Journal of Precision Teaching and Celeration

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Ten Products of Fluency
Ogden R. Lindsley

Lindsley's Unteaching Citation
Ogden R. Lindsley

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Christine Bashore & T. F. McLaughlin

Notes From Below the Floor:
The National Debt
Abigail B. Calkin
PT Data Lands in Fiction
Abigail B. Calkin

A Publication of The Standard Celeration Society
The *Journal of Precision Teaching and Celeration* (ISSN 0271-8200) 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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<tr>
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Editor's Comments

Claudia E. McDade

This is the inaugural issue of the Journal of Precision Teaching and Celeration, known through the first twelve volumes as the Journal of Precision Teaching. In May, 1995, the Board of Consulting Editors decided to modify the publication's name to encourage inclusion of articles showing multiple applications of standard measurement. We continue to accept articles from Precision Teachers about their classroom applications, but we hope to disseminate effective applications outside the classroom as well. Examples of such articles are found in this volume. Abigail Calkin evaluates the national debt on a Standard Chart and informs us that her latest novel is the first to use Precision Measurement in fiction. Susan Abba and Tim McLaughlin show how the Standard Chart can assist the nicotrol patch as aids to stop smoking cigarettes. Another study from Gonzaga University by a couple of Tim's students--V. Timmons and V. Kinakin--assisted an adolescent with severe cerebral palsy in raising his head through musical reinforcement monitored with the Standard Celeration Chart.

Classroom successes are also celebrated in this issue with two articles on handwriting legibility--one by Lisa DeAngelis, Tim McLaughlin, and Bill Sweeney with two sixth-grade special education students. In the second, Christine Bashore and Tim McLaughlin combine a token economy system with Precision Measurement to improve the handwriting skill of a second-grade student. Using prompts measured with the Standard Celeration Chart, Julie Spaulding, Manfred Haertel, Randy Seevers, and John Cooper improved free writing output in elementary-aged students with specific learning disabilities. Michele and Robert Morrell worked with Rick Kubina to teach rural elementary school students to read sight-words; their approach combined Precision Teaching with Direct Instruction.

A panel discussion entitled "Fluency Research: Questions, Parameters, and Designs" was held at the 21st annual meeting of the Association for Behavior Analysis. Anyone interested in basic research into why fluency is so critical to true mastery and the interactions among its components should seek out members of that panel, many of whom also plan a preconvention workshop at the 22nd ABA meeting. Ogden Lindsley shares with us in this issue his contribution to the panel discussion. His "Ten Products of Fluency" reminds us that we are still discovering.

Exciting news is also shared here about the upcoming Precision Teaching Conference to be held at the University of Washington, Seattle October 9--12, 1996. Plan now to be there!!
Ten Products of Fluency
Ogden R. Lindsley

Background
This article reports the content of my presentation in the panel titled “Fluency Research: Questions, Parameters, and Designs” on 29 May 1995 at the 21st annual convention of the Association for Behavior Analysis in Washington, DC. I handed out a single sheet with the ten products of fluency listed down the left side and lined spaces to the right in which the audience could write their research ideas opposite each fluency product. I then described each of the ten fluency products in turn and briefly suggested how each might be measured.

More product research is needed
Berquam’s (1981) dissertation on retention is one of the few controlled researches on fluency products. Binder’s (in press) current article cites a few more. But many more are needed as the power of our basic applied research attracts academic interest. Published controlled research articles will gain fluency and a little academic respectability, but not the attention of public education.

Aim for even higher gains
Only massive educational results will attract public attention, as demonstrated by Johnson and Layng’s 2 grade level gains in 16 hours of instruction at Malcolm X College. Even that attention may be transient and not enough to force large scale public educational curricular adoption. Even greater gains might be necessary to force public school adoption. So, let’s not drop our guard. Let’s keep working to produce even greater gains. Times four per week academic celerations are possible. Even times sixteen per week celerations occasionally occur by chance now. No student brains and no fingers have started smoking from being used too fast in our classrooms yet!

Early 1 minute timings in elementary schools
The first step toward fluency was taken in 1968 when Eric Haughton and his students Clay and Ann Starlin moved from monitoring the frequency of all classroom performance (35 to 50 minutes) each day as I had urged to monitoring only a 10 minute sample each day. Starlin (1970) at first did this so that teachers, who were still doing the timings and charting for the students, could get to each child during a class session each day. I (Lindsley, 1964) had urged the direct technology transfer of “direct and continuous measurement” from laboratory free operant conditioning to academic performance in public school classrooms. Haughton (1971a), Clay Starlin (1971) and Ann Starlin (1971) soon moved on to only 1 minute timings per day for each child, but several timings each day, and each timing with a different pinpoint for each learner. These, originally called probes, were used to diagnose functionally in which of several areas a student most needed help.

