTS

The variety of channel sets and even some realization of their implications gives rise to greater awareness of programming requirements. Our data to this date suggest that substantial levels of performance are

Dr. Eric C. Haughton
LOYALIST TEACHING MASTER

80/10/15
Y M D

Topic Orff Music

PERFORMANCE MATRIX
ACADEMIC PERSONAL SOCIAL

E.C.E. LOYALIST COLLEGE

INPUT	AIM (A)	DO (DO)	DRAW (D)	EMOTE (E)	MARK (Mk)	MATCH (M)	SAY (S)	SELECT (St)	TAP (Tp)	THOUGHT (Tt)	WRITE (W)
THINK (T)			Represent Action, idea				Songs, ideas exercises	Best Song and action	Beat or Rhythm	Imagine	
TOUCH (To)	Self, other person	Pass pattern on to next person		Touch gentle hard soft slow		Same type of touch	Type of touch, Contact	Preferred type of contact			
TASTE (Ta)											
SNIFF (Sn)											
SEE (Se)	Action. Instrument	Action clap/patch	Actions, people in movement notations			Rhythmic patterns	Action, patterns Songs	Favourite Song	Beat or Rhythm	Impression of movement	Notation
HEAR (H)	Game of hot and cold	Actions in Songs	Imagery	Various feelings	Rhythm patterns	Imitate or echo Songs, taps	Songs	Favorite Song	Clap/Patch to beat	Imagine ideas in song	Trace or copy song
FEEL (F)		walk, run, hop, Jump	Actions of feelings				Songs about feelings		Clap hands, self, others		

OUTPUT

Figure 2. An example of a matrix describing portions of an Orff Music Program

R. Michol — Supervisor
Eric Haughton — Advisor
Katherine Smithrum — Manager

ECE I-II STUDENTS — Behaver
Age
Reg Students — Label

Dr. Eric C. Haughton
LOYALIST TEACHING MASTER

PERFORMANCE MATRIX
ACADEMIC PERSONAL SOCIAL

80/11/12
Y M D

Topic Transportation

E.C.E. LOYALIST COLLEGE

INPUT / OUTPUT	AIM (A)	DO (DO)	DRAW (D)	EMOTE (E)	MARK (Mk)	MATCH (M)	SAY (S)	SELECT (St)	TAP (Tp)	THOUGHT (Tt)	WRITE (W)
THINK (T)	Different types of transport	Act or move transport	Different types of transport				Safety rules Traffic signals			Safety rules Conserving and consuming	
TOUCH (To)	Toy vehicles		Vehicles, parts	Likes and dislikes of textures			Occupations Likes and dislikes.				
TASTE (Ta)			meals and on planes			Foods sold in transportation					
SNIFF (Sn)	Fumes - exhaust - gasoline	Mimic fumes	Sources of fumes and exhaust	Feelings about pollution	Instances and nonexistence of odors, fumes	Oil fumes to oil	Named odors, fumes				
SEE (Se)	Vehicle and roadway	Stop and go Safety rules	People conserving	Likes and dislikes of conserving consuming	Kinds of transportation	-Vehicle -Traffic Signals	Vehicles, Safety Occupations			Occupations	car truck plane boat
HEAR (H)	Conserving or consuming	Act like vehicle		Likes and Dislikes.	Vehicles, Conserve Consume	Types of transport	Sounds, Safety rules	Fast, slow, conserve, consume	Vehicles	Imagine old and new ways of travel	car truck boat
FEEL (F)	Occup.	Role play	Types of transport -conserve -consume	What like to be -	occupation on ditto		Likes and Dislikes, Safety	Seasonal Vehicles -Safety			

Figure 3. Matrix describing the teaching theme- transportation

Liz Vandersel — Supervisor
Eric Haughton — Advisor
ECE I + II Students — Manager

Preschool Students — Behaver
3-5 years — Age
Reg. Preschool — Label

Dr. Eric C. Haughton
LOYALIST TEACHING MASTER

PERFORMANCE MATRIX
ACADEMIC PERSONAL SOCIAL

84 10/03
Y M D

Topic *Vegetables*

E.C.E. LOYALIST COLLEGE

INPUT	AIM (A)	DO (DO)	DRAW (D)	EMOTE (E)	MARK (Mk)	MATCH (M)	SAY (S)	SELECT (St)	TAP (Tp)	THOUGHT (Tt)	WRITE (W)
THINK (T)		Pretend to be a Vegetable - mime	Favourite Vegetable	Likes and Dislikes Veg. -Preparation -raw/cooked	Favourite foods	Vegetable to pic	Shapes, Colours, nutrition, textures.	Likes and Dislikes: Textures, Colours		Imagine colours, shapes, textures	
TOUCH (To)	Texture, likes and dislikes		Art. texture	Likes and Dislikes	Textures	Textures	Names of Veg.	mature or immature Smooth or rough			
TASTE (Ta)	Likes and Dislikes -cooked -raw		Veg.	Likes and Dislikes	Flavours	Cooked or raw	Favourite dish -name of veg. raw or cooked	Likes or Dislikes		How to improve taste - spices etc.	Sweet sour spicy
SNIFF (Sn)	Correct Vegetable		Veg.	Likes and Dislikes	Pictures of Veg.	Sample to whole	Names of odours Likes and Dislikes.	Favourite odour	Veg.		
SEE (Se)		Pretend to be veg. mime	Shapes, colours, Country or garden scene	Likes and Dislikes	Shapes colours, plant and crop	Mature or Immature Veg.	Names, Colours, Shapes.	Food preferences, snack food	Shapes, Textures	Plan menu for snack time	names
HEAR (H)	Specific Vegetable	Act like Veg.	Specified Vegetable		Nutritious Vegetables	Colour, Shape, Size	Names, Vitamines	Nutritious Vitamines Roughage	Veg.	Imagine food for meal.	names
FEEL (F)		Pretend to feel like a Veg.	Emotions	Likes and Dislikes	Preferences		Emotional description	Favourite food		Imagine emotion at celebrations	emotion words.

