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Standard Glossary and Charting Conventions

A Publication of The Standard Celeration Society
The *Journal of Precision Teaching and Celeration* (ISSN 1088-484X) is a multidisciplinary journal that is 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 and Celeration* 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  
  (See Volume X, Number 2, Spring, 1993, pp. 79 - 82.)  
* 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  
* direct data points may be submitted, so the Charting Macro program (Slocum, 1990) may produce an electronic version of the Chart  
* original charts may also be submitted.

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. “About PT” is a column for shorter notes.

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Editor's Comments

Claudia E. McDade

This Spring, 1997 (XIV 2) issue of the Journal of Precision Teaching and Celeration brings several applications of Precision Teaching to improving reading and math in children, to driving to designated locations, and to self-management issues. It also contains a celebration of our roots with an article reprinted by permission of Bea Barrett. “Communications and the measured message of normal behavior” was originally published in York R., and Edgar, E. (eds.). Teaching the Severely Handicapped, Volume IV in 1979.

Two studies out of Gonzaga University, supervised by Tim McLaughlin, enhanced reading levels and comprehension of elementary students. Cheryl Anthony, Lisa Rinaldi, and Carol Hern assisted three fourth-graders using the reading racetrack intervention to x3 their fluency of sight words read. Tiffany Abrams used hand signals and role reversals to improve a sixth grade LD student’s see/say words in context and reading comprehension.

Marie Kell, Georgia State University, and Mark Koorland and Vivian Fueyo, Florida State University, assisted three LD fourth grade students in increasing their fluency of multiplication facts. Comparing stimulus fading with error correction, they discovered both differential learning and that two of their three students preferred the approach by which they learned best. Rosemary Ashbaugh, another of Tim McLaughlin’s Gonzaga students, assisted a mildly mentally retarded 17 year old boy in learning street names and then driving to the locations.

Melissa Judy, Paul Malanga, Randy Seevers, and John Cooper from The Ohio State University worked with the first author to modify her forgetting behavior by accelerating encouraging self-statements. Betty Jo Wood, also from Gonzaga, used the Standard Chart to reduce her caffeine intake while increasing her water consumption. An e-mail message from Marshall Dermer, University of Wisconsin-Milwaukee, described his intervention to reduce his worrying behavior.

The Standard Celeration Listserv (SClistserv@lists.acs.ohio-state.edu) is running from The Ohio State University, while the Standard Celeration Society’s webpage can be accessed at www.celeration.org. Let’s celerate our use of these electronic communication tools!
Communitization and the Measured Message of Normal Behavior

Beatrice H. Barrett

We live in pressing times, we are pushed into judgments and formulations, the need overrides discretion, and expediency supplants research. Our guesses become theories, our narrow-mindedness becomes dogma, our ignorance becomes curriculum, our complacency becomes conviction. The result: a series of “authoritative” pronouncements without benefit of practical knowledge. These pronouncements, if taken seriously, have profound effect on the pattern of education for the severely retarded child. (D’Amelio, 1971, pp. 4-5)

Now that normalization has become a guiding concept in human service, community placement in itself is considered a vast improvement over institutionalization: less regimented, therefore more dignifying; less barren, therefore more humane. However, communitization may be destined for the pitfalls of any massive relocation pursued without careful preparation and without full awareness of its potential impact on target population.

Although communitization is moving more slowly than anticipated (Blatt, Bogdan, Biklen, & Taylor, 1977; Roos, 1977), the objective of many institutions is community placement of as many of their residents as possible, as fast as possible. In some instances relocation is being “imposed” rather than “offered” (Wolfensberger, 1972). In more instances people are being moved into community settings without having been taught how to behave in them. The implicit assumption is that normal environments will somehow elicit normal behavior, despite overwhelming evidence that this is a false hope.

Normal environments fall far short of what severely handicapped persons require (Throne, 1975). The discrepancy between normal environments and appropriately adapted environments becomes more obvious in direct relationship to the escalating literature describing new habilitative developments designed to bridge the gap. The broadening scope and increasing complexity of activities recommended to implement effective community placement (Sontag, Smith, & Certo, 1977) convey a straight-forward message; if community environments are to serve severely handicapped persons better than institutional environments, they must undergo both extensive and intensive modifications spanning the range from child-rearing practices to architectural design and community protective by-laws.

Implicate in this message is recognition of a long-standing definition. People are called “retarded” or “handicapped” or “special needs” because they do not interact adequately with or learn optimally from a normal environment. Or, conversely, from a behavior-analytic point of view, the normal environment limits people with severe handicaps because it fails to provide the prosthetic or remedial assistance necessary for their optimal functioning (Lindsley, 1964).

Proliferation of specialized services will surely heighten the visibility of the severely handicapped, who have been out of view --- contained within those special “purgatories” (Blatt & Kaplan, 1966) of grim but safely distant state institutions. The public will be seeing more and more people with peculiar gaits and anomalous faces and physiques and will be meeting increasing numbers of their professional and lay advocates. But heightened visibility may have salutary or tragic consequences for the handicapped, depending on the extent to which community environments can be modified to normalize their behavior.

Behavior-normalizing technology is emerging. Evidence of its success has been increasing exponentially. Techniques developed from the
experimental analysis of behavior and from research on military training have brought expanded instructional opportunities to people traditionally excluded from classroom as "untrainable" and therefore "hopeless" (Barrett, 1977; Birnbrauer, 1976). And research continues to develop, analyze, and refine methods for teaching people with increasingly severe behavior deficits. The success of these methods has made it feasible to mandate ever, normalization ideology is being emphasized Soeffring, 1974; Wolfensberger, 1972) at the expense of training in the technology of behavior normalization. As a result, advocate-habitatators are seldom prepared to teach the behaviors that community living requires.

Most experts in behavior-normalizing technology consider normal environments inappropriate for people defined by their inability to function adequately within them. A large body of evidence supports this position. Diverse as they may appear at first glance, behavior-analytic procedures that normalize both deviant and deficient behavior share a common property --- a property that distinguishes them as "special" in the habilitation of handicapped individuals. All such procedures employ successive and often extreme modifications of the instructional environment.

In the initial stages, these modifications are designed to produce instructional environments that even the most severely handicapped person can respond to and derive reinforcement from. Subsequent steps in the development of new behaviors consist of gradual revisions of the instructional environment. Each revision more closely approximates the "normal" environment, thereby requiring progression in the form, complexity, or fluency of a person's behavior.

Initial modifications may have to depart greatly from procedures used successfully with the non-handicapped. An example is the physical guidance or "putting through" required in early stages of movement formation. Another is the very finely tuned fading that may be necessary to produce visual discriminations that normal children learn almost instantly. Or the departure may be as simple as provision of more-frequent-than-normal praise for appropriate social, academic, or self-help behaviors. Severity of handicaps may be more functionally described by the "power" of the procedures necessary to normalize them than by conventional classification (Gold, n.d.). In this case, "power" refers not only to the extent of departure from "normal," but also to the degree of sensitivity and skill necessary to design optimally instructional environments.

Just as normalization advocates often overlook behavior-normalizing technology, behaviorally oriented teachers often fail to incorporate more "normative" practices (Wolfensberger, 1972) into what should be a pedagogical continuum. If normalization of behavior is long-term goal, we should make maximum use of existing guides for developing increasingly normalizing technology. At the risk of using a controversial concept, I refer to community behavior norms --- descriptions of activities and performance standards typically found in community settings.

In varying degrees, community norms are implicit in most training endeavors. However, as instructional guides, they appear to be used in consistently. For this reason, community behavior norms bear re-examination and re-explication. If our goal is to help severely low-functioning individuals to become more competent and thus more acceptable to and better "blends" with their peers (Vincent & Broome, 1977), we should examine in greater detail the characteristics of typical behavior (Bricker, Ruder, & Vincent, 1976; Haring & Gentry, 1976; Haughton, 1972). In particular, what are some of the implications of community behavior norms for (1) selection of instructional outcomes, (2) modification of instructional procedures, and (3) choice of methods for evaluating progress toward behavioral normalization?

**SELECTION OF INSTRUCTIONAL OUTCOMES**

Instructional outcomes are the products of instruction --- the skills that the learner is expected to have as a result of instruction. Ideally, they should be quantifiable performances that occur under specified conditions and that meet specified criteria.

It seems obvious that the least restricted persons are those with the greatest variety of readily available skills for dealing with community life.
Yet the range of instructional outcomes selected for handicapped pupils is often unnecessarily (albeit unintentionally) restrictive. Decisions about what to teach more often than not reflect the instructor's methodological training. They also reflect the instructor's assumptions about the nature of retardation and his or her expectations of what retarded people can or should be able to do. In addition, educational options for low-functioning people continue to be limited by psychometric classification. This situation exists even in Massachusetts, where a 1972 act of legislature obliterated the political phenomenon of "mental retardation" (Jordan, 1973) and substituted another one --- "special needs."

Assumptions about what is "normal" for "retarded" people still underlie selection of instructional outcomes. As a result, we see emphasis on self-help skills without any consideration of the numerical skills, sight vocabulary, handwriting, or other forms of communication that are necessary for community living. Or, worse yet, we see "eliminative" education (Goldiamond, 1975) aimed solely at removing "undesirable" behavior from people with already abnormally barren repertories --- often divesting these people of their only means of interacting with their environment.

Other nonnormative variations emphasize cosmetic behavior control --- being "still, quiet, and docile" (Winett & Winkler, 1972), "on task," "in seat," "clean," and so forth. Community peers who regularly present such appearances might be called well-behaved, but unless they also display the social and academic skills expected for their age levels, they, too, risk being labeled "retarded."

Instruction limited to specialized skills has also become popular. Outcomes chosen for instruction include such sophisticated skills as telephoning, time-telling, making change, and reading price tags and restaurant menus. No doubt the "face" validity of these cosmetic instructional outcomes will improve the credibility of publicly sponsored educational programs by normalizing the "image" (Wolfensberger, 1972) of handicapped people. But ironically, instruction that imparts only a veneer of normality may set these people up for failure that would have been less likely without it. Community peers who regularly engage in these complicated activities have previously mastered a complex substructure of prerequisites and components as well as a host of related skills. A handicapped person who displays specialized competencies may provide persuasive evidence that expectancies should be changed. But the same person may become trapped by deficits that accumulate from failure to display related skills normally expected by and of age peers with comparable advanced skills. (A "special needs" savant?)

Diametric to the specialized skills approach is one that focuses only on elemental skills such as object sorting, identify matching, cross-modal matching, and object naming across various kinds of materials and with varied instructors, without any discernible sequential programming toward more commonly expected competencies. This task × materials orientation to curriculum content may appeal to those seeking a systematic approach to some form of generalization training with a very "basic skills" emphasis. Pursuit of these instructional objectives may yield a pool of subjects well pretrained for popular laboratory tasks and may, indeed, be a boon to the statistician. Unfortunately, such splinter skills appear to be unrelated to the cumulative skill development that underlies most normative notions of education.

These approaches exemplify application of "retarded norms" --- not "normal norms" that the rest of the world recognizes. And, inconsistent though it may seem, they may be practiced by instructors who are firmly committed to some concept of normalization. Nevertheless, they all seem to operationalize some unrecognized assumptions. One such assumption may be that low-functioning people are so far removed from the average that attempts to progress toward more conventional educational practices will be waste of time. Recent redefinition of the psychometric range of retardation could bolster such an assumption (Grossman, 1973). Another may be that within this population, individual differences are so great as to preclude application of standard presequenced curriculum. A third may be that even outside the institution, currently low-functioning persons will never be required to use any of the skills normally considered basic in both elementary education and community life. Such assumptions and their instructional products contradict any concept of normalization.
Ill-defined though it may be, cumulative skill development is the community educational model. And there is no compelling evidence that the cumulative skill model is any less applicable to the instruction of severely handicapped people than it is to the instruction of their community peers. If instructional objectives are sequenced so that subordinate skills at each level facilitate acquisition of skills at the next higher level, the result is a hierarchical arrangement of the curriculum (Resnick, Wang, & Kaplan, 1973). If properly arranged, sequentially or simultaneously taught skills at a given level serve contributive or "enabling" functions in acquisition of the next skill or set of skills in the hierarchy (Gagne, 1974).

In order for cumulative skills to eventuate in more normal behaviors, the long-range instructional outcomes of a curriculum should be selected from those normally taught in community school systems. If this seems an unrealistic goal, check your own assumptions!