Kunzlemann, in close contact with Haughton, was using 1 minute timings a day for 5 successive days to diagnose learning problems from 13 different tool skill movement cycles covering 6 say and 7 write behaviors (Kunzlemann, Cohen, Hulten, Martin, and Mingo, 1970, p. 280). These brief timings were considered mainly diagnostic, even though one of their three alternative suggested remedies was to continue with daily one minute timings.
At first, I resisted my students departing from the continuous measurement of the laboratory free-operant towards what seemed to me mere samples or tests. I also reacted negatively to the term “probe”, which not only called up images of a cold metallic object being poked into a tooth or other body cavity, but also implied that the timing was not the performance itself, only an indicator of some underlying behavior. Soon, Haughton and Kunzelmann and their students were producing such excellent learning results from one minute daily practice sessions that I admitted my error in resisting the one minute timings. At this point, I was proud of the fact that I had students so fine that just a few years out of graduate school, they made major discoveries. I was more proud of the fact that I could learn from my students and give them the highest compliment of all, which was to rapidly adopt their discoveries and distribute 1 minute timings throughout the hemisphere in symposia and workshops.

In the spring of 1972, I was using one minute timings at the start and end of workshops and in university classes to measure the participants’ gain in knowledge in a way that would be comfortable and have meaning. Because the first timing should be fluent and therefore fun and not threatening, participants freely abbreviate facts about themselves for one minute. Then they “correct them” by sharing what their abbreviations meant with their neighbor. This is a great warm-up exercise and a lot of fun. It also teaches how to abbreviate, how to count abbreviations, and how to structure facts for fluent abbreviation. Next, the participants free-abbreviate facts about the day’s class topic. This provides the before teaching base-line and demonstrates to the participants that pre-testing need not be unpleasant - it can be fun! At the end of the session, a closing one minute free-abbreviate of the class daily topic was run to determine how much each participant had learned in the session. Collecting these before and after frequencies on a Standard Celeration Chart at the overhead projector showed the students how their performance compared with others in the class. The frequency distributions also showed how much the class middle had shifted up (always a doubling and often times five). The distributions also showed the participants that group distributions are spread normally - the same distance up as down on a multiply scale. So the Standard Celeration Chart normalizes performance distributions. Haughton and Kunzlemann called these “think-write” timings, but I, a dyed-in-the-wool, Hunter, Kimble, and Skinner trained behaviorist, renamed them “free-abbreviate”.

Spread of 1 minute timings throughout North America

Workshop free-abbreviate timings
In fall of 1975, I started using one minute sessions with flash cards and practice sheets charted on daily Standard Celeration Charts by the students in my graduate class in the Supervision of Instruction at the University of Kansas. By the fall of 1978, I was using flash cards practiced to fluency and called SAFMEDS (Say All Fast a Minute Each Day Shuffled) in all five of my University graduate classes. These were used both as learning aids and grading criteria. Soon, all of the student tasks for all of my courses were either one-minute fluency timings or 10 minute essay or 10 minute lecture timings. For example, the learning tasks and grading criteria for my graduate course in the Supervision of Instruction for the Spring Semester 1979 are summarized in the following table:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Learning Picture Facts</th>
</tr>
</thead>
<tbody>
<tr>
<td>see - say SAFMEDS</td>
<td>1 minute</td>
</tr>
<tr>
<td>free-write essay</td>
<td>10 minutes</td>
</tr>
<tr>
<td>free-say lecture</td>
<td>10 minutes</td>
</tr>
<tr>
<td>free-abbreviate</td>
<td>1 minute</td>
</tr>
<tr>
<td>free-write essay</td>
<td>10 minutes</td>
</tr>
<tr>
<td>free-say lecture</td>
<td>10 minutes</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Supervision of Instruction Facts</th>
</tr>
</thead>
<tbody>
<tr>
<td>free-abbreviate</td>
</tr>
<tr>
<td>free-write essay</td>
</tr>
<tr>
<td>free-say lecture</td>
</tr>
</tbody>
</table>

| Letter Grade Earned | C | B | A |

To get the letter grade at the bottom of a column the student had to perform at or above the number of facts listed in each of the six timings in that column. No averages or medians were permitted. The students could stop and start over in their final check-out grading timings with their instructor. Also, students could repeat timings as often as they wished to earn a higher grade. They were permitted even to take an “incomplete” grade for the course and come in during the next semester, after they had more practice, and earn a higher grade. Most students earned A’s in the course, and the number of facts required was gradually increased each semester until by 1989, the criteria for A was 75 facts in one minute for Learning Picture see-say SAFMEDS and 100 facts in one minute for Supervision of Instruction free-abbreviate facts.