OUTPUT

Figure 4. This matrix describes the teaching theme- vegetables

Liz Vandersel — Supervisor
Eric Haughton — Advisor
ECE I-II Students — Manager

Preschool Students — Behaver
3-5 years — Age
Reg. Preschool — Label

required, especially in the Think/ and Feel/ rows, making 18 channel sets of the possible total of 63. Using this matrix descriptively, you will be surprised at how few channel sets we generally employ in our programming.

This lack of comprehensive use of, and instruction in, appropriate amounts of channel sets can be illustrated by referring back to the math comparison data. The examples I selected were all See/Write, as were all of the 40 topics checked. Thus, descriptively, this study explored 40 different math topics, all in the See/Write channel set, or 77/1, where 77 is the total possible and 1 is the number of channel sets measured, recorded, compared and analysed. In another instance, I summarized our efforts with a young exceptional student, and surprised myself by "discovering" that of approximately 80 charted projects, we indulged in mainly four channel sets: See/Say, See/Write, Think/Say and Think/Write. We gave no specialized attention to the Feel/ row and only quite mechanical coverage to Think/ row.

Since mobility is a crucial topic, we'll touch briefly on this matrix. The rows are the familiar Feel, Hear, See, Sniff, Taste, Touch, and Think, while the columns are Roll, Creep, Crawl, Scoot, Cruise, Walk, Run, Gallop, Hop, Jump, Leap, Slip, and Slide:

INPUTS

	/Roll	/Creep	/Crawl	/Scoot	/Cruise	/Walk	/Run	/Gallop	/Hop	/Jump	/Leap	/Slip	/Slide
T/													
To/													
Ta/													
Sn/													
Se/													
H/													
F/													

OUTPUTS

This gives us a matrix of 91 channel sets, not all of which have the same significance or programming importance, but which can be important as well as useful during instructional programs designed to develop basic mobility and walking.

4. Durations and Intervals - Sprints

In the late 1960's when we began our serious attempt to record both count and time, to explore such data's efficiency and usefulness, we tended to record performance to its completion, the end of a sheet or other arbitrary assignment length. This caused computational difficulties in determining the rates, and also set rather lengthy performance intervals for students. Harold Kunzelmann and I began exploring stable one and two minute intervals as a starting base for students, teachers and our information base. Since students seemed more comfortable and data were much easier to compute (many people find simple division difficult), we shifted much of our attention to relatively short intervals.

One minute is not a short interval if you are unskilled! I remember dropping to a .5 minute interval instead of the whole minute with a low performing student in Eugene, Oregon, to see if this interval would accelerate performance development. The student's half minute rate doubled the full minute's performance. This meant that the student emitted his full performance in the first half minute, fatiguing or burning out in the last 30 seconds. During skill building we've found that short intervals are related to higher performance levels while also reducing the amount of duration-induced factors (attention and motivation, less fatigue, for example). We now set up "sprint" practices where a series of short intervals gives the learner the experience of high quantity in brief periods.

You could check various intervals in the same way you would check stimuli, consequences, channels or intervals, by snapshots or 10-day Classroom Learning Screening, a process developed by Og Lindsley and carried on by International Management Systems (Kunzelmann & Koenig, 1979). Determining the learner's maximum interval that ensures learning is a cornerstone in an effective program.

Compounding

Combinations of skill-building factors will help people to develop high performance levels in brief developmental periods. Perhaps it is self-evident that effective practice conditions may combine several practice considerations. Common combinations are the sprint interval, strong channels, related to aims based on our best estimate of proficient performance.

One of the most effective applications of these contemporary quantity and quality considerations occurs in locating and establishing prerequisite skill performances. It seems cruelly ironic that our failure to specify frequency-based performance criteria causes student failure to reach necessary levels. Not only is there a lack of criteria, but teachers are even encouraged not to quantify information about performance. Quoting again from the Hall-Dennis Report (1968), elementary school teachers are instructed:

> The teacher will be concerned with qualitative aspects of achievement - 'Does Jan like to read?' 'Can Susan describe her house?' rather than with quantitative measurement. (emphasis added - EH)

In Ontario, Canada, one consequence of such philosophy shifted teachers from poor achievement testing to no quantitative analysis at all.

Although there are many possible examples, perhaps relating to basic math skills will suffice. By about 1971 we realized that basic math facts in addition, subtraction, multiplication and division is needed at 120 to 80 correct per minute in the See/Write channel, whereas performance actually checked out at 25 to 30 problems correct per minute. Many students and teachers reported difficulties in reaching these new levels. We quickly realized that performance on See/Write sums to 18 rested on a set of prerequisites, that all had to be at, or close to, competent/proficient levels to synthesize constructively into the See/Write +18 assignment. We checked some correlations, finding high, statistically significant relationships between the target task (eg. See/Write +18) and prerequisites such as Think/Write digits 0-9 (Haughton, 1972). I recently checked the performance of Loyalist College students on See/Write mixed math facts correlated to Think/Write 0-9. The middle correct on computations falls at