With the methodology of task analysis, we should be able to set as long-range instructional outcomes at least the rudimentary skills normally acquired in early elementary education. By task analyzing these outcomes into their component and contributive skills and working backward, we should be able to specify the prerequisites for the prerequisites until we reach the most elemental skills critical to final performance. If we go far enough, we should be able to include in our longitudinal curricula even the most developmentally primitive reflexes found in the lowest functioning individuals. If analyzed exhaustively and sequenced according to facilitative skill functions, the product of this undertaking would be a hierarchy of instructional objectives that starts with the subskills in any given pupil's behavior repertoire and eventuates in the skills usually included in early elementary curricula (Barrett, 1977). Each skill in the hierarchy would be described by the conditions for testing its presence in each individual's behavior repertoire.

Such a longitudinal approach (Brown, 1973; Williams, Brown, & Certo, 1975; Williams & Gotts, 1977) would decrease the likelihood of fragmented or misinterpreted skill profiles. Moreover, it should prevent deficits from accumulating, because the necessary component and prerequisite skills would be taught prior to instruction in the skills that depend on them. People reported to have learned to "tell time" would also have learned to show you which numeral is "four," to tell you what numeral you are pointing to --- whether vocally or by signing --- and, perhaps, even to set clocks correctly. People who match coins to price tags would also have acquired one-to-one correspondence, rational counting, and even equivalence. People who once engaged in atavistic behaviors to avoid or escape various activities would have been taught to indicate choice by saying or signing "No" or perhaps even by displaying anger if their "No" is not honored.

Standardized, validated, hierarchically arranged curricula that aim toward the goals of community skills are defensible in theory. They are also methodologically justifiable as operational referents for determining how far and in what ways handicapped people depart from and therefore need specialized instruction in approximating community behavior standards.

**SELECTION OF INSTRUCTIONAL PROCEDURES**

Normalization of behavior also requires progressive modification of instructional procedures commonly used in classrooms for low-functioning people. We may all agree that, for severely handicapped pupils, specialized instructional technology is necessary to teach a host of behaviors that normal preschool children already have. However, we should also be continually aware that persistence with some procedures may limit our pupils' approximations of normality. Even the best analyzed and best sequenced hierarchy of instructional objectives will fail to produce more normal behavior if the methods used to reach those objectives are not themselves successively modified toward normality.

For example, many have questioned the kinds of consequences dispensed during instruction. Community peers don't get bits of food for correct responses. They do get token rewards --- but most frequently in the form of marks rather than plastic chips. And the back-up for tokens usually consists of parental, peer, or teacher praise, privileges, and access to leisure-time
activities including simply resting or appearing to "do nothing." The "keep 'em busy" practice in some special classrooms precludes "doing nothing." The "keep 'em busy" practice in some special classrooms precludes "doing nothing." Yet this is a highly prevalent "activity" among handicapped people. Perhaps some would learn to get marks for that purpose.

Contrived consequences are often necessary in the early stages of instruction. But they can become yet another stigma of and restriction on the handicapped student unless additional training is undertaken to build the reinforcing function of more normally available events. Such training would require the same sensitive programming as techniques used to condition the reinforcing function of other response-produced events (e.g., tokens, teacher of peer approval) that originally failed to strengthen behavior that is supported by commonly available consequences, the closer the approximation to community reward systems.

Compared with the irregular scheduling of consequences in the "real" world, reinforcement of every correct response is artificial. We must constantly remind ourselves that behavior is not sustained by the schedule that works best in early acquisition (Ferster & Skinner, 1957; Lindsley, 1964); that intermittent scheduling must be intentionally programmed for all behavior that we expect to see maintained outside the prosthetic environment of acquisition. To ensure that our pupils are minimally restricted, our instructional procedures should be extended to incorporate schedules increasingly like those that sustain the behavior of community peers.

Instructional formats also deserve some examination for their relative normality and their normalizing effects. Once again, the notion of least restrictive alternatives is applicable. Unfortunately, many instructional formats that proliferate under various "behavioral" guises seem to be unnecessarily inflexible.

Despite the heterogeneity that characterizes community classroom pupils, the effort to achieve homogeneously handicapped groups still enjoys undue popularity. This notion seems to have originated from concern that less capable students would develop "failure sets" from participating with more capable people. By now we should realize that a teacher can arrange contingencies to prevent that from happening. Furthermore, if a teacher uses the imitative skills that exist or are being taught, less competent pupils, instead of experiencing "failure," may acquire more normal forms of behavior through imitation of their more competent peer models (Brown, Nietupski, & Hamre-Nietupski, 1976).

One of our residents with Down's syndrome --- an astute observer of others --- acquired one-to-one correspondence and rudimentary equivalence simply by repeatedly seeing his more competent peers counting their pennies to exchange for dimes. So, clearly, even unprogrammed modeling provided by heterogeneous groups can be an instructional aid that also provides a more community-like instructional environment.

Another related practice is exclusive reliance on individual tutorials, often in cubicles. Isolation may be necessary to facilitate training of various attending behaviors. However, without individual instruction in group settings and, eventually, group instruction, pupils are prevented from acquiring behaviors commonly expected of their community peers. Retarded pupils should be taught to take turns, to attend to and consequence one another's behavior, to work independently in the presence of others, to cooperate as well as compete with one another --- in short, to learn from one another. Appropriately designed contingencies make these realistic and normative goals.

How often have behavioral conditioning procedures been called dehumanizing, rigid, automatic, robot-producing, or behavior-controlling, rather than behavior-developing? How often do we hear teachers complaining about inflexible scripts that are boring to follow? How often do we see pupils who do nothing until they are told to do something? Isn't this one of the characteristics we hope to change? Surely such dependence is not characteristic of their community peers.

Exclusive use of teacher-controlled, teacher-presented trials reflects the assumption that low-functioning people will always be totally dependent on their instructors. This will surely be so if teacher presentation is coupled with rigid adherence to priming or prompting (Skinner, 1968) without provisions for shifting control of
responding from teacher to instructional materials. Opportunities for self-presentation and independence skill practice with multiple-stimulus formats such as worksheets should be available to handicapped people. Procedures and formats that foster continued dependence on teachers are highly restrictive and may be only a short step above custodial care. They are also antithetical to the normalizing function of good programming.

Self-presentation, self-pacing, and fading of unnecessary prompts are basic procedures of programming instruction. They operationalize what Skinner meant by "freeing" the student (Skinner, 1968). While primes, prompts, and other forms of teacher control may be necessary during early acquisition, continued use of "acquisition crutches" (Lindsley, 1964) prevents development of independent responding. Until we provide transition to free-response formats, we will not have offered handicapped people the full advantages of programming technology. Nor will we ever know how closely they can approximate normal behavior patterns.

In short, if we wish to produce greater flexibility in the behavior repertoires of our pupils, we must first become more flexible in our own ways of arranging their instructional environments. Again, the patterns of community peers should be our guides.

**CHOICE OF METHODS FOR EVALUATING PROGRESS**

Expanding our instructional objectives and elasticizing our instructional procedures may create more normal or even less restrictive appearances in many classrooms. Lattices of longitudinal curricula with well-developed rationales and communicable lesson plans may provide recorded evidence that, indeed, a more normalizing education is being provided. Standards may be met and funding may be assured because everything looks technologically sophisticated, consistent, and credible.

But how much more normally are the pupils behaving? Are we really narrowing the gap between them and their community peers? Or is it possible that we have applied yet another layer of cosmetics to convince ourselves that we have fulfilled our moral obligation to the handicapped? Do we really want to know? If so, how can we tell?

The best way to evaluate changes is to ask the pupils themselves. Since neither their verbal behavior nor ours can accurately describe the effects of instructional methods, we must adopt another medium of communication. That medium is measurement—a universal language. If appropriately calibrated for sensitivity to their behavior, measurement permits us to understand nonspeaking people (Barrett, 1977).

If we adopt measurement as a communication tool and behavior normalization as a long-range goal, there is readily available a variety of community performance standards against which we should compare our pupils' progress. After all, normal performance is, by definition, measured performance. It is measured performance described by norms.

While the label "norms" may conjure up bell-shaped curves, IQ tests, and a host of other controversial concepts, I am not suggesting that we revert to the global, nonprescriptive measures that have historically justified exclusion of our pupils from their rightful education. But to make comparisons that will help us set more normalizing aims, we must measure the same skills and subskills in normal children that we are trying to teach to handicapped children (Haughton, 1972; Walker & Hops, 1976). Furthermore, to ensure a communication system common to both normal and handicapped behavior, we must adopt the parameters of measurement typically applied in assessment of normal behavior.

Community behavior norms do guide the training of handicapped persons to the extent that we implicitly or even explicitly compare our pupils' accuracy with that of normal schoolchildren. But the comparison may be too restricted in scope to achieve a normalizing effect. Take, for example, the prevalent use of an 80 to 90% accuracy criterion for handicapped people. To what extent does this restrict their successful communization of their community peers perform the same skills at 100% accuracy? If we so limit our information about our pupils, how likely is it that our
moment-to-moment decisions are producing cumulative deficits in the process of instruction? If the skills being taught are to become enabling skills in the acquisition of superordinate skills, they must at the very least be taught to normal accuracy. Lowering the "normal" criterion to accommodate the errors of the handicapped not only prevents their attainment of mastery but also perpetuates the expectancy of limitation that we are trying to dispel.

But suppose we require consistent 100% accuracy as a criterion in cumulative skills development, and suppose we also incorporate in our curricula the practice periods, retention checks, and reviews found in conventional school curricula. Is accurate performance sufficient to achieve the degree of behavior normalization we seek for handicapped people?

If we look more closely at the measures used in community schools, we find that accuracy is only one dimension of normally measured behavior. Percentage correct is a highly restrictive measure that yields relatively little information from a pupil. Whether it be derived from a person's performance in one setting with one teacher and one set of cues and materials or from many variations of these environmental variables, a major dimension of behavior is disregarded if we rely solely on percentage correct. That disregarded dimension is time. How long does it take to teach Jimmy to feed himself? to brush his teeth? Once taught, how long does Jimmy take to perform these complicated behavior chains? And how consistently does he perform them? Has he really mastered these skills that normal children perform easily and rapidly every day? These questions cannot be answered from percentage of components completed accurately nor from percentage of time Jimmy engages in these activities appropriately. We are restricting Jimmy's communication to us by limiting the measured dimensions of his behavior.

Why do we limit our own effectiveness by persisting with such fragmentary information when we invest so much energy in trying to train the handicapped?

In the community, time is one of our most precious commodities. The clock and the calendar provide a base for evaluating instructional effectiveness. If a pupil can't keep up the pace, remedial procedures are called for. And pupil records are cumulative through time. Progress is judged by Jimmy's cumulative skill development during units of time called terms or semesters. In community living, time restrictions are everywhere.

And if we ask how well our most accurate pupils will be able to function in community environments, we are forced to consider such temporal measures as duration and rate of responding. Jimmy must be able to count money at supermarket-acceptable speeds. He must be able to speak, read, or sign fluently enough for comprehension. A trial-by-trial teaching format locks the child's performance into a rate determined by the teacher. On the other hand, self-presenting lets the child's rate emerge. Self-presenting also provides a format that facilitates fading of teacher prompts that slow the child down. As teacher prompts are gradually faded, the child is freed from the ceiling imposed by teacher-presented trials. Furthermore, removing the teacher-determined ceiling on the child's speed of accurate performance permits us to include the time dimension in the pupil's communication to us. Stops to independence from teacher prompting become quite clear if we measure the rate of prompts as well as the rate of behaviors executed without prompts. The pupil's growing independence is measured directly and described functionally by the increasing graphic distance between the rate of prompted behavior and the rate of unprompted behavior over time.

Research continues to develop methods that increase instructional efficiency by fading prompts and thereby reducing the time required to bring handicapped people to criterion accuracy. And appropriate use of acquired skills in various settings with varying materials, cues, and people has become the subject of analysis (Auskis, Baur, & Jackson, 1974), demonstration (Barrett & McCormack, 1973), and pedagogical concern (Certo, Brown, Belmore, & Crowner, 1977; Williams et al., 1975). But even if they perform accurately and appropriately in the range of situations commonly encountered in community life, people may still be called "retarded" if their performance is too slow.
How fast is fast enough? At present there is no empirical evidence to answer that question. Commonly available norm-referenced tests with time limits may furnish some clues. However, because the instructional objectives for handicapped people are more finely task analyzed than those appropriate for most nonhandicapped people, it is not likely that the subskills of concern will be represented in instruments standardized on a "normal" population. Therefore, the fluency aims for this group must be developed from another source. In this as in other comparisons, useful guides are obtained from nonhandicapped people (Haughton, 1972; Starlin & Starlin, 1973; Willis, 1974) performing the same skills and subskills that are being taught to currently low-functioning people.