In 1969 to 1971, Eric Haughton (1971a, 1971b, 1972) and Harold Kunzelmann (Kunzelmann, Cohen, Hulten, Martin, and Mingo, 1970) were researching and writing about the need for taking student performance far beyond 100% accuracy to what they called proficiency. Later, in 1974, Haughton started using the term fluency in place of proficiency. By 1976, White and Haring referred to fluency in their special education training textbook. However, Koenig and Kunzlemann (1980) continued using the term proficiency in their district-wide computerized learning screening programs.

Webster’s Third International Dictionary (Gove, 1961) defines fluency as “fluent quality: smoothness, ease, and readiness esp. of utterance.” Haughton (1980) described fluency as “quality plus pace.” Binder (1990) used the more accepted definition within Precision Teaching of “accuracy plus speed.” Most all workshop participants know fluency and use it correctly prior to instruction.
Defining products of fluency: Retention, Endurance, Application, Performance Standards

Eric Haughton originally named the first two fluency products: Retention and Application in his acronym RAPS (Retention / Application Performance Standards) in 1981. Eric saw retention and application as criteria for determining performance standards. He aimed at frequencies that would guarantee both retention without regular practice and application in the real world (generalization) without specific practice. The frequency that produced these was the performance standard goal. Retention and application were used to develop aims for the different pinpoint points.

Later that year, Haughton (1981) added endurance and expanded his acronym to REAPS (Retention, Endurance, Application, Performance Standards). This expanded Haughton’s number of fluency products to three, with performance standards actually making a fourth. These can be considered the defining products of fluency. During 1982 and 1983, Eric continued furthering fluency and REAPS, but spent most of his creative time on matrices of learning channels and their relationship to performance standards (Haughton, 1982, 1984).

Late in 1984, Eric started his nineteen month battle with liver cancer which prevented his further development of fluency products. Eric finally succumbed on 11 July 1985 (Lindsley, 1986). I am certain that, had he lived, Eric would have expanded the number of products of Fluency.

By 1981, I had 5 five years experience aiming at fluency in all my graduate classes. This was two classes a semester, three semesters per year for a total of thirty classes in 5 years. Each class had about 25 students, and each student learned two decks of about 75 to 100 SAFMEDS for a total of 50 fluency learnings per class. The 30 classes, with 50 charted SAFMEDS learnings in each class, yielded 1500 SAFMEDS learning charts with graduate level adult learners. Several products not stressed by Haughton in his REAPS acronym jumped out of this mass of data. These products are described in the order in which they appeared.

First, as an aviation cadet in World War II, I had to daily practice repeating my army serial number, the names of his company officers and Air Force generals, the names of both friendly and enemy fighters, the words to Air Force marching songs and other verbal chains until they could be recited perfectly at any time on call from an upperclassman at 100 to 300 words per minute. Similarly repeated high speed practice of emergency aircraft exit drills, and field disassembly and assembly of the Army 1911A1 automatic pistol blindfolded in one minute, was part of my official military training. This was said to produce performance under stress in battle, in emergencies, or in a snow storm or sand storm without error. The same stability and resistance to distraction occurred when my graduate students approached fluency in their one minute SAFMEDS practice sessions. Only the beginners who were making the mistake of starting at slow frequencies had their pace broken by the noise of the other students saying their SAFMEDS and slapping them down on the chair arms close by.

This prompted me to convert the S in Haughton’s REAPS to Stability - a fifth product of fluency.
Fun

In workshops and university classes it became clear that fluent performing was fun, and participants laughed and giggled when comparing their frequencies correct after a fluent timing. Fluent timings were so much fun that they were used as “ice breakers.” When asked to perform a task in which they were not fluent, adults always grumbled, groaned, and made critical comments. For these reasons, we learned to start and stop workshops and class sessions with fluent timings. For example, we might start with abbreviating facts about themselves, and close with facts about the town or university. This is similar to band directors and athletic team coaches starting practice sessions with fluent performance and closing them with fluent performance to keep up team spirit.

Fluent timings are so exhilarating and so much fun that they can be used at any time in a lecture or workshop to perk up participants when they are beginning to doze, or gossip, or look uncomfortable. Just call a one minute timing. Correcting of the timing with a neighbor is always fun and will take 10 to 15 minutes after the timing to discuss it until the room quiets down.