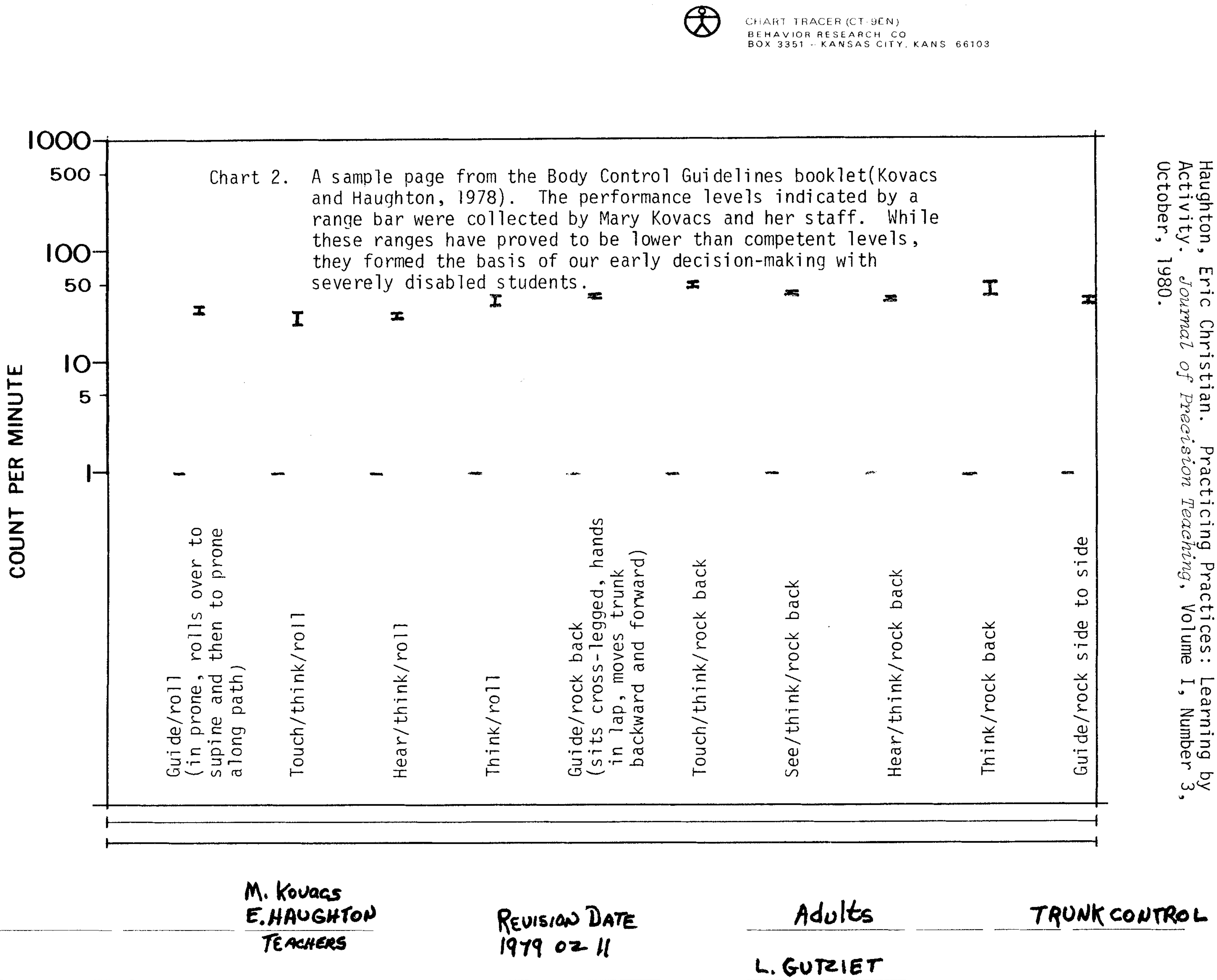
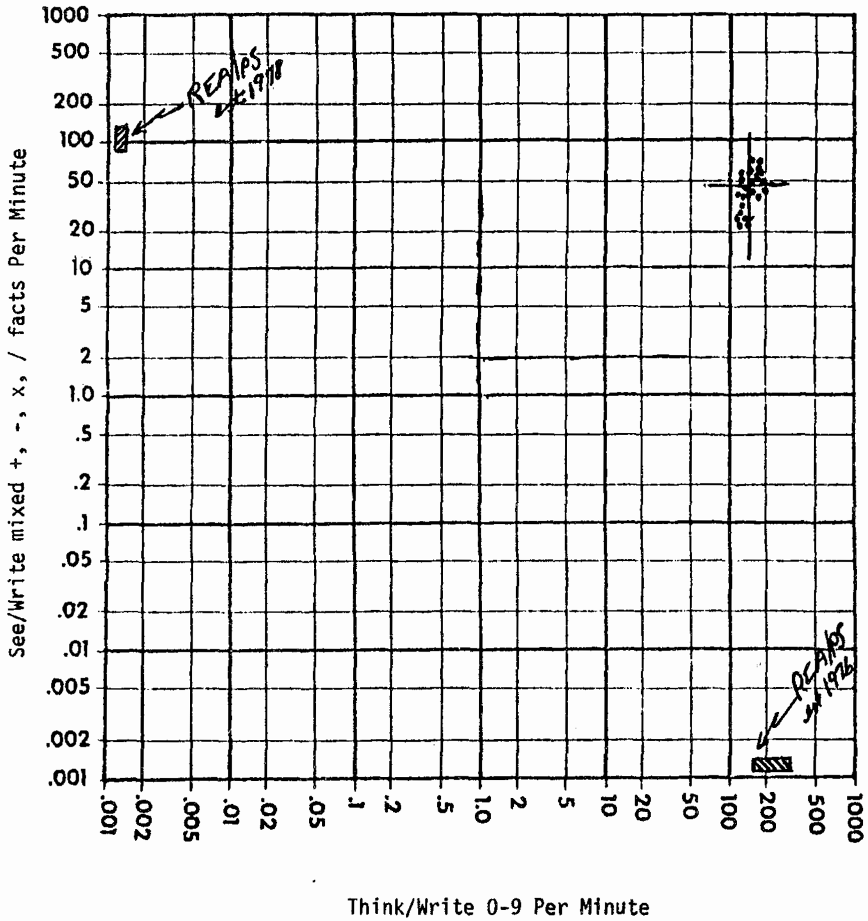


Chart 2. A sample page from the Body Control Guidelines booklet (Kovacs and Haughton, 1978). The performance levels indicated by a range bar were collected by Mary Kovacs and her staff. While these ranges have proved to be lower than competent levels, they formed the basis of our early decision-making with severely disabled students.

Haughton, Eric Christian. Practicing Practices: Learning by Activity. *Journal of Precision Teaching*, Volume I, Number 3, October, 1980.



ERIC HAUGHTON - MAY, '77

6 X 6 CORRELATION CHART

6 x 6 CR-3

Manager ECEI students

Adviser Eric Haughton

Supervisor Ray Michol

Grade Loyalist 1st year

Count 26 (3 lost)

math snapshot

PHI CORRELATION .56

EXACT PROBABILITY (Fisher) 1.0×10^{-2} (.01)

Matrix:

2	8
10	3

Charter E.H. 80 10 02

Calculator EH

Figure 5. College students perform writing digits 0-9(Think/write) at too low a level to correctly signify their skills in basic math computations on a sheet with mixed +,-,x,/(See/write). The correlation of .56 reinforces the point that more adequate Think/write 0-9(at 250-150 legible digits/minute) would facilitate these students' math capabilities.