In the absence of a standard curriculum, an exact description of the behaviors being taught may vary from teacher to teacher and from pupil to pupil. But that should not be an obstacle. Whatever skills are being taught may be used to probe the speed at which competent nonhandicapped people perform them under the same conditions used for assessing proficiency among handicapped pupils (Haring & Gentry, 1976; Lovitt, 1976; White & Haring, 1976).

For example, suppose we are teaching some of the component and enabling skills involved in basic reading, writing, and arithmetic. Our handicapped pupils have been taught to perform consistently at 100% accuracy and have made a successful transition to formats permitting unprompted accurate repetition of these skills within specified time limits. Having normalized our pupils' accuracy and permitted them opportunities to speed up their performance, as their community peers do, we now question whether, in so doing, we have normalized their fluency. Using the exact formats provided our pupils, we have some community schoolchildren and adults perform the same skills within the same short probe periods, say, 30 seconds.

For example, Figure 1 presents exploratory results from four of our state school pupils as they compare with an equal number of young nonhandicapped public school pupils and adults. Rate (frequency) ranges are based on the highest of four rates attained by each individual on successive probes.

Note that, even through the groups are very small, there is a lawful relationship among the rates of the three groups across all 16 skills. The state school pupils performed at consistently lower rates than much younger public school pupils and they, in turn, performed at consistently lower rates than the adults. Note also that, of the 16 skills probed, only five show any overlap in the range of fastest performances obtained from state school residents and those shown by younger public school pupils. Yet all were performing these tasks at 100% accuracy. Furthermore, the state school residents were theoretically at an advantage because they had practiced these tasks prior to the probes that yielded these data. This example shows us how incompletely we have performed our own task of normalizing our pupils' accurately performed behavior.

![Figure 1](image_url)

**Figure 1** Frequency comparisons on some components and prerequisites of elementary skills (Based on an unpublished pilot study conducted by Frances George and Deborah Fease).
By adopting one additional dimension in our measurement system, we increased the opportunities for our pupils to communicate with us. Then, by comparing their performances with those of their community peers, we were made aware that both our methods and our objectives must be expanded in the direction of normality if we are to provide our pupils increasingly normalizing habilitative options. Use of a single additional parameter of "normal" performance - rate - necessitates revisions in instructional methods and in curricular formats to permit multiple opportunities for pupil response limited only by specified time intervals. With a quantitative description of the "normal range" on the subskills chosen for comparison, we now have a first approximation of the "normal" criteria that should be applied in evaluating our pupils' progress.

CONCLUDING COMMENTS

"Retardation" is more than a label. It is more than a sociopolitical arena. It is a behavioral reality. Until we can fully normalize our pupils' performance, the reality of retardation will persist regardless of what labels are substituted and what geographic locations the labeled people behave in. An our effectiveness will be inversely related to the restrictions we place on the measured communication to us.

Clearly, normalizing the behavior of severely handicapped people is a very different and more complicated undertaking than simply changing their habitat. Yet it cannot be accomplished without successive environmental normalization as an integral process in behavioral habilitation. Moreover, if we adopt the common language of measured "normal" performance standards as instructional guides, we see the need for considerable methodologic development to provide the skill-supportive instructional environments that will enable our pupils to perform as normally as possible.

No matter how strong the legal and political pressures, we must evaluate our environmental changes in terms of their effects on the behavior of the people to be habilitated. Only our pupils can tell us what environments are more favorable for them. And we must give them as many options as possible for communicating with us. If we permit their measured interactions with various environments to determine the adequacy of our environmental designs, we will avoid the inconsistencies that accrue from approaches that disregard their critical evaluative feedback.

It is the thesis of this article that:
1) Communitization of the severely handicapped is being undertaken without adequate evidence of its effects on the people for whom benefits are being sought; 2) Until their measured behavior supersedes our assumptions, inconsistencies between principles and application will continue to undermine our mission enhancing their future well-being; 3) The medium of communication best suited to articulate and amplify their response to our interventions is the universal language of measurement; 4) Only by posing relevant questions of the seeking answers from the measured behavior of our clients and their community peers can we begin to reconcile their needs and our assumptions.

With measured progress toward the goal of behavioral normalization and with the measured message of normal behavior as a guide, we will be better able to determine where we have been, where we are going, and how far we have to go.

References


E-Mails of Interest

Subject: OG's ListServ History
Date: Thu, 7 Aug 1997 22:17:32 -0400 (EDT)
From: Olindsley@aol.com
Reply-To: SCListserv@lists.acs.ohio-state.edu
To: SCListserv@lists.acs.ohio-state.edu
CC: owner-SCListserv@lists.acs.ohio-state.edu

For some reason this message did not go through our SCListserv with its following message <List Manners and Abuse> which I hoped you would read after this. This message sets the scene for <list Manners and Abuse> and leads into my closing of <Too little? Too Late?>.

This email is to be read before the message < List Manners and abuse>. It is sent in two parts to keep each message brief enough for all email systems.

I never subscribed to the Behavior Analysis <Behav-An> list because the sample postings that I read were full of academic trivia and many one on one arguments between two members who apparently had no other way to command our attention than to argue in public.

I kept a private list of over 45 edresses called <PT Folk> that I sent messages to. I told them of events, deadlines, updates, and address and edress changes. It took more and more time to maintain <PT Folk>. Therefore, I welcomed the founding of our <SList> by Rick Kubina, and sent him my <PT folk> list to help him start up our <SList>. I hoped that I would no longer have to maintain my <PT Folk> list.

Recently I printed out the subscribers to our SList by sending a <review SListserv> request to <listserv@lists.acs.ohio-state.edu>. I noted that ten of our most experienced leaders had not subscribed to our SList in fear that it would become another Behav-An list. I privately emailed each of these people urging them to join. I told them we posted about 2 important messages a day, with no space wasting debates and little trivia.

Since the late 1950's I held deep concern that Fred Skinner stood idly by and let Operant Conditioning degenerate without saying a thing in public. Technical advances degenerate by drifting back to what they tried to improve upon. And, Operant Conditioning degenerated by drifting from rate of response back to latency, duration, trials to extinction, and percent correct (Hull's four measures of response strength).

True, Fred Skinner sadly muttered and moaned to his current students and friends. But, nowhere did he blurt out about the decrease in cumulative recording and rate of response in the journal (JEAB) that we founded as a place to publish them. Only when too late did Skinner publish the whimpering article <Good by, my LOVELY>. Too little. Too late.

Observing Skinner's lack of attention to the quality control of his products, I determined to give immediate and accurate feedback to Standard Celeration persons whenever I noticed poor quality and degeneration in our products. Some have criticized me for being blunt, negative, or punitive in giving corrective feedback. But I'd rather be blunt in defending our products, than stand idly by and watch them degenerate.

SO, HERE COMES OG'S BLAST!

Our SC list shows signs of degeneration and of making me a liar to my friends. Here's my effort to save our SC list before I signoff the list because of the poor manners of a minority of members. We must not give up our list to list abusers. They can start their own lists, or continue to abuse other lists. But they should stay the hell off of our list.
LIST MANNERS AND ABUSE

GOOD LIST MANNERS:

A list is like a powerful loud speaker in a room of 100 working, networking, and chatting people. We should broadcast only messages important to the majority in the room. We should not use the loudspeaker to announce a reply to a friend or opponent.

1) Post things all of us should know. (Remember you are holding a powerful loudspeaker in your hands when you list! Everyone gets your message! Not everyone may want to hear it.)

2) Post websites and reference locations. (If you must call our attention to a hot new world of information that might help us all, or a downloadable software application, do only that. Post it with a one sentence description, and let us visit to find more.)

3) Talk Plain English. (If we could find an eprime or verb to be counter our computers could screen the postings and automatically return submitted postings high in verbs to be and high in words with over 2 syllables, back to the poster for rewriting. <Revolutioneering> has 6 syllables! The article that followed that title had a Flesch grade level off 14.9! We should aim for grade level 6.0 to 8.0!)

4) Talk Precision Teaching and Standard Celeration language. (Codic, duplic, echoic, and sequelic belong on the Verbal Behavior List serv and not on ours! Just as jump up, turn down, up bounce, and celeration belong on the SC list and not the VB list. Poorly mannered talk Greek in Rome. Equally poor mannered talk VB in SC. It brands the talker a careless intruder with no concern for the locals.)

LIST ABUSE:

1) Don't list your reply to 1 or 3 people. (Send an email to that person with carbon copies to the others. Our time is valuable. If you want our attention you must honor it. Do not defile our attention with replies to others.)

2) Don't list chat. (Most of us don't care why Tom Jones didn't visit Cumadora U. on his trip through Waywardstate. If you must chat, email Cumadora, and Tom.)

3) Don't advertise a new product, product descriptions, costs, etc. on our list. (Call our attention to a new product website with one sentence. Leave the catalog off our list and on the vendor's website.)

4) Don't list important things going on in other disciplines that we should be aware of (according to you). (We are big girls and boys now, and fully capable of screening other disciplines on our own. We do not need travel brochures on the marvels of Greece littering our SList bulletin board.)

LET'S BE GOOD TO OUR LIST.
LET'S KEEP IT LITTER FREE.
LET'S KEEP IT CLEAN!

TOO LITTLE? TOO LATE?

(The above two messages <OG's ListServ history> and <List Manners and Abuse> combined had 4 characters per word, 0 passive sentences (but several to be verbs), and a Flesch grade level of 8.4.)
I recently received this sad notice via e-mail. I would have forwarded it sooner, but have not had access to your addresses because my tired old Power Book 170 crashed and I had trouble getting my AOL 2.6 address book into AOL 3.0 on my new Power Book 1400c.

<<From: Beth Sulzer-Azaroff, [75463,1745]
DATE: 4/2/97 9:08 PM
RE: Ellie Reese

At 4:25 PM this afternoon Ellie Reese peacefully died of terminal pulmonary disease. Personally I am deeply saddened at the loss of one of my closest friends and colleagues. For the field of behavior analysis her absence will create a gaping rent. An exquisitely creative researcher, she led the way toward broad-based ecological experimental analyses of behavior. As a crafter of elegant prose and artful films and videos she breathed life into the concepts of behavior analysis, making them accessible to the world at large. It will take eons for the oceans to wash away the footsteps she left in the sands of time.

Beth Sulzer-Azaroff >>

Since 1953, I knew both Tom and Ellie Reese who taught at Mount Holyoke College. Ellie was the very first to invite me to present the research we were doing at the Behavior Research Laboratory of Harvard Medical School at Metropolitan State Hospital. I’ll never forget that first opportunity to present my human operant data. I was still a graduate student at the time.

Ellie was among those few who really knew the power of the free operant. In my recent article, "The Four Free Operant Freedoms, The Behavior Analyst, 1996, 10, 199-210" I quoted from what Ellie wrote about operanda in the "Free Operant Method" section of her popular textbook, "The Analysis of Human Operant Behavior (1966), Dubuque, IA: William C. Brown." Read what she wrote about the freedom to form responses.

<<The gerbil in figure 2 is pressing one kind of mouse lever. When the lever is depressed a certain distance, it operates a microswitch which defines the response. The gerbil may press with either paw or both paws, or he may climb on the lever or straddle it. Only those behaviors-but all of those- which operate the microswitch are defined as lever-pressing responses. (p.5)

A beautiful, clear, plain English description of the freedom to form responses in the free operant method.

That was our Ellie.

I will miss her. Sadly, many of you will never have the opportunity to meet her. But, you will have the opportunity to read her. Please do. She was one of the truly great free operant pioneers.

With Precision, Peace, and Love.

Og

Subject: Subscription of J of Precision Teaching
Date: Tu 27 May 1997 14:34:00 -0500 (CDT)
From: Marshall Dermer<dermer@csd.uwm.edu>
To: cmcdade@jsucc.jsu.edu

Hi Claudia,

It was so good to meet you at ABA! I would appreciate your sending me an order for subscribing to your journal.

Thanks,

Marshall

PS I though you might like the following. I think I will do a controlled study follow-up. "Who, Me Worry?" Marshall Lev Dermer <dermer@csd.uwm.edu>

Copyright 3/97

Several months ago, once each evening, I had set my wristwatch's countdown timer for one minute and began typing as many positive attributes about myself as possible.
At first, I could only enter twelve attributes per minute. So, I talked to family and friends.

Judy, my wife, smiled and suggested that I enter “kissable.”

Noah, my teenage son, sarcastically noted that I could do arithmetic (including divide by 1 and multiply by 0) breath, walk, think, and dress as well as toilet myself. Although I then reconsidered having introduced him to Mad Magazine, his suggestions reminded me of life’s basics.

My Aunt Katie told me that I was a terrific nephew and that I had been a wonderful son to my mother.