These experiences led me to name fun as a sixth product of fluency.

Understanding

I started my graduate students in class each semester with their first week’s assignment to make their first deck of SAFMEDS. In the second class meeting, they started saying their cards as close to 60 per minute as they could. Correct frequencies were low and the error frequencies high, and there was no time spent on explaining what the words and symbols on the cards meant. One by one, a student would demand to know what some particular word meant. The rote learning of the cards produced a strong need to know meaning. Some students always figured out on their own what some cards meant and told the meanings to others. The push of rote learning had produced the nicest interest in understanding that I had ever witnessed in my classes. Even when I was trying to “teach to understanding”, I had never seen such interest in the content meaning. It is almost as if once a term or symbol has been forced into a student’s fluent, motor repertoire, automatically, questions are asked about it.

As a result of this experience, I began urging teachers who wanted to generate understanding to produce fluency first; for then, students would take care of getting understanding on their own. This was maximally efficient, because no valuable classroom time was wasted on teaching understanding relationships that the students already knew, or would learn on their own. The teacher only had to answer requests for meaning and understanding that the students had not figured out on their own.

For these reasons I listed understanding as the seventh fluency product.
No cheating

The eighth fluency product, no cheating, seemed obvious to anyone who has taught or practiced to fluency. But other teachers who continuously fussed with the problems of student cheating did not realize that fluency totally eliminates cheating. Different versions of practice sheets or tests are not needed. Students need not be separated by empty chairs during group timings. There is just no way a student can look at another's practice sheet fast enough to get answers above 60 per minute. There is just not enough time. Looking at another's sheet slows him/her up. Cheating slows him/her up. There is no way a student can bring another student's behavior with him/her to a grading check-out session. A student can fake his/her chart, or paper, but not his/her performance or speed.

For these reasons I listed no cheating as the eighth fluency product.

Fluency REAPS FUN

I used the acronym Fluency REAPS FUN describing eight products of fluency in workshops and classes throughout the 1980's and finally published it in 1992.

Confidence

Over the last two years, I realized that the urging we gave our teachers of developmentally delayed children in the late 1960's to not stop practicing when their handicapped learners reached normal frequency range, but to practice them far above normal frequencies to championship levels, was to develop the children's confidence. Since their charts seldom leveled off, the students could build speed up to super fluent frequencies beyond normal adult range. When disabled people can write letters, or do basic add facts, or count items faster than brothers, sisters, parents and teachers, they gain real confidence - a confidence that no amount of verbal stroking can achieve. Carl Binder (1990) called attention to "confidence" as a benefit of fluency in the title of an article describing fluency to industrial trainers. These events prompted adding the ninth product of confidence.

Generativity

Haughton's (1972) original discovery that smooth, fluent application occurs when component tool skills were truly fluent at frequencies from 40 to 100 per minute became the aim for most precision teachers. To them, creativity, problem solving, and improvising depended on fluent component skills. In the middle 1970's we tried to produce "curriculum leaps" (Stromberg & Chappell, 1990) from fluent tool skills. We saw all these as a special cases of Haughton's Application product of fluency.

Johnson & Layng (1992, 1994), and Layng, Jackson, and Robbins (1992), have recently related the selectionist language and laboratory research on contingency ad- duction (Andronis, 1983) and generativity (Epstein, 1985, 1990) to fluency based instructional design and the Morningside Precision Teaching approach, (Johnson, 1992) in particular. Although "leaps" is one syllable and follows our rules for choosing Precision Teaching words (Lindsley, 1991) more closely, I have once again temporarily accepted the discoveries of the next generation and use the term "generativity" though the six syllables still grate. You can keep "leaps" on the back burner if you prefer.

For these reasons I called the tenth product generativity.
These ten products of fluency are the benefits of teaching and learning to fluency.

The acronym for these ten products of fluency is “REAPS FUN CG”

R  Retention
E  Endurance
A  Application
P  Performance standards
S  Stability
F  Fun
U  Understanding
N  No cheating
C  Confidence
G  Generativity

Research studies supporting these products are detailed in the excellent and comprehensive current article by Binder (in press). The purpose here is merely to list the fluency products and single them out for potential laboratory research.

It should be clear to persons justifying fluency practice beyond the levels of 100% accuracy to school boards, the government, and corporation officers that these products are actually benefits to the learner. The products also benefit the teaching agency which can save real dollars in increased worker performance, increased worker confidence and attitude, and decreased training costs provided by generativity.