45 per minute, while sequential number writing is at 130 per minute.

We are no longer surprised to find that educational settings that are unaware of quantity criteria fail to produce appropriate levels in such crucial topics as: Think/Say counting forwards and backwards, See/Say reading numerals, sequenced and mixed order, Think/Write numbers, See/Say operational signs, Think/Say from a number to a number along with adequate coverage of Think/Say or /Write and Feel/Say or Write my personal reasons for becoming skilled in math. I won't go into specifying criteria levels for these topics, but you will not be surprised to find extremely low and non-applicable performance levels in these topics, since no effort had been made toward establishing high, proficient levels of performance.

Our lack of specific performance aims, goals or standards is creating a contintental crisis in education. It is also partly due to this lack that we fail to practice adequately. When performers know what criteria they are up against, as in track or swimming, they generate extremely high practice ratios to ensure adquate performance levels.

While many professionals have ignored the importance of goals or aims, I will never forget the insightful reaction of a second grader. While exploring the importance of aims, I asked the class why we needed goals or aims. One second grader popped up with, "Well, if you don't have aims, then you'd be AIMLESS!" While we haven't exactly been aimless, desiring as we do to produce performance improvement, our lack of precise aims has led to conducting inadequate practicing practices. Out of the mouths of babes....

Combining the will of our students to improve with our excellent stimulus and consequence management, while augmented by our growing information about proficiency levels and practice conditions, we will greatly increase our students' performance and problem-solving capacities. Thoroughly developing our students' skills will greatly enhance their capacity to cope with problem resolution and decision-making challenges they will face in the future.

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Fisher's Exact Probability and Precision Teaching: Uses, Limits and an Efficient Method of Calculation.

Bruce C. Flanagan
Kansas State University

Workers in the discipline of Precision Teaching occasionally need to make statistical statements about their data. When these occasions arise, providing an exact probability is a more precise statement than providing an estimate of a significance level (Lindsley, 1980). The purposes of this paper are to refresh the Precision Teacher's memory of Fisher's exact probability formula; to show how to efficiently calculate exact probability; to provide an example of the use of this statistic with data plotted on the Standard Behavior Chart; and to share some of the strengths and weaknesses of Fisher's exact probability test which have been expressed in the statistical literature.

It should be made clear that the author is not advocating statistical analysis, but simply recognizes that the Precision Teacher must communicate with related professionals. Some of these professionals need to see or hear a significance level stated before they appear able to process the data one wishes to share. If the methodology and product of Precision Teaching is not compromised by the dictates of statistical analysis, the only possible loss is the time used to punch numbers into a calculator and record the product.

The frequencies (count per minute, etc.) generated over time (successive calendar days, etc.) and recorded on the Standard Behavior Chart can be cast into a 2 x 2 contingency table. The count per minute, the y axis, can be bisected by the median frequency of the distribution for the frequencies charted. Successive calendar days, the x axis, can be divided at a phase change. There are a number of other rational methods for dividing the x and y axis of the Standard Behavior Chart into the four quadrants necessary for the construction of a 2 x 2 contingency table.

Chart 1 provides an example, using the median frequency to bisect the y axis and the phase change to divide the x axis. Each dot on the chart represents the middle frequency counted per day of appropriate linguistic pauses which Steve emitted while vocally describing a variety of stimuli. Three one-minute timings were obtained per session. The frequencies to the left of the phase change line (Phase I) were obtained when the clinician provided pictures and children's books for Steve to describe. After the phase change (Phase II) the stimuli which the clinician provided were manipulable objects. The aim of the training was to increase Steve's count of appropriate linguistic pauses to at least 12 per minute (Flanagan, 1977). The Phase II change was made because the Phase I was not yielding the desired celeration.

Employing the data from Chart 1, the median frequency and the phase change were used to assign each frequency plotted to one of the four cells of a 2 x 2 contingency table. The median frequency for the two phases combined was equal to 10. The phase change occurred before the 50th successive calendar day. For Phase I the frequencies were assigned to cell a or c as follows: If a frequency was above the median it was assigned to cell a. If the frequency was at or below the median it was assigned to cell c. The same