After about three weeks of suggestions and daily timings, I found myself entering about 31 attributes per minute. But I also discovered something else.

To improve my rate, I had practiced during the day. At first, I would intentionally practice. Gradually, however, I found myself spontaneously practicing in the car, while walking, and in bed when going to sleep.

Moreover, practicing to increase my entry rate was reducing the time I spent worrying. Stated another way, worrying about serious things like cancer had been replaced with worrying about something trivial like improving my entry rate.

Do I ever worry now? Sure, but now I have a way of controlling my worrying. I literally count my blessings -- as fast as I can.
The Use of a Treatment Package to Reduce Caffeine Intake and Increase Water Intake with a 21-Year-Old College Student

Betty Jo Wood and T.F. McLaughlin

The purpose of this research was to determine the effectiveness of physical prompts, self-monitoring, leaving money for soft drinks at home, and carrying water bottles to school, as well as daily assessment and self-charting to modify the caffeine intake of a 21 year old female a college student. An ABAC single-subject design (Kazdin, 1982) was employed to evaluate the impact on caffeine intake, as well as to increase water consumption. Throughout the study the student monitored number of Cokes consumed, as well as number of 8 oz. glasses of water drunk.

During baseline the number of glasses of water consumed was highly variable (M= 1.25; range 0-2), while the number of Coca Colas drunk was high (M= 3.75; range 3-5). When self-recording, bringing two water bottles to school, charting, and daily assessment were employed (Treatment Package 1), the number of glasses of water consumed increased (M=3.6; range 2-5), and the number of cans of Coke drunk declined (M=1.6; range 1-2). A return to baseline produced a small decrease in the amount of water consumed (M= 3.3; range 3-4), as well as an increase in Coke consumption (M=2.6; range 2-3). Treatment Package 2 consisted of the reintroduction of self-monitoring, daily charting and assessment along with leaving change to use in the pop machine at home. During Treatment Package 1, water consumption increased (M=4.79; range 3-6) while Coke consumption decreased (M=1.32; range 1-3).

The study indicated that the use of a treatment package was effective in reducing the caffeine intake of a college student. In addition, the amount of water that the participant ingested increased. Other factors contributing to the differential improvements might have been variability in the participant’s life. On test days, for example, she felt an increased need for caffeine.

As Fisher and Jensen (1990) have indicated, increasing one’s intake of water is healthy and aids in many bodily functions ranging from digestion to circulation. The participant’s goal was to drink six glasses of water and only one Coke a day. This goal was not reached for three consecutive data days, but the participant felt better physically. This should motivate her to continue the program. At this writing, the student continues to carry out the procedures.

References
Precisely Teaching Street Names and Locations

Rosemary Ashbaugh and T.F. McLaughlin

The effects of a flash card drill and a say/find street signs intervention were evaluated with a 17-year-old male high school dropout with mild mental retardation. Twenty common street sign names were used. After a three day baseline, flash card drill was implemented. The next phase employed both saying street names and pointing to them on a map of a large urban city visited by the participant. The last phase consisted of two generalization probes to assess the participant’s skills at reading a map and driving his vehicle to the correct street. Precision Teaching techniques were used to count, record, chart, and make instructional decisions about see/say street names. Results revealed a significant increase in the frequency of see/say as well as say/point correct street names, and a significant decrease in errors between baseline and the first intervention was noted. Important instructional implications for the use of these procedures are outlined.

Flash cards are often used to teach basic skills to students (Van Houten & Rolider, 1989). Flash cards have been successfully employed to teach letter names and sounds (Young, Heccimovic, & Salzberg, 1983), multiplication facts (Maheddy & Sainato, 1985; Van Houten & Roiter, 1989), sight words (Drago & McLaughlin, 1996; Heron, Heward, Cooke, & Hill, 1983), and picture naming (Olenick & Pear, 1980). Since the use of flash cards has been successful in both teaching sight words (Heron et al., 1983) and naming objects by person with mental retardation, the present case report examined their use in teaching an adolescent street names and locations on a map. Knowing street signs and being able to find one’s location, can be viewed as a prerequisite skill for economic success and independence in our society (Cipani, 1988). Such knowledge and skills should allow a young adult to be more independent, mobile and possibly more employable (Matson, 1988).

The purpose of this study was to evaluate the effectiveness flash cards, corrective feedback, praise, and generalization techniques in the developmental street naming, map reading, and actual driving to a location using Precision Teaching measurement and data-based decision making. The investigation focused on the correct and incorrect frequency of see/say street names, see/say and point to street names on a map, and finally being able to drive to the map location in an automobile. As additional purpose was to test for generalization of skill acquisition (Stokes & Baer, 1977) demonstrated by actual driving to location of the street names.

Method

Participants and Setting

The participant was a 17-year-old male, identified as mildly mentally retarded. The student had qualified for special education services pursuant to the state and federal definition for this disability designation (Washington Administrative Codes for Special Education, 1992) before he dropped out of school two years previously. Assessment results indicated that the participant exhibited large deficits in academic achievement related to written language, was 5.4 years below grade level on the Woodcock-Johnson Tests of Academic Achievement-Revised (Woodcock & Johnson, 1990), and had an overall IQ of 51 on the WISC-R (Wechsler, 1974). However, the participant had a valid Washington State Driver’s License, but was unable to read street names and find locations.

The study took place in the participant’s home in a rural and remote part of the Northeastern United States and in the participant’s car while driving on the streets of a large urban city in the Pacific Northwest.
Materials

The curriculum was composed of flash cards with models for each of the street names. A street map of a large metropolitan city located 90 miles from the experimenter’s residence was also used. The sessions lasted a total of 20 minutes, three to four times a week.

Measurement Procedures

Precision Teaching measurement procedures were used throughout the study. Baseline and First Intervention were see/say street names. In the third phase, a say and point to the street name on a city map was added. During generalization probes, the participant had to drive to the street location on the map. Even though the participant had to engage in more than one movement cycle in the third and fourth phases, the total movement cycle was scored as either correct or an error. The participant’s last timing was recorded on the Standard Celeration Chart. The intermediate instructional aim was 20 correct responses based upon the evaluation criterion with no learning opportunities (i.e., errors) during the trials. This instructional aim was a modified version of the performance standards developed during the Seattle-Tacoma-Spokane (i.e., SST Project) Child Service Demonstration Project (Intermediate School District No. III, 1974) and the Precision Teaching Classroom Learning Screening Instrument (Koenig & Kunzelmann, 1977). In addition, the participant’s tool rate was determined, as well as a comparison rate that was determined by the first author’s performance on the task.

Design Elements and Experimental Conditions

An ABCA single case replication design (Kazdin, 1982) was used to evaluate the effects of flash card drill and corrective feedback on see/say, see/say/point, and drive in a car to street names.

Baseline. During baseline conditions the first author simply presented 20 flash cards to the participant. Street names needing improvement were selected from the three sessions.

Practice, flashcard drill, and corrective feedback. During this intervention condition, participant was provided with instruction. He was told to “practice his words when the experimenter was not there,” and especially to practice the street names that he was having difficulty remembering. Five minutes were allocated to the participant to complete going through his error cards. During these error drills, specific street names were placed in three separate parts of the flash card stack. A two minute time trial followed the error correction, drill, and corrective feedback. This condition was in effect for eight calendar days.

See/say street names and point to street names on map. The same basic conditions and procedures employed in the first intervention were continued, but the participant had to also point to the correct street name on a city map. Traditionally in Precision Teaching, three consecutive days, with the number of corrects below the instructional aim and the minimum rate of progress line and the learning opportunities below 5 per minute, indicates that the participant is making unsatisfactory progress towards mastering the skill (Sweeney, Omness, Janusz, & Cooper, 1992). However, the first author felt that additional time and work on this phase was needed, so she kept the participant on the program longer than recommended. This condition was in effect for 12 calendar days.

Generalization probes (drive car to street locations). On two occasions, the experimenter and her brother drove to the city and evaluated the participant’s performance.

Results and Discussion

See/Say Street Names

Improvement in the see/say street names was seen when individual practice, error correction and drill, plus corrective feedback were employed. For corrects, the difference between baseline and the first phase was statistically significant \( U = 0; p = .024 \). This was also noted for errors \( U = 0; p = .024 \). The number of corrects found during baseline for see/say street names was low \( \bar{M} = 12; \text{range 11 to 13} \), while the frequency for errors was high in baseline \( \bar{M} = 8; \text{range 7 to 9} \). When independent practice, error correction and drill with flash
cards was implemented, performance improved. The number of corrects increased to 20 with an average of 18, range 16 to 20, while the number of errors declined (M=1.6, range 0 to 4).

See/Say and Point to Street Names on Map
When the participant was in this phase, he not only had to say the street name but also point to the street on a city map. During the first part of this phase, frequency of corrects was low and errors high. However, by the end of this phase, corrects were high and error rate low. For the last two sessions the frequency increased to 19.0 for corrects with only one error.

Generalization Probes
During the last two sessions where the participant drove to the street sign, there were a large number of errors (18) with 2 corrects.

The remediation of a see/say and finally the see/say/point was consistent with previous studies focusing on improving functional skills with Precision Teaching procedures and flash cards. The participant’s learning picture appears to show a more inconsistent celeration of corrects across both intervention conditions, when compared to baseline scores. His learning opportunities did show a + learning trend in both the independent practice and drill with flash cards.

Although the student improved both see/say and point skills with street names during this study, he was unable to transfer the skills over to driving in a large urban city. The lack of skill generalization to another response topography (say/point to a drive/find) was disappointing. This change in topography may have been too large. It may be beneficial for future research to continue to probe the participant’s driving skills with finding streets and determining his location starting in his rural town, before moving to a large urban city. Another procedure, where the participant Charts were posted (Van Houten, 1980) in the car, could serve to prompt an increase in performance. Training the participant to count, record, and chart his own performance on Standard Charts could improve performance evaluation for both the experimenter and participant.

Future research should continue to examine under what conditions increases in fluency of skills in saying and pointing are related to generalization of these same or similar skills to other settings and behaviors (Howell & Lorson-Howell, 1990). The data in the present analysis were very clear that this was not the case.

References


Effectiveness of Error Correction, Error Drill, Praise, Role Reversal, and Hand Signals on Correct Rate, Error Rate, and Comprehension

Tiffany Abrams and T. F. McLaughlin

The purpose of this study was to determine the effectiveness of drill, role reversal, and hand signals on correct and error reading frequency and comprehension. The participant, "Sarah", was a grade-sixth student with learning disabilities. Data were taken at the end of each session from Sarah's basal whole language reading materials. The teacher provided verbal praise (e.g. "good" and "well done") for improved student performance at the end of the session when the participant's data were charted. Effects of various procedures were evaluated in an ABAC single subject replication design. During the first intervention error correction, error drill, and praise were evaluated. After a second baseline, a role-reversal procedure where the same procedures were used but with "Sarah" functioning as the tutor and hand signals were added. Outcomes indicated that Sarah's see/say words in context significantly increased, while error frequency decreased during both interventions. Comprehension scores also improved. Implications of the outcomes and procedures for practice are discussed.

Reading continues to be one of the most important academic skills taught to children in today's schools. Research in reading indicates that the child who reads well, has a very high probability of being successful in school (Slavin, 1989; Slavin, Madden, Dolan, Wasik, Ross, & Smith, 1994). If reading skills are not established, the child has a greater chance of later dropping out of school, as well as being incapable of performing successfully in today's society (Hart & Risley, 1995; Howard, McLaughlin, & Vacha, 1996; Vacha & McLaughlin, 1992).

Several data-based and effective procedures from Precision Teaching (Johnson & Layng, 1994; Lindsley, 1991) have been suggested to improve the literacy of children and adults. These have included allowing the student to reread the materials several times (Sweeney, Omness, Janusz, & Cooper, 1992), error drill, where students practice the words, phrases, or sentences which they read incorrectly (Brunner, McLaughlin, & Sweeney, 1993; Freeman & McLaughlin, 1984, Smith, 1982), previewing the materials to be read (Haring & Eaton, 1978; Smith 1982), employing consequences when student performance reaches late acquisition or fluency (Haring & Eaton, 1978; Smith 1982). Precision Teaching can also permit students to increase their opportunity to respond (Greenwood, 1991; Greenwood, Delquadri, & Hall, 1984; Morgan & Jenson, 1988). One such procedure has been assisted reading (Hagedorn & McLaughlin, 1982) which exposes the child to accurate reading patterns either with the teacher modeling through reading or by hearing teacher-made or commercially available tape recordings of the reading passage as the child simultaneously reads orally the same passage. According to Hoskisson (1975, p. 313), "...the experience in reading they [the students] need in order to acquire the visual or graphic features that will allow them to use their knowledge of the natural way they have learned their spoken language." Assisted or repeated reading has been more commonly used to build reading rate and fluency in oral reading and to decrease the number of errors (Gregori & McLaughlin, 1996; Holmes & McLaughlin, 1987; Sweeney et al., 1992; Smith, 1979; Van Wagenen, Williams, & McLaughlin, 1994; Gilbert, Williams, & McLaughlin, 1996; Williams & Gilbert, 1984) than to improve comprehension.