Some might argue that these ten products are all different aspects of the same thing, for example “endurance.” But, the proof that they are separate is that one must use separate measures to record them. To record “fun” we would have to count smiles and laughs. To record “confidence” we would have to count feelings of doubt and feelings of assurance while on a sales call, or just before and just after one. In each fluency product, we must use a different count or measure. Therein lies their identity.
To further clarify product separateness, a suggested measure to use in recording the presence of each fluency product is listed below opposite each product. The measures are not the only such measure, nor necessarily even the best such measure for each product. Several different tactics for measuring each product are possible. These suggestions are only listed to point out how each product requires its own unique measures. These measures identify it.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Description</th>
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<tbody>
<tr>
<td>Retention</td>
<td>How much drop in the practiced frequency occurs after specified weeks or months without practice?</td>
</tr>
<tr>
<td>Endurance</td>
<td>How many minutes or hours (beyond the daily practice period) can the performance continue without error or decrease in frequency?</td>
</tr>
<tr>
<td>Application</td>
<td>How much drop in the practiced frequency occurs when performing in real world settings different from the practice setting?</td>
</tr>
<tr>
<td>Performance</td>
<td>What frequency aim produces retention, endurance, stability and application?</td>
</tr>
<tr>
<td>Stability</td>
<td>Does total bounce (measured proportionally on the Chart) decrease as fluency is reached? How many strong distracters do not interrupt performance?</td>
</tr>
<tr>
<td>Fun</td>
<td>Count performer laughs and smiles while performing or have them rate their fun on a 19 point multiply scale.</td>
</tr>
<tr>
<td>Understanding</td>
<td>What portion of the fact meanings are immediately known? What portion of the meanings are figured out by learners? What portion of the meanings are asked of the teacher?</td>
</tr>
<tr>
<td>No cheating</td>
<td>Compare cheating incidents between fluent and dysfluent practice.</td>
</tr>
<tr>
<td>Confidence</td>
<td>Frequency of confident compared with fearful statements made just prior to and just after an important performance.</td>
</tr>
<tr>
<td>Generativity</td>
<td>Frequency of composite skills that leap up, without having been specifically taught, from fluent tool skill components.</td>
</tr>
</tbody>
</table>
The degree of independence of these fluency products - their ability to be independently manipulated by different types of fluent performance lies out there as an interesting research area. Our experience so far suggests that with adults at the same levels of fluency, you get more fun from the point-see-say channel in chorus, than when the learner point-see-says by himself/herself in public. This is merely one example of the kind of operation that might demonstrate product independence in which you change the amount of one product without changing the others.

This list of fluency products has steadily grown over the past fifteen years since Haughton (1981) first called attention to R/APS. The more we practice fluency, there is every indication that we may discover still more beneficial products. Even though we have been talking about curriculum leaps since the middle 1970’s, it is only in the last two years that generativity emerged as a powerful product and should be listed separately as a benefit.

Recently Stephen Graf (personal communication, August 1995) suggested an 11th product which he called “Stress Inoculation.” According to Graf, it would be measured by how little emotional or game stress disturbs a fluent performer. At first thought this seems fairly close to a special case of “Stability.” However, time will tell if it is useful enough and different enough to add it as an 11th product benefit.

It is exciting to think that something just as powerful might be lurking out there, in that lovely unknown, undiscovered, just waiting for us.

References


Ogilv R. Lindsley is the founder of Precision Teaching and Professor Emeritus at the University of Kansas, Lawrence, KS.
Lindsley’s 1995 Annual Citation for Excellence in Unteaching

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for

Incapacitating children by the hour, and convincing children, parents, and teachers that children learn by merely watching mesmerizing entertainment, and that this is educationally worthwhile.

1 October 1995

Ogden R. Lindsley, Ph.D.
signed
Visual Imagery and Structure Words: Accelerating Number of Words and Number of Descriptive Words Written During Free Writing

Julie Spaulding, Manfred W. Haertel, Randy L. Seevers, and John O. Cooper

We investigated what effects teaching structure words and visual imagery have on the total number of correct and incorrect words written and the total number of correct and incorrect descriptive words written during free story writing. Four elementary-aged students with specific learning disabilities requiring remedial instruction in free writing served as participants. Our investigation began with the assessment of students’ writing performance with a different story starter each session; then we randomly alternated the instructional conditions of: (a) different story starters, (b) same story starters, and (c) the same story starters with structure words and visual imagery instruction. The last phase of this investigation withdrew the instruction on structure words and the instruction for the use of visual imagery. Our data showed improved free writing performance from the four students during the alternating instructional conditions and the withdrawal condition.