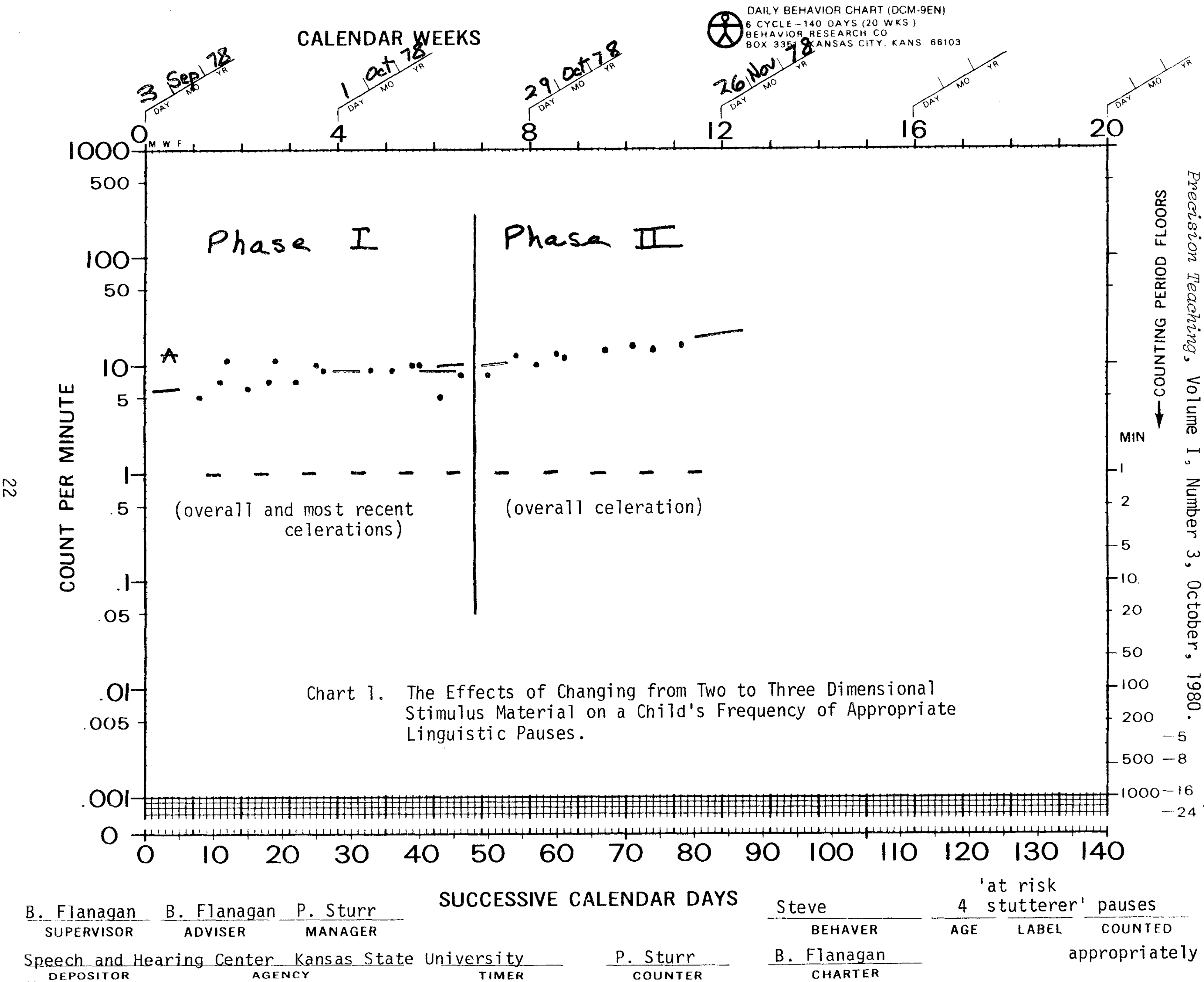

Chart 1. The Effects of Changing from Two to Three Dimensional Stimulus Material on a Child's Frequency of Appropriate Linguistic Pauses.

Flanagan, Bruce C. Fisher's exact probability and Precision Teaching: uses, limits and an efficient method of calculation. *Journal of Precision Teaching*, Volume 1, Number 3, October, 1980.

criteria were used for assigning the frequencies in Phase II to cells b or d. The data from Chart 1 casted as described into 2 x 2 table are shown in Table 1.

Table 1

Frequencies from Chart 1 Divided by Median and Phase Change Cast Into a 2 x 2 Contingency Table

	Phase I	Phase II	
Above MD	a 2	b 7	a + b = 9
MD = 10			
At or Below MD	c 13	d 2	c + d = 15
	a + c = 15	b + d = 9	N = 24

A commonly cited working formula (Cochran, 1952; McNemar, 1955; Siegel, 1956) for computing Fisher's exact probability test (1934) is

$$P = \frac{(a+b)!(c+d)!(a+c)!(b+d)!}{N!\ a!\ b!\ c!\ d!}$$

or

using the data from Chart 1

$$P = \frac{(9!) \times (15!) \times (15!) \times (9!)}{(24!) \times (2!) \times (7!) \times (15!)\ (2!)}$$

Statisticians agree the test cited is laborious to compute. Recall that a factorial (!) is the product of a given series of consecutive whole numbers beginning with 1: as the factorial of 5 is 5 x 4 x 3 x 2 x 1 or 120. Consider the following relation between n, n! and the common logarithm of n! (log n!) shown in Table 2.

Table 2

Factorials and Their Common Logarithms

n	n!	log n!
0	0 (by definition)	0.00000
1	1	0.00000
2	2	0.30103
3	6	0.77815
4	24	1.38021
5	120	2.07918
6	720	2.85733
7	5040	3.70243
8	40320	4.60552
9	362880	5.55976
10	3628800	6.55976

Given the size of the numbers which need to be computed in the problem at hand, one gains an intuitive understanding of why Fisher's exact probability test is considered laborious to compute. Even with the calculators available today, the capacity of these machines is quickly exhausted. However, Finney (1948) suggested the labor can be reduced by the use of a table of the common logarithms of the factorial functions. It can be noted in the right column of Table 2 how the conversion of factorials to a common logarithm keeps the numbers to a manageable size. Even the log of 100! is 157.97000, a number which is not beyond the capabilities of today's electronic calculators.

To turn the laborious task of computing Fisher's exact probability into a relatively modest effort, the Precision Teacher needs to be reminded of two rules which are required for the multiplication and division of logarithms:

1. To multiply two numbers, add their logarithms.
2. To divide two numbers, subtract their logarithms.

These mathematical relations hold regardless of the magnitude of the number.

The conversion of the linear equation cited previously for computing Fisher's exact probability to a logarithmic equation requires that the two rules stated above be followed. The resulting logarithmic equation is:

$$\log P =$$

$$[\log(a+b!)+\log(c+d!)+\log(a+c!)+\log(b+d!)]-[\log(N!)+\log(a!)+\log(b!)+\log(c!)+\log(d!)]$$

$$P = (\log P)^{10}$$

or

using the data from Chart 1

$$\log P = \begin{matrix} \log(9!) = 5.55976+ \\ \log(15!) = 12.11650+ \\ \log(15!) = 12.11650+ \\ \log(9!) = 5.55976 \end{matrix} \quad - \quad \begin{matrix} \log(24!) = 23.79271+ \\ \log(2!) = 0.30103+ \\ \log(7!) = 3.70234+ \\ \log(2!) = 0.30103 \end{matrix}$$

The sums of the above logarithmic conversions are:

$\log P = 35.35253 - 37.89148 = -2.53895$

$P = (-2.53895)^{10} = .00289$

If the reader has a calculator equipped with the factorial (x!) common logarithm (log) and antilogarithm (x^{10}) math function keys, plus a memory capability, the computation of the above data takes a few minutes. See the Appendix for the exact steps necessary, with a calculator equipped as described, for the calculation of the product of this equation.

To obtain a probability (P) value comparable to the usual significance test of the null hypothesis, all P's more extreme than the obtained P must be calculated and added to the P calculated above. This can be made clear by an example. In Table 3 the observed set of frequencies (part I) and sets showing more extreme frequencies are found (parts II and III).