The purpose of this study was to implement and evaluate a package of teaching techniques that included error correction and drill, role reversal, hand signals, and praise. Data were collected for correct and error frequency for see/say words in the context with a 12-year-old male elementary
student with learning disabilities. To extend and partially replicate our recent work (Gregori & McLaughlin, 1996) data on reading comprehension data were gathered.

Method

Participants and Setting
The participant, "Sarah," was a 12-year-old female elementary student with learning disabilities. The participant was assigned to a resource room for 30-minutes each day with the goal to increase her reading and vocabulary skills. Sarah's performance was in the low average range for reading in the regular classroom. On the Key Math Diagnostic Arithmetic Test (Connolly, Natchman, & Pritchett, 1976), Sarah scored a 3.9 overall grade/age equivalent in the beginning of the academic year. Results from the Wechsler Intelligence Scale for Children - Revised (Wechsler, 1974) were a verbal IQ of 92 + 8 and a performance IQ of 80 + 9. This yielded a full scale IQ of 82 + 7. Data were collected daily in the special education classroom by Tiffany Abrams and the teaching assistant.

Dependent Variable and Measurement Procedures
The dependent variables were see/say words and accuracy of comprehension questions over the child's reading material. Passages were taken from the stories in the child's basal whole language basal reader. During a 30-minute independent teaching session, the student completed a reading assignment without being timed, and then was tested on the words Sarah missed or were difficult for her. Comprehension questions were developed by the teaching assistant and experimenter and included information related to the reading such as "right there," "think and search", "on my own" and "writer and me" questions. For example, "What does the author mean by the statement "right there"?", or "Find the answer to this question, "When did John come home?" 'on your own'". Data were collected at the end of each teaching session through a 1 minute timing for correct and error words and a non-timed trial when the participant answered the comprehension questions from the reading materials.

Experimental Design and Conditions
An ABAC single case design (Kazdin, 1982; McLaughlin, 1983) was employed to assess the effectiveness of the various interventions to baseline conditions. A description of each condition follows.

Baseline 1. During Baseline 1, Sarah read reading materials from her basal reader, while the first author followed along providing feedback and error correction. A recording was taken of the words the student mispronounced, or read after a pause of 5 sec. or more, and a list of comprehension questions were formulated over the material. No praise, role reversal, or hand signals occurred during Baseline 1 which lasted four sessions.

Error correction, error drill, and praise. A one-week training session was held after Baseline 1. During training, student and teacher met individually each day to determine how much progress had been made since baseline. The first intervention attempted to increase correct and decrease error rate through instruction and error drill. Tiffany and the teaching assistant monitored the student's reading performance and provided error correction as the student read her materials orally. Also, a probe sheet was developed where Sarah practiced the words which she could not initially pronounce, substituted words or paused for longer than 5 sec. Sarah was required to repeat her error words until she could say the words without an error. She then read again from the basal reader.

Baseline 2. Baseline procedures were again implemented for one school week and four sessions. Tiffany Abrams and teaching assistant continued to record data for correct and error rate, as well as the frequency of comprehension questions answered correctly. No feedback was provided.

Error correction, error drill, role reversal, and hand signals. During this phase role reversal and hand signals were added to error correction, error drill and praise procedures. Role reversal consisted of Sarah using the follow along sheet to provide error correction and drill to the teaching assistant who deliberately read inaccurately. Hand signals involved Sarah's signaling when to begin and stop reading to the teaching
Data were taken for Sarah's correct and error rates, as well as comprehension. This last condition lasted for four sessions.

**Results**

**Chart 1: Correct and Error Rates: See/Say Words in Context** During the first baseline condition, correct rate was low and averaged 57.5, range 47 to 59, and error rate was low with a mean of 59.5, range 55 to 67. With the implementation of error correction, error drill, and praise, Sarah's correct rate increased and averaged 76.25 with a range 57 to 103. Sarah's error frequency decelerated to a mean of 37.25, range 11 to 57, indicating a cross-over jaws learning picture. Return to baseline resulted in a further increase in correct rate, mean 81.25; range 68 to 91, and a small decrease in error rate (M = 32.75, range 23 to 46). The addition of hand signals and role reversal to the treatment package generated further increases in correct rate (M = 101; range 91 to 114) and decrease in errors (M = 3.0, range 23 to 0). Some very impressive celerations--x5 for corrects and +10 for errors--are seen.

A Friedman Two-Way-Analysis of Variance (Siegel, 1956) across phases was calculated. Differences between phases, corrected for ties, were found to be significant ($\chi^2 = 11.1; p = .0112$) for both corrects and errors.

**Chart 2: Frequency of Think/Say Comprehension Questions** For the first baseline, the number of comprehension questions correctly answered ranged from 0 to 2, M =1.25. The first intervention generated an increase in the number of comprehension questions answered correctly with mean of 3.75, range 3 to 5. Return to baseline generated a decrease in the number of comprehension questions answered correctly (M = 2.25; range 1 to 4). Adding role reversal and hand signals increased the number of comprehension questions answered correctly (M = 4.75; range 4 to 5). Friedman Two-Way-Analysis of Variance (Siegel, 1956) across phases showed differences between phases, corrected for ties, to be significant ($\chi^2 = 11.1; p = .0112$) for both corrects and errors.

**Discussion**

While correct and error rates were improved with error correction, error drill, and praise, adding role reversal and hand signals had the greater effect for both corrects and errors. Return to baseline did not decrease corrects or increase errors. Academic behaviors are difficult to make to return to baseline levels (Kazdin, 1982; McLaughlin, 1983). Also, the student's rate of response was approaching fluency for the see/say words in context; some maintenance of treatment effects were being seen (Smith, 1982).

Comprehension scores did return to prior baseline levels. Sarah had far less opportunity to practice comprehension skills, compared to the number of opportunities provided for see/say words in context. Other researchers have postulated greater maintenance of treatment effects when the opportunity to practice a specific skill is higher than when it is not. This procedure has been labeled "build and sustain response fluency" (Sulzer-Azaroff & Mayer, 1991). This outcome has been documented in both the basic (Weiner, 1964) and applied research (Becker & Carnine, 1981; Young, West, Howard, & Whitney, 1986).

Sarah reported that she enjoyed the procedures with the words with which she had difficulty reading. She claimed they were fun and helpful; she especially enjoyed one-on-one instruction and role-reversal.

The teaching assistant also enjoyed participating in the one-on-one reading with Sarah, noting that in spite of Sarah's great difficulty with reading words, she improved her confidence with reading and learning other subject-matter areas.

**References**

Error correction, error drill, and praise

Baseline 1
Baseline 2

Error correction, error drill, role reversal, and hand signals

COUNT PER MINUTE

COUNTING PERIOD FLOORS
MIN HRS

SUCCESSIVE CALENDAR DAYS
Elementary Student
McLaughlin
Abras
McLaughlin
McLaughlin
SUPERVISOR
ADVISER
Gonzaga University
MANAGER
AGENCY
Abras
Abras
BEHAVIOR
McLaughlin
DEPOSITION
AGERY
TIMER
COUNTER
CHARTER
See to Say
Words in Cont


Reading Racetracks: A Direct Replication and Analysis with Three Elementary School Students

Cheryl Anthony, Lisa Rinaldi, Carol Hern and T.F. McLaughlin

We used “reading racetrack” procedure and Precision Teaching techniques to increase the accuracy and fluency that three fourth-grade students read Grade Two Priority Words in isolation. One participant received special education services for learning disabilities. School personnel viewed the other two participants as academically at risk. During the reading racetrack intervention, participants improved their accuracy and fluency in reading sight words. We discussed the applicability of employing reading racetracks as a drill and practice procedure for children academically at risk.

Children who read well usually achieve well in school (Slavin, 1996; Slavin, Madden, Dolan, Wasik, Ross, & Smith, 1994). Children who do not read well have a greater instance of dropping out of school and have less success in work and other life skills. (Howard, McLaughlin, & Vacha, 1996). Unfortunately, educators continue to disagree as to how to improve their reading skills, so all the students will be literate when leaving our current educational system (Rinaldi & McLaughlin, 1996; Rinaldi, Sells, & McLaughlin, in press; Slavin, 1996).

We used the “reading racetrack” procedure and Precision Teaching techniques to improve the accuracy and fluency that students read Grade Two Priority Words in isolation. We also replicated and extended the findings of Rinaldi and McLaughlin (1996) with students with and without disabilities. In the present replication we used a more rigorous experimental design that Rinaldi and McLaughlin.

Method

Participant and Setting
The participants were three fourth grade elementary school students. One student was labeled as learning disabled and met the state and federal guidelines for that disability designation. That student received 60 minutes of instruction in the resource room for reading and written language. Accordingly, the other two students were achieving at the 2.2 grade level in reading. Each received 30 minutes of extra assistance each day in both in-class and pull-out models from the classroom teacher and the learning assistance (LAP) aide.

This study took place in the resource room of an urban elementary school in a low socioeconomic area in a large urban city. The first author, an undergraduate student at a local university, worked with the participants. The primary teacher in the resource room had five years of teaching experience and had an instructional aide. The first author worked with the child for five minutes two to three times per week.

Two pinpoints evaluated in the present study were the number of words read correctly and incorrectly per minute. An error was defined as a word read incorrectly, an omission or addition of a word, or any words read out of order. An error that was self-corrected before going on to the next word was counted as correct.

Upon the completion of each one-minute timing, the student counted the number of words that he read and self-recorded these data on the lines provided along the bottom of the data form (see Figure 1). The first author tallied the number of errors, gave this number along with specific feedback (e.g., “great job,” “you missed apple today,” “you were really working hard today,” etc.) to the child, who would then record these
data. They were then collected and the first author rescored the students’ reading from an audio-tape. Finally these data were displayed on the Standard Celeration Chart.

**Experimental Design and Experimental Conditions**

A multiple baseline design (Kazdin, 1982) across participants was used to analyze the effects of using the reading racetracks. By introducing reading racetracks at different points in time, changes in performance can be attributed to their use, not some other variable such as maturation, changes in word difficulty, time, etc.

**Baseline.** The baseline consisted of having the participant read the list of Grade Two Priority Words aloud. Each child was given the list of words and was told to read them as quickly and as accurately as he could. At the end of one minute the first author said “stop,” praised the student for his hard work and cooperation and then recorded data. Baseline consisted of five one-minute timings over the course of 3 to 7 sessions.

**Reading racetracks.** A more complete description of data collection and teaching procedures can be found in Rinaldi and McLaughlin (1996) and Rinaldi et al. (in press). Briefly, each child’s words were placed in the individual cells of the reading racetrack form. These words read from the racetrack were taken from the Second Grade Priority Word List (Spokane School District #81, 1996). The words taken from this list and put on the reading racetracks sheet were carefully selected to avoid having any two words on a particular racetrack that were either auditorily or visually similar. For example, “apple” and “zebra” could be used from the list on the same race track, but “ate” and “late” could not. The children were provided with their racetracks and were told to study them on their own. They raised their hand when they were ready to read their lists. The students were then taught by the “model, lead, test and retest” Direct Instruction procedure to teach or review the words that they just missed. This procedure consisted of first modeling the correct pronunciation of the word, then saying the word with the child, the child would then read the word independently, and finally, the child would be asked to reread the word correctly several more times. This teaching procedure took approximately one minute. At the end of the session, the children self-monitored and graphed their performance for both corrects and errors (See Figure 1). The reading racetrack intervention occurred for 9 to 10 data days (4 to 5 weeks of school).

**Reliability**

Interobserver reliability checks were taken once during baseline and once during reading racetracks. The percent of interobserver agreement was calculated by dividing the smaller number recorded by the larger and multiplying by 100. The overall percent of interobserver agreement was 100%.

**Results and Discussion**

The number of words read correctly and incorrectly appear in Charts 1 through 3. The number of words read correctly during baseline was 36 for the three students (range 21 to 51). Median rates ranged from 32 to 45 words. The mean number of errors made during baseline was 6.0 (range 1-9) with medians from 4 to 7 errors.

With the implementation of the reading racetracks there was an immediate jump up for the number of words read correctly by each participant. The mean number of words read correctly during reading racetracks for all three students was 106 (range 45 to 86) and their median performance ranged from 103 to 119. The number of errors markedly decreased. The mean number of errors across participants made during reading racetracks was 2.0 (range 0 to 11) with a median error rate of 0.0.