Persons who write well often achieve success in technological cultures. For example, writing text that readers understand is a tool skill for many tasks in business and the military (e.g., corresponding with organizational hierarchies, clients, constituents), for personal communication (e.g., notes, letters), for personal skill development (e.g., e-mail), and for general entertainment (Graham, 1992; Mosenthal, Tamor, & Walmsley, 1983). Technological cultures clearly link writing to successful academic, intellectual, social, personal, and occupational activities, and believe that writing is a critical functional life skill.

The news media and trade publications (e.g., AFT-Chrysler Report on Kids, Parents, and Reading) report declining performances in the quality and effectiveness of teachers’ writing instruction and of students’ written products. For example, over 500 teachers interviewed by the American Federation of Teachers (AFT) said that more than 50% of the student population are inadequate writers, and that only about 15% of the student population write well (Soule', 1995). Many school psychologists find writing difficulties so pervasive among students even without disabilities, that many times they have difficulty differentiating between students with disabilities and those without (Stein, Isaacson, & Dixon, 1994).

Parents, teachers, and education administrators share these popular media concerns. In response, many instructional programs recently increased the duration of school time used for writing and the number of written assignments (Graham & Harris, 1988a; 1988b; Mosenthal, et al., 1983; Soule', 1995). Even some state governments (e.g., Ohio) now require students to pass an examination in writing before receiving a high school graduation diploma.

These developments have implications for students with specific learning disabilities who often write less polished, less expansive, and less coherent texts than their normally achieving peers (Graham, Schwartz, & MacArthur, 1991; Mon-tague & Leavell, 1994). Aubry (1995) reports that students with writing difficulties often write and rewrite with little understanding of their achievement. Graham, Harris, MacArthur, and Schwartz (1991) suggest that these writing difficulties may result from problems with basic text production, limited knowledge about writing, and limited skills in planning and editing the text.
In addition, several authors (e.g., Englert, Raphael, Anderson, Gregg & Anthony, 1989; Graham et al., 1991) suggest that students with specific learning disabilities experience writing difficulties because writing requires attention to such a large range of skills and processes.

Recognizing the importance for instruction and research in the content area of writing, we taught four students with specific learning disabilities how to use structure words and visual imagery for planning their free writing, and assessed the effects of this instruction on the total number of correct and incorrect words written and the total number of correct and incorrect descriptive words written during free story writing. We emphasized the importance of effective instructional methods, and a demonstration of instruction for developing fluent writing.

Method

Participants and Setting

Four elementary students assigned to an instructional resource room for students with learning disabilities participated in this study. The fourth-grade students, Victor and Marquita were 11 years old at the start of this study, and Tccaro and Andy, the fifth-grade students, were 12 years old. Victor, Marquita, and Tccaro participated in the free lunch program at their school. Andy paid the full lunch price. All four students received special education instruction in language arts and math, and were mainstreamed in the regular classroom for instruction in social studies, science, and health. Moreover, Victor, Marquita, and Tccaro received special education instruction in reading, but Andy was mainstreamed for reading instruction. Criteria for the selection of the participants included: (a) deficits in language arts, including free writing skills, (b) basic sound associations for spelling, (c) writing a complete sentence, and (d) using more than one character in free writing. In addition to free writing completed for this study, the students also wrote in a journal everyday and completed other weekly writing assignments (e.g., book reports, story starters, free choice writing, written reading assignments). These assignments included a written retell of the story and a written statement expressing the main idea of the story.

The study took place in the participants' regular classroom—an elementary middle level grade resource room located in an urban area within a large city school district. No other students assigned to the resource room were excluded from their normal school instruction or activities because of this study.

Definition of Performances

Number of correct and incorrect words. We defined the total number of words written as the number of words written during a 10-minute counting period that formed a composition of coherent thought, and defined words written legibly and used in proper syntax within the phrase or sentence correct. For example, we scored the sentence, "My dog was hungry" as four correct words, but conversely counted, "I go dog is the door" as six incorrect words. When the teacher or student could decipher misspelled words (e.g., enuff), these words were scored as correct. Words the teacher or student could not decipher were scored as incorrect. Students could also use beginning sounds and a line to abbreviate words they did not know how to spell (e.g., blizzard abbreviated as bl o or blz ). The students, however, needed to tell the teacher what word each abbreviation indicated for an abbreviation to count as a correct word, and we counted abbreviations incorrect if the students failed to say the unknown words. The teacher (the first author) counted the number of correct and incorrect words and tallied the number at the end of each line of each student's written text, and entered the total sum of written words on data sheets.