Table 3

The Series of 2 x 2 Table Required
For Calculation of P Directly and Exactly

I
observed

a 2	b 7	a+b =9
c 13	d 2	c+d =15
a+c =15	b+d =9	N=24

II
more extreme

a 1	b 8	a+b =9
c 14	d 1	c+d =15
a+c =15	b+d =9	N=24

III
more extreme

a 0	b 9	a+b =9
c 15	d 0	c+d =15
a+c =15	b+d =9	N=24

Note that each part is based on the preceding part by subtracting 1 from a and d and adding 1 to b and c. This process is continued until cell a or d or both are equal to zero. The ad bc subtraction and addition process would be reversed if a zero cell could be reached in fewer steps by progressing in the reverse direction.

Part I contains the observed frequencies presented in Table 1 and calculated in the preceding section using a logarithmic formula for calculation of P. Thus P = .00289. Table 3 shows that the marginal frequencies for Parts II and III remain unchanged from Part I. From the viewpoint of efficiency of calculation, this fact is important because the value obtained for the left half of the calculation [log(a+b!)+...] - remains a constant in the calculations of the P's for Parts II and III. The resulting probabilities are:

$P^{I} = .00289$
$P^{II} = .0001033$
$P^{III} = .0000008$
$P = P^{I} + P^{II} + P^{III} = .002995 = .003$

Without any assumptions or approximations, which would be necessary with alternative statistical treatments, the contingency table observed may be judged to significantly contradict the null hypothesis of proportionality if P is a small quantity: in this case, .003, or about 1 out of 333, showing that for any case in which the hypothesis were true, observations of frequencies obtained would be extremely exceptional (Fisher, 1934). Using an alternative statistic, Chi-square, the best the Precision Teacher could do would be to estimate the P value. Instead of stating that the probability of proportionality of the Phase I versus Phase II frequencies could be explained by chance one time out of 333 times, it would be necessary to state that the probability of proportionality was greater than one time out of 100, but less than one time out of 1000.

The Precision Teacher should recall that Fisher's exact probability test is a one-tailed test. That is, one must be willing to state the expected direction of change in frequency that the conditions of the phase change are likely to produce. The expected direction of change in frequencies between Phase I and II in this example was that the frequency would increase. If the Precision Teacher does not have a basis for expecting what effect the phase change will have on subsequent frequencies, such as with a maintenance schedule, a two-tailed test of probability should be used. To obtain a two-tailed probability value, multiply the P obtained above by two.

Fisher recommends the test for all types of dichotomous data; this recommendation has been questioned. Tocher (1950) has offered a modification to correct for possible Type I errors which would be useful in certain sampling situations. According to Cochran (1952), Tocher's modificiation should be used when:

(1) One is selecting a random sample (n) from some population and classifying the observation into one of four cells.

(2) One is taking a random sample from a population denoted by A, and an independent random sample size r^2 from another population.

In the example in this report, neither of these situations appear to fit. The frequencies from Phase I and Phase II have not been randomly selected, but represent the population of frequencies which exist for Steve at the defined task. The population of interest is Steve's rate of appropriate linguistic pauses and the related variable of his fluency while speaking. Unlike Fisher's example (1956) of "Mathematics of a lady tasting tea," the question of whether the frequencies of Steve's training data will relate his behavior in another setting is not a theoretical issue, but an empirical question, which can be and was resolved by the collection of repeated probe data (Sidman, 1960) in settings removed from the training situation.

The probability statement concerning the frequencies in Phase I versus Phase II will most likely have the greatest utility when the author is attempting to share data with a related professional who has a strong history of reinforcement for seeing or hearing a significance level stated before he can look at data.

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APPENDIX

The author went to the University Book Store and searched for the most inexpensive name brand calculator which contained the factorial (x!) common logarithm (log) and antilogarithm (x^{10}, usually) math functions and a memory to accumulate the log conversions. A calculator which met these requirements was identified (Texas Instruments, Model T1-25, cost approx. $20). What follows is a step-by-step description of how to use this calculator to efficiently calculate an exact probability.

This problem was worked on a different set of frequencies than those used in the body of the paper. The frequencies cast in a 2 x 2 contingency table are as follows:

a 6	b 2	a + b = 8
c 3	d 9	c + d = 12
a + c = 9	b + d = 11	N = 20

To calculate the marginal frequencies of the logarithmic equation, [log(a+b)+......] -, the steps are as follows:

a + b	1.	Enter 8
	2.	Press x!
	3.	Press log
	4.	Press SUM
c + d	5.	Enter 12
		Repeat steps 2 thru 4
a + c	6.	Enter 9
		Repeat steps 2 thru 4
b + d	7.	Enter 11
		Repeat steps 2 thru 4
	8.	Press RCL
	9.	Record display <u>26.446776</u>

To calculate N and the cell frequencies - [log(N!) + log(a!).....], the steps are as follows:

	1.	Press Off
	2.	Press ON/C
N	3.	Enter 20
	4.	Press x!
	5.	Press log
	6.	Press SUM
a	7.	Enter 6
		Repeat steps 4 thru 6
b	8.	Enter 2
		Repeat steps 4 thru 6
c	9.	Enter 3
		Repeat steps 4 thru 6
d	10.	Enter 9
		Repeat steps 4 thru 6
	11.	Press RCL
	12.	Record <u>27.882402</u>

To obtain the log of P:

Press ON/C clear display
Enter 26.446776 log(a+b!)......
Press -
Press RCL
Press =
Record <u>-1.4356257</u>

To obtain P:

Press INV
Press log (code for x^{10})
Record .0366754

P = <u>.0367</u>

A similar step-by-step procedure for a Texas Instruments, Model T1-55, for these calculations is available from the author on request. This more advanced calculator has the advantages of capability for programming part of the steps and a sufficient number of memories that the sub-products of the equation can be stored in the machine (i.e., more efficiency and less chance of entering an error).