The reading racetrack intervention was effective not only in terms of a jump up in frequency of correct words read, but also in the elimination of nearly all errors. The improved error performance produced an important change in accuracy of performance. Each of the participant’s regular classroom teachers and the resource room teacher were impressed with their performance in reading see-say words in isolation during this program.
The use of a multiple baseline design suggested a functional relationship between the use of reading racetracks and changes in both correct and errors. These outcomes add further strength to prior outcomes (Rinaldi & McLaughlin, 1996). In that report, only one student was used and only an AB design was employed. Additional replications by other researchers using other students appears warranted. In the present replication, students with disabilities and those without disabilities served as participants. Future research could use younger or older students.

Reading racetracks are very attractive and practical because after the initial session, subsequent daily sessions were easy to implement and manage. This also occurred in the first study (Rinaldi & McLaughlin, 1996) and in an additional replication (Rinaldi et al., in press). This program in conjunction with classwide peer tutoring (CWPT) (Greenwood, Delquadri, & Carta, 1988) could offer individualized instruction for an entire classroom in less than 10 minutes of daily classroom time. This could be especially valuable in grades one and two when students are expected to learn and remember sight words that do not follow the phonetic rules.

References
A Self-Experimentation on the Detection of Forgets: Using Encouraging Think/Say and Hear/Tally Statements

Melissa Judy, Paul R. Malanga, Randy L. Seever, and John O. Cooper

This self-experiment investigated the effects of daily encouraging self-statements said orally within a one-minute counting period on the frequency of detected forgets. We used six weeks of initial baseline data (i.e., the Before condition) to assess the frequency of detected forgets in the absence of the intended treatment of encouraging self-statements. We observed an immediate change in frequency of detected forgets following the initiation of the encouraging self-statements. As the frequency of encouraging self-statements accelerated, the frequency of detected forgets improved to a total frequency spread of no occurrences to 1 occurrence per counting period during the final five weeks of intervention. The frequency of detected forgets remained low for the four weeks without the counting periods for the daily self-statements.

Within the past 50 years, self-experimentation has remained mostly unexplored in the behavioral sciences. Rarely do behavioral scientists and practitioners experimentally analyze their own behavior. More often, scientists experiment on and observe non-humans in operant chambers or humans in laboratories, classrooms, clinics, and other numerous settings (Neuringer, 1981). Experiments with other participants provide meaningful and necessary information about human behavior. As B. F. Skinner (1953) expressed in Science and Human Behavior, however, there exists a part of the universe enclosed within the skin, and this portion of the universe remains relatively uncharted. Exploration and discovery of the inner self have the potential to provide great insight concerning one's inner concerns and their solutions.

Self-experiments have a long history in the medical and behavioral sciences. In the medical field, for example, over a period of 30 years, Sanctorius studied the energy expanded by living organisms by weighing all the food he consumed and then weighed his excrement. Some experiments involved more physically challenging procedures. For instance, Forssmann placed a catheter through the veins in his arm to his heart to demonstrate the feasibility of this medical procedure. Helstod used LSD in a self-experiment. Henry Head severed the nerves in his arm to study the regeneration of pain. Lazear performed the ultimate sacrifice in self-experimentation -- he died from his experiment with yellow fever (Neuringer, 1981).

Experimental psychologists have a history of reporting their own experiences. The early volumes of American Journal of Psychology and Psychological Review document numerous cases in which the experimenter was the sole or major subject in his experiment. For example, Lombard (1890) examined the effects of fatigue on muscular contractions using his own muscles. Thorndike (1900) conducted a series of experiments on mental fatigue where he served as the primary subject. Dressler (1891) investigated his own response frequencies as functions of time of day and of physical and mental exercise. Ebbinghaus's (1913) inquiry into his own memory in an extensive series of experiments lasting for more than two years provided some of the most renowned studies of self-experimentation in psychology. His discoveries continue to influence experimental psychology. More recently, Neuringer (1981) used himself in an experiment to study the effects of physical activities on intellectual tasks and behaving randomly. Also a number of Neuringer's students perform self-experiments of various conditions (Neuringer, 1996). Calkin (1981) and Conser (1981) performed self-experiments measuring
inner behaviors of positive and negative thoughts and feelings.

A number of reasons exist that encourage self-experimentation. Foremost, it expands our understanding of human behavior (Neuringer, 1981). Neuringer appears to believe that discoveries derived from non-human and human laboratory research ultimately offers only hypotheses about our own behavior. "[I]f my interest is my own behavior, I must test on myself any hypothesis offered about me by the experimental analysis of animals or other people." (p. 89). Experiments conducted on humans and other animals in controlled settings may yield limited applicable results. Neuringer (1981) advocates, "A simple behavioral 'law' obtained from laboratories may be relevant for some people some of the time, but rarely will the law be relevant to all, all of the time" (p. 89). Ultimately, self-experimentation "is compatible with the experimental analysis field and, indeed, can be viewed as the next step in the evolution of that field: from the experimental analysis of the behavior of rats to the behavior of psychotic people to the behavior of normal people to one's own, ongoing behavior" (Neuringer, 1981, p. 90).

Some experimenters have concerns with doing and reporting self-experimentation as science. Neuringer addressed a number of these concerns in Self-experimentation: A Call for a Change (1981) and challenged those concerns. One major concern addresses the difficulty of replication. Consequently, this difficulty makes it harder to acquire knowledge about general human nature. Nevertheless, the difficulty of replication occurs with most experiments. Some experiments will yield more or better general insights than others. A second concern addresses experimenter bias, where expectations may be self-fulfilling. Experimenter bias, however, can exist in all areas of experimentation. Neuringer believes the checks and balances that accompany the scientific process will make the experimenter bias issue associated with self-experimentation less salient. Low experimental control presents a third concern from those who question the reliability of self-experimentation. Consider, though, that Copernicus and Darwin worked within extremely complex and uncontrolled subject areas that resulted in gains in scientific progress (Neuringer, 1981). Fourth, self-experimentation takes time away from engaging in leisure activities not associated with experimentation. Fifth, there is the lack of models who demonstrate benefits from employing and analyzing personal behaviors.

The final and perhaps greatest concern, is the absence of measuring and reporting interobserver agreement. Ultimately, truth by agreement merely provides an indication that two independent observers agree to the existence of an occurrence or nonoccurrence of an event based on a definition under the control of similar contingencies. Consequently, this "agreement" has the potential to occur solely based on method rather than philosophy. Simply because the determinations of a response are only accessible to the individual performing the behavior does not make the response less real or less valid (Moore, 1995).

These concerns possess a degree of validity. Nevertheless, overcoming these concerns is not an impossible task. Many scientists have succeeded, despite the obstacles, in performing self-experiments that produced great contributions to behavioral science.

We analyzed the effects of self-statements on the first author's (Melissa Judy) encounters with items previously forgotten. These self-statements focused on encouraging Melissa to improve her memory. To quantify this encouragement, she made a daily tally of the number of self-statements that she said orally during a one-minute counting period. Her remembrances of items forgotten appear as the total number of detected forgets within 24-hour counting periods. This self-experimentation on inner behavior represents the distinguishing feature of our research.

We addressed the following questions. What effects will daily encouraging self-statements said orally for one-minute have on daily encounters with items previously forgotten? Will encouraging self-statements be functionally related to the frequency of forgets detected? How will the number of daily self-statements change over the course of the experiment? How will encouraging self-statements affect the number of "quickies" (i.e., items expected to be completed within approximately 5 minutes, but are forgotten)

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encountered each day? What effect will the absence of encouraging self-statements have on the frequency of detected forgets?

**Method**

**Participant**
The nature of this experiment dictated that I, Melissa Judy, serve as the sole participant of the study. As a 28 year old college student, I engage in a number of activities and responsibilities. I spend a large amount of personal time working on school related activities such as papers, study guides, projects, or reading. In addition, I work 3 to 4 days a week doing in-home personal care for individuals with disabilities. My father and I frequently engage in social activities at home and in the community. For instance, we attend movies or the theater, eat out, and vacation together. I take care of many errands and household responsibilities for him as well. I coach and play sports (softball) from Spring to Fall and try to attend some professional sporting events and do other recreation with friends whenever possible (e.g., attend movies, eat out, talk).

I often and quickly forget things that have caused me personal, professional, and academic difficulties. This behavior pattern generated concern and produced emotional distress and unpleasant consequences as a function of forgetting. Clearly, my behavior made me a suitable candidate for this research topic.

**Settings**
I counted detected forgets during each day of the study, in all settings and situations that I engaged. For example, I counted forgets while at home, at school, driving in my car, in every social setting, and during all activities. I collected data at any place and time of the day that I encountered an item previously forgotten.

**Pinpoints**
The number of detected forgets that occurred in daily twenty-four hour counting periods defined the pinpointed counts. I counted three characteristics of forgets.

One characteristic included any thought or planned action for the future, whether immediate or distant, that I forgot to do in a designated or sufficient amount of time to complete the action. For example, I planned on my way home from school to buy bread and milk at the store. I bought the milk but did not buy bread. If I "remembered" the bread after leaving the store, I counted that event as a detected forgot.

A second characteristic of detected forgets included of any piece of information that I did not remember within a 15-second period. For example, when I could not immediately recall the name of a person or a book title for instance, I counted that event a detected forgot.

I called the third characteristic of detected forgets a "quickie." A "quickie" was any action I thought of with the expectation for it to occur within a short amount of time (approximately five minutes), but I forgot to do it. For example, my call waiting signal sounded while my brother and I talked on the telephone. I answered the call waiting to receive a call from my graduate advisor. I told my advisor I was on another line and asked if he would mind holding while I said good-bye to my brother. After I said good-bye, I disconnected the line and did not speak with my advisor. When I learned I left my adviser holding a dead telephone line, I counted that event as a "quickie" forgot.

I measured the dependent variable daily throughout a twenty-four hour period beginning and ending at 8:00 AM each day during the study. I selected this counting period as a result of the variable amount of sleep that I receive each day. I usually go to bed between 1:00 AM and 3:00 AM in the early morning and rise sometime between 7:00 AM and 8:00 AM. The twenty-four hour interval enabled me to record data at any time. For example, I could record when I tended to stay up later than normal, or if I woke up and remembered something forgotten. Consequently, I displayed counts on a Standard Celeration Chart with the counting period floor marked at the 24 hour frequency line.

**Experimental Design**
I used a single-subject withdraw design ($A_1 A_2 B A_2$) to assess the effects of encouraging self-statements on the number of forgets occurring in a twenty-four hour period. I measured the number of detected forgets during two baseline con
ditions (i.e., Before conditions), a treatment condition (i.e., During condition), and a return to baseline condition (i.e., After or Maintenance). I defined stability as celerations multiplying by x1.1 or less or dividing by /1.1 or less per week. Following a stable celeration in the last three weeks of the second Before condition, I began the daily encouraging self-statements. After ten weeks in the treatment condition, I then returned to the After condition where I removed the daily encouraging self-statements, but I continued to measure the number of detected forgets.

**Materials**
The materials I used included:


2. A wrist counter that has a button on the side that I pushed once per each count to keep track of detected forgets. Three windows on the face of the counter indicate the number of counts to 999. The counter increases at increments of 1 by pushing the button on the side, or manually operated knobs located on the face of the counter increase by 1's or 10's or 100's (Lindsley, 1968).

3. One data sheet to record the type of forget, the description of the detected forget, and whether the forget was a "quickie" or not. I used another data sheet to display the total number of encouraging self-statements said daily with the date.

4. An audio tape recorder, GE model # 3-5363A.

5. A pad of paper for tally marks, and

6) Pens and pencils.

**Procedures**

**Before 1.** Following the first week of data collection, I altered the initial definition of detection of forgets to the one described previously in the "pinpoint" section. Initially, the definition did not include the characteristic of a "quickie," and only involved detecting forgets that were concrete (e.g., to call someone, leaving a book at home, locking the door). It did not include forgets concerning mental issues, for example, people's names, things I wanted to say, and whether I forgot a forget. The following conditions used the improved definition.

**Before 2.** This Before condition consisted of 5 weeks of data collection until I established a steady state of responding. When I detected a forget, I marked a count on the wrist counter. I also wrote the type of forget, and the description of the forget on the data sheet that I carried with me throughout the day. The different types of detected forgets consisted of "interpersonal," that applied to any forget that pertained to or directly affected another person (e.g., returning a call), "academic," that encompassed anything directly relating to school, or "personal," which pertained to all other detected forgets. A detected forget that would have acquired the characteristic of a "quickie" included any item that required execution within approximately 5-minutes, and that I subsequently forgot before completion. I transferred the information to the identical data sheet on my computer and charted on a Standard Celeration Chart the total number of detected forgets that occurred in a counting period of twenty-four hours. I repeated this procedure each day except for those days that I voluntarily chose to postpone charting until the following day. I never exceeded two days without charting the data.