Number of incorrect and correct descriptive words. Descriptive words included adjectives, adverbs, and metaphors. We counted these descriptive words correct when students used them in a sentence with correct contextual meaning. For example, "My dog is very large" had a correct count of two descriptive words (i.e., very, large). We counted descriptive words incorrect when the student used them in a sentence without contextual meaning. For example, "The boys fuzzy big down the road" was counted as two incorrect descriptive words (i.e., fuzzy, big). Repeated descriptive words counted as one correct response. For example, "My dog is very happy"; "I threw him a ball"; "He was (very)
excited”; “I am (very) glad he caught the ball”; had a correct count of four (i.e., very, happy, excited, glad). We accepted misspellings and abbreviations of descriptive words and counted them correct or incorrect as described above. The teacher underlined correct descriptive words on the students’ written product with a blue line.

The teacher counted the number of correct and incorrect descriptive words, tallied the number at the end of each line of the student’s text, and recorded the sum of all the lines on a data sheet. Frequency was displayed as count per minute on the Standard Celeration Chart.

Assessment for Accuracy of Measurement
Before scoring each writing sample, the teacher made one photocopy of the students’ original 10-minute writing samples, then scored the original sample. A second observer verified the accuracy of the teacher’s measurement by counting and recording total number of correct and incorrect words written and the total number of correct and incorrect descriptive words written in the copy of the writing samples. Before the study, the teacher instructed the independent observer on the procedures used to mark, total, and record student performances on the data summary sheet. During instruction, the observer watched as the teacher explained the counting and recording procedures using a student’s written product. They discussed occurrences of correct and incorrect words throughout this instructional process. Following that activity, the observer independently counted and recorded three student written products and compared those counts to the teachers’ independent counts. The teacher and observer identified and discussed disagreements in their counting until achieving an accurate measurement. The teacher and observer practiced these counting and recording procedures until they could achieve 95% agreement on the independent counts.

During the study, the independent observer scored four samples from all four students’ free writing samples, two days out of four days. The independent observer randomly selected the samples to assess 50% of the students’ written products for accuracy. These assessments for accuracy of measurement occurred twice a week. Twenty-four out of a possible of 48 sessions were checked by the observer.

To ensure random selection, we represented each of the four days in the experimental week by a card numbered with 1, 2, 3 or 4. After shuffling the cards, the observer selected two cards. These two cards represented the two days that the observer checked for the accuracy of measurement. The observer recorded the data on a data summary sheet. We compared the counts of the teacher and observer and recalculated all discrepancies after a re-review of the written products. We corrected any incorrect counts and recorded the corrected frequency on the data sheet.

The observer and teacher achieved complete agreement concerning the total number of correct and incorrect words written and the total number of correct and incorrect descriptive words written on all 24 sessions checked. Although there were, on occasion, small disagreements on the word counts, the observer and teacher in these cases re-examined the true value (i.e., the student’s original writing) to derive accurate counts.

Procedural Integrity
We used 15 of the total 48 sessions to assess procedural integrity. Using a procedural checklist, an independent observer made random observations to assess the integrity of the delivery of our instructional procedures. The observer watched the teacher and students during the free writing activities and used a checklist to check off each instructional procedure that the teacher used correctly as defined in the Procedure section of this article. The total number of check marks was divided by the total number of possible check marks, and that result multiplied by 100. Overall agreement ranged from 79% to 100%, with an average agreement of 91%.
Developing Story Starters. The teacher listed possible discussion topics for story starters on the chalkboard and gave an example story starter (e.g., “One day as I was walking down the street, I heard...”). The four students then verbally suggested story starters using the topic areas previously listed. The teacher wrote these story starters on chart paper, showed the paper to the students, and the students orally read the story starters. After the oral reading, the teacher wrote all story starters on separate slips of paper and placed the slips of paper in a jar. Students randomly drew story starters from the jar during all phases of our investigation.

Different story starter. Before each session, the teacher reminded the students that their writing would not count toward their class grade, that their writing would help her (i.e., the teacher) to learn different methods of instruction. During each session, students took turns randomly drawing a new story starter from the jar, and the teacher wrote that story starter on the chalkboard. The students orally read the story starter together, then wrote it on their papers. Students had three minutes to think about what they wanted to write. The teacher emphasized that the students could abbreviate difficult words. The teacher then said, “pencil up, begin,” starting the 10-minute counting period. When the timer sounded, students completed their last word and put their pencils down.

Same story starter. The same story starter condition used procedures identical to the different story starter phase except that the teacher assigned the same story starter for each writing session. Each student continued writing with a given story starter four days a week until he or she wrote 200 or more words during the 10-minute counting periods. When a student reached the instructional aim, she or he began with a new story starter.