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PERFORMANCE AND LEARNING WORLD RECORDS

Performance Records

Tanya Kelb (Belleville, Ontario)	See-think 1470 words per minute (silent reading)
Vicky Vachon (Belleville, Ontario)	See-write 146 subtract facts of 18 per minute

Learning Records

Mary Hurst and Patsy (Potosi, Missouri)	See-say 10 survival words over and over for one minute -- corrects x20 and incorrects /15 for eight data days

---

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PATSY STARTED IT AND NOW EVERYBODY WANTS TO DO IT

Mary Hurst, Rick Hurst and Joanie Clemons
Potosi, Missouri

After attending the seminar, Learning and Teaching in Plain English, I was very excited and anxious to see what could be taught by this method. I chose Patsy, a 38-year old woman who is classified as moderately retarded. In Patsy's entire life, she had learned to sight read only two words successfully -- cat and dog. I was very concerned about setting Patsy's aim too high. I hesitated to set her aim at reading aloud ten words, which included cat and dog, at a rate of 50 words per minute.

On Patsy's first timing she successfully read only one word and misread seven words in 1 minute. I practiced these words with Patsy only about 5 minutes a day. At the end of only 8 days, Patsy reached her aim. She was so proud of herself that she called her sister and just read the words to her over the telephone again and again. It didn't matter who walked in the door, she would pull them over to the bulletin board in the dining room, which is where she kept her learning picture, and show them the progress she had made. Then she would run and get her word list and show them how she could read her words. The first day Patsy had reached her aim we were both crying, jumping around the room, and shouting at the top of our lungs. I never in my life would have thought Patsy could have come near this, but this experience gave me enough confidence to change Patsy's aim to adding 20 new words to her word list and her rate to 100 words per minute. I derived this rate from asking a fellow employee, who is of normal intelligence and a high school graduate, to read aloud for me for 1 minute. He read at a rate of 117 words per minute. Again, Patsy reached this aim without any real difficulty and in less than 2 weeks' time.

This teaching method was carried over to the other residents. It is a ritual around the house. Every night we gather in the living room to do the timings, mark on their learning pictures, and hand out prizes to the ones who have reached their aim that evening.

We made a game out of this method. We lay the flash cards on the floor in the shape of a circle, snake, or whatever design they feel like making. They argue about who goes first! Everybody wants to do it! It is amazing to see these residents so enthusiastic about learning. Everyone is happy now, because we are all having fun!

Mary Hurst is the Administrative Assistant, Rick Hurst is the Administrator, and Joanie Clemons is the teacher at the Moses Austin Group Home in Potosi, Missouri.

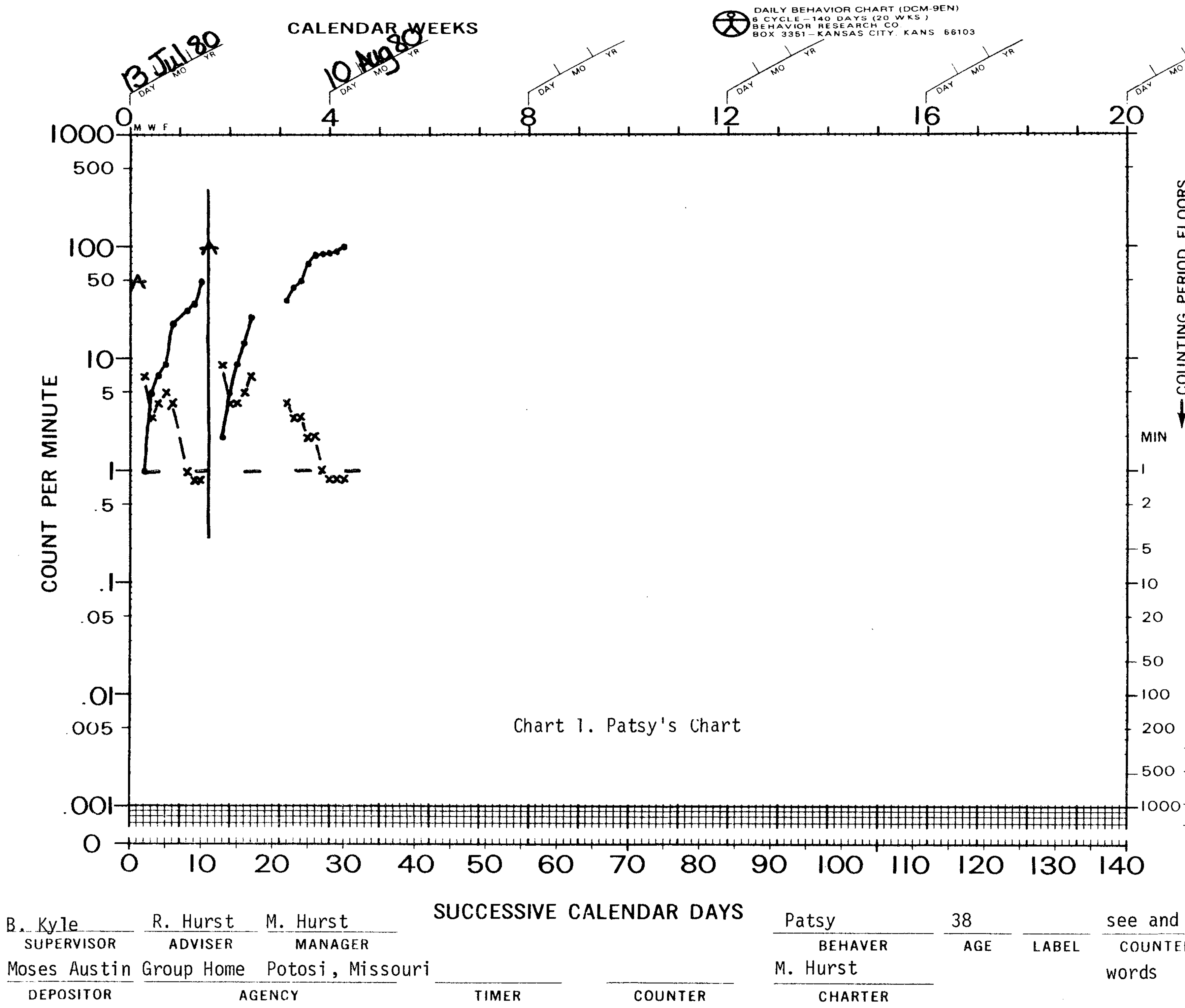

Chart 1. Patsy's Chart

Hurst, Mary, Hurst, Rick and Clemons, Joanie. Patsy started it and now everybody wants to do it. *Journal of Precision Teaching*, Volume I, Number 3, October, 1980.