**During.** After I achieved a steady state of responding in the Before 2 condition, I introduced daily one-minute oral encouraging self-statements (e.g., I will have less forgets. I will have more remembers. I will perform better. I will not forget anything today.). I created and used these self-statements to provide incentives and motivation to decrease the number of detected forgets and improve the amount of items remembered. I performed this intervention daily in the morning usually close to the beginning of the counting interval at 8:00 AM as think-to-say and hear-to-tally learning channel sets. I said the statements into the audio tape recorder for one minute. I then listened to the recording, tallied the number of statements while it played, and transcribed the total number of self-statements I said on a data sheet that indicated the total number and the date. Approximately every day, I charted this information on a Standard Celeration Chart.
After (Maintenance). I measured the maintenance of the behavior beginning in the 16th week of the study. Then I concluded the intervention of making oral encouraging self-statements and returned to the Before condition. I recorded detected forgets in the same manner as exercised throughout the study. When I detected a forget, I tallied it on the wrist counter, wrote the relevant information on the data sheet, and I subsequently charted the data on a Standard Celeration Chart.

Results

The overall results show an accelerating frequency of encouraging self-statements counted in one minute and a decelerating frequency of total daily detected forgets. The Standard Celeration Chart #1 displays the count per 24-hour period of detected forgets during both initial Before conditions, the self-statement condition, and the After condition. The Chart shows the Before condition with the final three weeks of steady state of detecting forgets. The Before condition indicates a performance spread from no occurrences to 12 counts per 24-hour counting period. The During condition continued for approximately ten weeks with the one-minute counting of self-statements in effect. The Chart displays an initial turn-down in celeration from the Before condition to the During condition. The total frequency for the During condition spread from no occurrences to 4 occurrences of detected forgets. The After condition consisted of 24 days of data collection. A steady state of responding occurred during the After condition with a frequency spread from no occurrences to 1 occurrence. An exception to that frequency spread was the outlier data points graphed on 6/29/96, 7/9/96, and 7/20/96.

Concerning the categories of detected forgets, I observed a higher frequency of personal forgets, than of interpersonal or academic types. This may be because of the increased opportunity of personal activities and events. The personal category encompassed everything that was not interpersonal or academic.

The count of encouraging self-statements charted displayed a total performance change from 15 to 74 counts per minute. The frequency of encouraging self-statements said during a one-minute counting period had an acceleration value initially of x3, then an ending acceleration of x1.

The Standard Celeration Chart 2 displays the same counts as shown on Chart 1, except on Chart 2 we present these data by calendar weeks rather than by successive calendar days.

Discussion

Following the implementation of the one-minute encouraging self-statements, we observed an immediate improvement in frequency of detected forgets. Melissa experienced a more profound effect on the frequency level of her detected forgets than on the celeration. This is consistent with findings in Calkin's (1992) analysis. Calkin noted that lower frequencies of troubling inners occurred following the introduction of positive one-minute counting periods with a jump-down in frequency rather than a deceleration. The lower frequency of detected forgets continued until approximately the final 5 weeks of the During condition where the total frequency bounce was no occurrences to 1 occurrence of detected forgets per day. During the 15th week of the study, there were 4 days when Melissa did not count detected forgets. This occurred because she went out of town and believed that the variety and type of activities she would engage presented numerous possible confounding variables likely to affect the accuracy of her counts.

When an experiment indicates that an event can be made to happen by manipulating another event, it is said that a functional relation exists between the two events (Cooper, Heron, & Heward, 1987). Following the removal of the environmental variable at the onset of the After (Maintenance) condition, the frequency of detected forgets remained low. From a therapeutic point of view, this type of responding is desired. From an experimental standpoint, this is not desired because it limits the possibility of experimentally establishing a relationship between the counts of detected forgets and the self-statements. Melissa's counts displayed on the Standard Celeration Chart do, however,
suggest the existence of a functional relationship between frequency of self-statements and detected forgets.

The acceleration of self-statements corresponded with a frequency change in the detected forgets. This pattern may indicate increased concentration focusing on improving her behavior. It is possible that our results occurred because the self-statements focused Melissa's attention on remembering and becoming more aware of her forgets and how to prevent them. Melissa reported that she consciously forced herself to not forget as many items as she had during the previous day or days. Once she noticed that her behavior improved, Melissa said that the improvements encouraged her even more to continue trying to increase the daily self-statements and decrease her frequency of forgetting.

The limitations of this study preclude the demonstration of a suggested functional relationship between the one-minute counting periods and the detection of forgets. This study did, however, (a) emphasize the importance of an apparently effective instructional method and (b) emphasize a demonstration of improving troublesome inner behavior. This self-experiment showed a change in frequency of detected forgets, the maintenance of improved inner behavior, and a replication of response patterns as reported by other experimenters (e.g., Calkin, 1992; Cooper, 1991). This analysis of replicated patterns follows the experimental procedures exemplified by Ferster and Skinner's (1957) experiments with schedules of reinforcement rather than the use of steady state logic in the search for functional relationships (Sidman, 1960).

An increase in frequency of daily self-statements occurred in the During condition. On the first day of the intervention, Melissa orally made 15 self-statements. On June 20, she made 74 self-statements. Melissa demonstrated a steady acceleration of self-statements. This is most likely because of practice that enabled her to quickly develop an extensive repertoire of self-statements and the opportunity to repeat previously verbalized statements.

Melissa experienced a deceleration of the number of "quickies" recorded in a 24-hour counting period immediately following the implementation of the encouraging self-statements. Again, this could be attributed to the increased attention Melissa placed on her performance and the improved thoughtfulness and focus on her daily activities.

During the 31 days of the After condition, the frequencies of detected forgets spread from no occurrences to 1 occurrence. Three days of data collection contained outlying data points. We considered these frequency counts outliers because they were not consistent with the counts observed in the other 21 days in the after condition. Additional environmental factors may have contributed to the increased frequency recorded on these days. Without encouraging self-statements, Melissa achieved a steady state of responding that was consistent with the last 5 weeks of the During condition.

One limitation of the study involves the inability to establish accuracy concerning whether a detected forget was actually something forgotten. No other person can confirm the occurrence of a detected forget, nor can another individual verify the true value of the frequency of detected forgets within a counting period of 24 hours. This relates to the problem of experimenter bias, a concern of self-experimentation. If the results of the study indicate a potential self-fulfilling prophecy, no one can prove or refute that possibility.

A second limitation relates to time constraints and follow-up assessments of generality. Data collection and additional points after the study improve the believability of the effects of self-statements on the frequency of detected forgets.

Some suggestions for further research include conducting more self-experiments measuring inner behaviors. Research involving a number of participants engaging in self-experimentation who possess a variety of backgrounds and living situations may provide understanding regarding behavior change techniques, especially with inner behaviors. The more information we learn about ourselves and our own behavior, the more we can apply this information to help others with their problem behaviors.

Self-experimentation is an underdeveloped area of research. To expand on this research, individuals can simultaneously measure remembered pinpoints and detection of forgets. This type of information may provide a better picture.
of the effectiveness of the intervention. Calkin’s (1981) study that reported the effects of one
minute timings on both positive and negative thoughts illustrates this suggestion. She found
that there was a negative correlation between the frequency of positive and negative thoughts and
feelings. Simultaneously, as the frequency of negative thoughts decreased, the frequency of
positive thoughts increased.

A second suggestion is to monitor the context (e.g., daily events, situations) to analyze the ef-
facts of a constantly changing context on fre-
cency of thoughts. Days spent relaxing in front of
the television may possess less potential for a
large amount of items remembered or forgotten
than, for instance, a day beginning at dawn that
is filled with numerous errands and chores to do.
Furthermore, analyzing the context may provide
additional information about whether specific
events or stimulus conditions are correlated with
higher frequencies of forgets and remembers or
negative and positive self-statements.

We suggest using distributed practice of encour-
aging self-statements as a third area for future
research. Instead of performing the intervention
for one-minute in the morning, perhaps the par-
ticipant can say the self-statements during four
15-second or six 10-second counting periods
distributed throughout the day. We believe it
would be worth trying distributed counting peri-
ods with difficult to change inner behaviors.

Fourth, an experimenter may also attempt to alter
or expand the categories of forgets. Melissa’s
categories included personal, interpersonal, and
academic. Other participants could reduce
Melissa’s classifications into additional, smaller,
or more specific categories. In addition, the data
pertaining to the frequency of each category
could be monitored and analyzed to determine
which, if any, occur independently of each other.

Finally, it would be desirable for researchers and
practitioners to realize the potential of self-
statements as an intervention technique for
changing inner behaviors. Ultimately in this
study, we found that a successful change in the
frequency of detected forgets accompanied daily
accelerated encouraging self-statements. Calkin
(1992) also witnessed success in her analysis of
the 45 studies assessing the effects of interven-
tions on inner behavior. She found that using
one-minute positive self-thoughts (not oral state-
ments) can improve behavior.

We proposed to determine the effects of encour-
gaging self-statements on the frequency of de-
tected forgets and to improve Melissa’s interac-
tion with her environment. At the end of this
study, Melissa said, “My personal and academic
lives have benefited from this experience. I re-
member more items necessary to function effi-
ciently in my day-to-day life, and I feel better
about my behavior and myself. I believe other
people can apply the procedures I used in nu-
merous situations and settings for improving both
inner and outer behaviors.”

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This article is based on a thesis submitted by the first author in partial fulfillment of the requirements for the Master of Arts degree at The Ohio State University. Address correspondence to John O. Cooper, Special Education Section, The Ohio State University, 356 Arps Hall, 1945 N. High St., Columbus, OH 43210.
Stimulus Fading Versus Error Correction in Math Fact Acquisition by Learning Disabled Students

Marie C. Keel, Mark A. Koorland and Vivian Fueyo

Teachers frequently develop their own materials to compensate for learners' unique characteristics, but these teacher-made materials are unlikely to capitalize on established instructional techniques using stimulus manipulation such as systematic stimulus fading or shaping. Although the research on stimulus manipulation for teaching discrete tasks is well documented with children with severe disabilities, the research with students with learning disabilities is limited. The present study compared the effectiveness of stimulus fading to simple error correction in teaching multiplication facts to three students with learning disabilities. The stimulus fading procedures increased the accuracy of multiplication facts of two of the three students over error correction. The third student acquired the facts more quickly under error correction. When asked, two of the three students preferred the method by which they learned best. Implications for using different instructional strategies for establishing initial skill acquisition with different learners is discussed.

Teachers frequently have difficulty locating instructional materials with features appropriate for individualizing instruction. They often develop their own materials to compensate for learners' unique characteristics. These teacher-developed materials are unlikely to capitalize on established instructional techniques using stimulus manipulation such as systematic prompt fading (Koury & Browder, 1988), stimulus shaping (McGee, Krantz, & McClannahan, 1986), or stimulus fading (Rincover, 1978), because of the great amount of time required for development (Cooper, Heron, & Heward, 1987).

The success of stimulus manipulation for teaching discrete tasks to children with moderate or severe disabilities is well documented (e.g., Browder & Lalli, 1991; Dube, Moniz, & Gomes, 1995; Mosk & Bucher, 1984; Strand & Morris, 1986). Stimulus manipulation has also been used successfully with mildly handicapped children to teach discrete tasks such as sight word discrimination (Browder, Koury, Belfiore, Heller, Wozniak, Lalli, & Lin, 1990), letter discrimination (Bradley-Johnson, Sunderman, & Johnson, 1983), missing minuend (Smeets, Lanciaoni, & Striefel, 1987), and writing mathematical operations from pictorial representations (Lanciaoni, Smeets, & Oliva, 1987). Few studies have focused specifically on the effects of stimulus manipulation for teaching discrete tasks to students with learning disabilities (Knowlton, 1980; Shimek, 1983).

Most of the research cited investigated the effects of stimulus shaping alone (Bradley-Johnson, et al., 1983; Lanciaoni, et al., 1987), in combination with verbal prompting (Mosk & Bucher, 1984), in comparison to collective feedback (Smeets et al., 1987), or to stimulus fading (Smeets, et al., 1987). Others investigated the effects of stimulus fading alone (Knowlton, 1980; Shimek, 1983), or combined with verbal prompts and compared to trial and error learning (Strand & Morris, 1986). In every case, the stimulus manipulation procedures were found to be effective in teaching discrete academic tasks to their subjects. Further, when compared to verbal feedback or trial and error learning, strategies frequently used in instruction, stimulus shaping and stimulus fading were found more successful. Although the stimulus manipulations proved successful, many of the investigators commented on the time required to prepare the materials used in the instructional tasks.

Existing evidence on the effectiveness of stimulus manipulation for teaching discrete academic tasks is compelling; however, the time required to develop the necessary materials remains a concern for many educators. When the issue of interest is not fluency but initial skill acquisition (Binder, 1993,1996), is stimulus manipulation...
always better than traditional methods? The present study was designed to analyze the effectiveness of stimulus fading versus error correction on the initial skill acquisition of basic multiplication facts with students with learning disabilities with a zero baseline. The purpose of the study is threefold: 1) to expand the research base involving stimulus manipulation with children with learning disabilities; 2) to compare the effectiveness of prompt fading to instructional procedures frequently used during instruction for initial skill acquisition; and 3) to determine the preferences of elementary-aged students with learning disabilities for prompt fading or error correction.

Method

Participants and Setting
The participants in the study were three fourth-grade students enrolled in a resource room for students with learning disabilities and/or behavior disorders. Each student had been classified as learning disabled (LD), according to state and local guidelines. All were identified by the resource room teacher as needing assistance with memorizing multiplication facts. Student 1, Jeremy, an 11-year-old boy, had been placed recently in the resource room, after being in a self-contained classroom for LD students. He was highly distractible and had difficulty attending for more than a few seconds at a time. He had scores of 100, 89, and 92 on the Sequential Processing, Simultaneous Processing and Mental Computation subtests of the Kaufmann Assessment Battery for Children. Student 2, Darrica, a 10-year-old girl, had been receiving LD services for only two months. Her WISC-R scores were: Full Scale-81, Verbal-77, and Performance-90. Student 3, Michael, an 11-year-old boy, had been working in an LD resource room for several years. His WISC-R scores were: Full Scale-104, Verbal-95, and Performance-115.

All instructional sessions were conducted individually in the resource room. The student sat facing the teacher at a table, with his or her back to the classroom. Four to six other students were working on individual assignments in their seats. Two instructional sessions, one for each method, took place each day, one between 8:00 and 8:30 a.m., and the other between 11:00 and 11:30 a.m. Each session was taught by either the resource teacher or a university research associate who had been a team teacher in the resource room the previous year. In this study, both will be referred to as teachers. The two had 4 and 8 years experience, respectively, working with students with mild disabilities. Both the time of day and the teacher were randomly alternated for each method, each day.

Experimental Design and Procedures
Experimental design. A multielement design was used to assess the effectiveness of error correction and stimulus fading for each of the three students. Each student received both teaching methods each day. Methods were counterbalanced each day.

Screening procedures. Students were administered a written screening test of the 100 multiplication facts comprised of all single digit math families (e.g., x1 to x9) on three consecutive days. The facts were presented randomly in horizontal equations. A different form of the screening test was used each day. The teacher gave each student an answer sheet and said, "Write the answer to each fact you know." The screening sessions were untimed because the teacher was interested in determining only those facts unknown to the student and for use in the pool of facts to be taught by the two instructional methods.

Before scoring, the teacher duplicated each student's answer sheets on a photocopy machine. One copy was scored by the teacher, the other by the university research associate. All responses were checked for interrater reliability, which was 100% for all students.

Students' incorrect responses for each screening session were recorded on a summary chart to determine facts which were unknown each day across the three days. These unknown facts were placed in a pool of potential training facts. If the student knew a fact one day and not the next, the fact would not be used in the pool. A group of twenty facts was selected from this pool of unknown facts. The twenty unknown facts were then divided randomly into two sets, one set for instruction using visual fading of the answers and the other for traditional error correction drill.
Instructional materials. The HyperCard (1992) application for the Macintosh computer was used to design the flash cards. The cards used in the training measured 3 x 5 with horizontally presented multiplication facts. Two probe sheets with 100 multiplication facts were designed for each set of facts. Each set of 20 facts was randomly presented 10 times.

Fading. Initially, answers to the multiplication facts were present on the flash cards used with the visual fading method. The intensity of the answer was then systematically faded using a computer command which lightened the answer (Chart 1). Five levels of fading were used.

Error Correction. During the error correction method, identical flash cards were used. During this procedure, however, the flash cards contained no answers.

Instructional Procedures. The instructional procedures for Fading and Error Correction were the same, except for the materials used. At the start of each session, the teacher told the students that they would be working on multiplication facts. The students were instructed to look at the fact and say the answer. If the answer was unknown, they were instructed to say, "I don't know." The teacher would then say the answer and go on to the next fact.

During the fading condition, the teacher, at the start of the session, presented a card displaying the five levels of fading, pointed to the level for that day and said, "Today the answers will look like this." These instructions were modified on Day 5 for Students 1 and 2, because both teachers felt that the students were not attending to the multiplication fact, but were simply reading the answer. On Day 5 and subsequent days, these two students were told to read the fact and then say the answer, during both instructional conditions.

The teacher then set the timer for 5 minutes. Facts were presented one at a time by the teacher. In both Fading and Error Correction, correct responses were followed with brief positive feedback, such as "Great," "Right," or "Correct." When an incorrect response was made, the teacher said, "No, the answer is... If the student made no response after 3 seconds, the teacher told the student the answer and went on to the next fact. After one trial with each fact, the teacher shuffled the cards and repeated the above procedures until the timer rang, signifying the end of the instructional session. The five minute session was for instruction and no probing took place at that time.

Probes. Immediately following instruction with the flash cards, the teacher placed a probe sheet face down in front of the student and said, "Here is a sheet with the facts we just practiced. Write the correct answers as quickly as you can. Skip the problems you don't know. If you spent too much time on a problem, I will tell you to go on. You probably won't finish the page. When the timer rings, put a line under the last problem you worked." The teacher set the timer for 5 minutes and told the student to begin. If the student hesitated for more than three seconds on a problem, the teacher said "Go on to the next problem." When the timer rang, the student was reminded to put a line under the last problem he or she worked on. The probe sheets were then scored by the teacher. Complete answers to problems were scored either as correct (the student wrote the correct answer), or incorrect (the student wrote an incorrect answer or skipped the problem). The scored probes were not shown to the student.

Procedural Reliability. Procedural reliability was collected twice for each student during each condition, once by a School-Based Special Education Consultant, and once by each teacher. Behaviors measured for reliability included appropriate directions, length of instructional session, teacher feedback, correct, incorrect, and no answer responses, and probe procedures. Procedural reliability was 100% for all sessions.

Social Validity. In order to assess social validity, one probe sheet from each set of facts was given to a fourth-grade teacher whose math class was identified as low average. None of the students were identified as having a disability. The teacher was requested to follow the same probe procedures used in the resource room. For the facts used in the visual fading condition, the fourth graders' corrects ranged from 3 to 29, with a mean of 11. Incorrects ranged from 0 to 91 with a mean of 25. For facts used in the error
correction condition, corrects ranged from 2 to 24 with a mean of 8. Incorrects ranged from 0 to 93 with a mean of 26.

At the conclusion of the study, each student was also asked which of the two procedures he or she liked best. Participant 1 definitely preferred the fading procedure. He was frequently frustrated when he did not know the answer during the error correction condition. Participant 2 was undecided about which procedure she liked the best, although she learned more facts during the fading condition. One possible explanation for her indecision was her recent placement in the resource room. Both procedures were very different from what she had experienced previously in the regular classroom. Participant 3 liked the error correction condition better, because he said it made him think harder. He also knew more multiplication facts at the beginning of the study than the other two and had much experience learning through an error correction method.

Results and Discussion

Although both teaching methods were used and students practiced each day, charted data from each method are shown separately, instead of overlaid on each day, for easier interpretation. Chart 2 shows results for Jeremy. His correct answers accelerated greatest under the fading condition (i.e., x 3.0 versus x 1.5). His incorrect answers decelerated more rapidly during fading as well. For Darrica (Chart 3), under fading, correct accelerations were somewhat greater and incorrect answers decelerated much more rapidly (i.e., divide 2.5 versus divide 1.4). For 2 of the 3 participants in this study, prompt fading generated greater correct accelerations and incorrect decelerations during initial acquisition of basic multiplication problems. The other student, Michael, learned considerably faster under the error correction procedure. The effectiveness of error correction for him was sizable. Results point to expected differences in learners and reemphasized the need to employ varied teaching strategies with students with learning disabilities.

These findings are consistent with the work of others. Browne, Kozey, Belfiore, Heller, Wozniak, Lalli, and Lie (1990) found no single method effective for all students when comparing stimulus shaping, stimulus fading, time delay, and trial and error. Similarly, McComas and her colleagues (McComas, Wacker, Cooper, Asmus, Richman, & Stoner, 1990) compared the effects of various stimulus prompts for teaching reading comprehension and spelling to low-performing students. No single strategy was most effective for all students in initial skill acquisition. They suggest evaluating the effectiveness of each strategy in a hierarchical manner (Harding, Wacker, Cooper, Millard, & Jensen Kovalan, 1991).

Because we were interested in establishing an initial skill repertoire and determining the best method by which to do so, we were not interested in addressing issues of fluency building. In contrast to investigations of developing an initial skill repertoire, when the question is one of fluency and skill retention, methods which develop performance to fluency prove most effective (Binder, 1993, 1996).

Although prompt fading was found to be effective, it requires materials preparation with more complexity than those used in error correction. For this study, a Macintosh computer and Hypercard program were employed to produce the specialized materials. Using a computer to produce the materials resulted in materials production in a fraction of the time normally required. Consequently, for those students responding to prompt fading during training, (and perhaps for those who do not), the effort to develop specialized materials is worthwhile, especially if computers will assist in the task.

Michael and Jeremy preferred the method by which they learned best. Asking students about how they like to learn appears useful, although direct measures of performance obtained during teaching or periodic review are the most accurate guide for teachers.

References


Standard Glossary and Charting Conventions*

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

**Accuracy Celeration Multiplier** - a measure of change in accuracy over time: celeration correct/celeration incorrect.

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

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

**Add-Subtract Scale** - any measurement scale on which adding and subtracting by a constant amount is represented by a constant distance. (e.g. the “up the left” scale on an equal interval Chart.)

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

**Aim** - an ending goal set for an individual; expressed as a specific frequency; symbolized by drawing an “A” at the expected frequency.

**Aim Star** - an ending goal indicating an aim date as well as an aim frequency; symbolized by drawing an “A” at the expected frequency on the aim date.

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

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

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

**Celeration** - unit of measurement of behavior change; change in frequency per unit time; 3 dimensions: number per unit time.

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

**Celeration Aim Star** - an ending goal indicating an aim date as well as an aim celeration; symbolized by drawing the celeration aim angle (e.g. \( \frac{A}{A} = x^2 \) aim or \( \frac{A}{A} = x^8 \) aim)

**Celeration Line** - a best-fit, straight line constructed through frequencies of a given movement on the Standard Celeration Chart (minimum number of data parts 7-10).

**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.

**Counted** - the behavior being measured.

**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.


Deceleration 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

\[ \begin{array}{c}
  \cdot \\
  \times \\
  \times 
\end{array} \]

Down Bounce - - the vertical 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; t/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.

Fluency -- fluid combination of accuracy + frequency that characterizes competent performance.

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

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

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; t/time from signal to start of movement.

Learning - - a change in performance frequency per unit time.

Learning Channel - - functional throughput following the operant responses as a unit rather than an S-R correction; named with active verbs (e.g., hear, see, do).

Learning Picture - - the celeration lines of both movements of an accuracy pair viewed together; for example, \[ \begin{array}{c}
  \cdot \\
  \times \\
 \end{array} \]

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

Median Celeration - - the middle celeration in a celeration collection; 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 Celeration Chart.
No Chance Day - a day on which the behavior being measured has no chance to occur.

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

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

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

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

Quarter-Intersect Celeration Method - A method used for difficult visual identification of celeration. Draw a vertical line halfway between the time period covered by the data (include ignored and no chance days), divide it into two equal parts and then divide the equal parts into halves. Locate the median frequency for each half and put a dash where the median frequency value and the quarter line intersect for each half period; then draw a line connecting the dashes. This is the celeration line for measuring trend and direction of the frequencies.

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

SAFMEDS - card deck with questions on one side and answers on the other. The mnemonic is Say All, Fast, a Minute, Every Day, Shuffle.

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

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* * *
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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.

Sprints - a short duration practice session (usually 10 - 30 seconds) used for establishing new skills.

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

Supervisor - a person who views the Charts on a frequent 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 - vertical distance from the celeration line to the frequency farthest above it.

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