EULOGY

Jean Piaget - 1896-1980 (84 years)

by

Dr. Eric C. Haughton
Teaching Master, Early Childhood Education Program
Loyalist College, Belleville, Ontario

In September of this year one of the giants of child study died. Piaget's concentrated study provoked discussion, analysis and research into the life experiences of young people. We in the behaviourial group found his tactics interesting but outdated. Interested as he was in classical biology, he followed the revered 19th century scientific precepts of detailed, exhaustive dissection and description of youngsters' interactions with their environments.

Despite his monumental personal efforts and huge impact in the field of child psychology, many behaviourists find his formulations and interpretations of behaviour creative, yet baffling. Let me suggest two reasons as the source of this puzzle and our feelings of impatience. Firstly, Piaget asserts that our development relies on highly repetitive and vigourous interactions with our complex environments. In the translator's preface to The Principles of Genetic Epistemology (Piaget, 1972), Wolf Mays states:

> The hypothesis that Piaget starts from his studies is that at the beginning of mental life the child's world appears as a set of sensory data centred about his own activity. But, even in the most practical activities, such as, for example, sucking reflexes, certain processes of conservation may be discerned which lead to repetition and hence a tendency to persistence, and this introduces a certain permanence in the primitive universe of the child. (Piaget, 1972).

Here he sounds like a behaviourist, insisting on large amounts of repetitive behaviour to establish performance, perspective and conceptualizations. And yet, Piaget failed to study the course of these repetitive acts, dissecting as he did the consequences or outcomes of these repetitions. His failure to record the developmental detail embedded in the thousands of repetitions caused him to construct elegant *post hoc* caricatures of how young people passed through developmental stages. In a book analysing Piaget's theories, Ginsberg and Opper state:

> The child extracts from the objects themselves a knowledge of their physical properties. Physical experience, then, involves sensitivity to the physical properties of things....Piaget himself has given relatively little attention to physical experience, despite his estimate of its importance. (Ginsberg & Opper, 1979).

We behaviourists have much to learn from Piaget's formulations; however, we are gaining deeper awareness and insights into the developmental process due to our interventions and the form of our data. Piaget's lack of interventions designed to develop performance characteristics kept him ignorant of the conditions that develop his topics of interest.

Secondly, Piaget's formulations of stages asks the question "When are youngsters at the same stage of development?" This antiquated question puzzles, while frustrating, those of us who experience the pleasure and joy of analysing the magnificent individualism of each developing person. Many of us ask "How does a person develop skills and knowledge?" The two questions are valid, one being more productive in learning how to support and assist development. No person is ever at the same "stage" in either space or time as another. Although a gross conceptual category such as conservation may descriptively encompass a portion of each youngster's process of development, our individual developmental patterns are unique.

These observations are the result of my studying some of Piaget's work in the past few years. His fascinating book, Genetic Epistemology (Piaget, 1972), and his many articles in our literature stimulate us due to his concentration on behaviourial fundamentals. He concentrates on young people's development of skilled performance in such topics as classifying, serializing and enumerating based on their perceptive observation skills. Our commitment is to foster and enhance these skills while developing memory, analysis, operative and communication skills so that youngsters can apply learnings to live full, satisfying lives. Thus we can build on his pioneering efforts.

Thank you, Jean Piaget, for your commitment, diligence and contributions to our understandings of young people. You are certainly a remarkable person to emulate. Rest peacefully Jean; your superb stimulation and influence continue.

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FEBRUARY 5-6-7, 1981
HILTON INN-FLORIDA CENTER
ORLANDO, FLORIDA

FEBRUARY 5 -- TRAINERS' INSTITUTE

WILL ADDRESS MAJOR ISSUES IN THE FIELD OF PRECISION TEACHING. DESIGNED PRIMARILY FOR PERSONS WHO ARE TRAINING OR CONSULTING WITH PRECISION TEACHERS.

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DEADLINE FOR ADVANCE REGISTRATION, JANUARY 10, 1981.

MAKE REGISTRATION CHECKS TO:

PRECISION TEACHERS OF ORANGE COUNTY
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February 5-6-7, 1981

Registration Form

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	FEES	Before Jan. 10	After Jan. 10
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	Requirement: Attendance at Conference and synopsis of classroom usage. Grade will be received during Winter Quarter.		
☐	Friday Nite Social Activities	$10 per person	
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Make registration checks to:

Precision Teachers of Orange County
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Orlando, Florida 32801

STANDARD GLOSSARY AND CHARTING CONVENTIONS**
(third draft -- October, 1980*)

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

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

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

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

Add-subtract Scale--any measurement scale on which adding and subtracting by a constant amount is represented by a constant distance.

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

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

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

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

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

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

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

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

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

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

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

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

Day Line--vertical line on the Daily Standard Behavior Chart.

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

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

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

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

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

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

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

Frequency Aim--the expected phase-ending frequency for a given movement; symbolized by drawing "A" at the expected frequency on the day the aim was set.

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

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

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

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

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

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

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

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

Median Celeration--the middle celeration in a celeration distribution; symbolized by drawing a "<" on the Chart.

Median Frequency--the middle frequency in a frequency distribution; symbolized by drawing a "<" on the Chart.

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

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

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

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

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

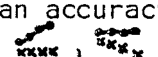
Performance--the number of movements per unit time; also called frequency.

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

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

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

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

Single Improvement Learning Picture--one movement of an accuracy pair with a celeration in the expected direction; for example 

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

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

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

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

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

Up Bounce--distance from the celeration line to the frequency farthest above it.

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*Additions or changes in the October, 1980 draft.

**Adapted from Pennypacker, H.S.; Koenig, C.H.; & Lindsley, O.R. Handbook of the standard behavior chart. Kansas City, Kansas: Precision Media, 1972 (by permission of H.S. Pennypacker).

Dedicated to Mrs. Irene McGreevy,
a very special person, and to the
children, who, by sharing their
Charts, taught us what we know.