Withdrawal of structure words and visual imagery. This condition continued to use the procedures described above except we withdrew the instruction on structure words, the written response prompts, and the use of visual imagery.

Results

Individual Standard Celeration Charts for Marquita, Victor, Andy, Tecaro display the number of correct words written per minute and the number of correct and incorrect descriptive words and
descriptive phrases written per minute by the
students during 10-minute sessions of free writ-
ing. The students wrote very few incorrect
words over the course of this investigation; there-
fore, we did not show the "incorrect" data points
on their charts (i.e., Tccaro wrote 6 incorrect
words during one session, Victor wrote 1 incor-
rect word during two sessions, and Andy and
Marquita wrote no incorrect words). Our in-
structional aim ranged from 20 to 25 words
written per minute for the students' free writing
based on Albrecht's (1981) research with chil-
dren's creative writing. We counted the number
of descriptive words and descriptive phrases
written in four different 150 word passages, ran-
domly selected from four published story books
written at the fifth-grade reading level, and found
that these authors (Brancato, 1977; Kerr, 1972;
Sachs, 1968; St. George, 1980) used a total of
15 to 21 descriptive words and descriptive
phrases in these passages. We extended this
outcome to suggest an instructional aim of writ-
ing in context 1.5 to 2 descriptive words or
phrases per minute for our students.

Phase One: A Different Story Starter
Each Session
Number of total words. Tccaro, Victor and Mar-
quita decelerated their frequency of words writ-
ten, Andy showed no deceleration, and most often
they all wrote between 5 and 10 words per min-
ute. Some small session-to-session frequency
bounce occurred but bounce began to diverge in
the performances of Tccaro, Victor and Marquita.

Descriptive words and phrases. Tccaro and Mar-
quita produced a deceleration of x1.0, and Andy
and Victor decelerated their frequency of writing
descriptive words or phrases. These four stu-
dents typically wrote less than 6 descriptive
words and phrases per minute, but had large ses-
sion-to-session bounce, with some bounces mul-
tiplying by x2, x3, and x4. No student made
more than one incorrect response during this
baseline phase.

Phase Two: Alternating Different Story
Starter, Same Story Starter, and Same
Story Starter with Structure Words and
Visual Imagery
Number of total words. The performances of
Victor and Tccaro jumped up in frequencies, and
celerations turned up, but their celerations of total
words written was x1.0. We changed story
starters accompanying the Same Story Starter
and Same Story Starter with Structure Words and
Visual Imagery conditions for Victor and Tccaro.
This instructional change corresponded with no
jumps in performances but acceleration turn ups of
x1.2 for both. The performances of Andy and
Marquita resulted in no jumps in frequencies
when introduced to the alternating conditions, but
produced turned ups of small accelerations, both
x1.1.

Descriptive words and phrases. Marquita
showed a frequency jump up and a celeration
turn up in the number of descriptive words writ-
ten-per-minute with the onset of the alternating
conditions. When we introduced the new story
starters during the alternating conditions, Mar-
quita's acceleration of written descriptive words
turned down. She also produced more incorrect
uses of descriptive words during the alternating
conditions than during the baseline phase.

Victor's use of descriptive words produced a cel-
eration turn up with the onset of the alternating
conditions and a celeration turn down with the
new story starters during the alternating condi-
tions.

Phase Three: Alternating Different
Story Starter, Same Story Starter, and
Same Story Starter with withdrawal of
Structure Words and Visual Imagery.
Number of total words. Andy and Victor each
had eight sessions under these alternating condi-
tions and showed no important changes in per-
formances, celerations, or session-to-session
bounce. Withdrawing the instruction on struc-
ture words and the use of visual imagery appar-
tently did not influence the stability of free writ-
ing. Marquita and Tccaro had five and four ses-
sions respectively under these alternating condi-
tions, too few data points for a good projection
of future performance, but the limited data
showed outcomes similar to the accomplishments
of both Victor and Andy.

Descriptive words and phrases. Victor produced
a jump up in frequency, accompanied by a turn
down in celeration. Andy had no jump in fre-
quency but did turn down in celeration. Again,
the few data points for Marquita and Tccaro limit
DAILY BEHAVIOR CHART (DCM-SEND)

CALENDAR WEEKS

6 CYCLE-140 DAYS (20 WKS)

BEHAVIOR RESEARCH CO
BOX 3351-KANSAS CITY KANS 66103

Alternating Instructional Conditions

Different Story Starters
Story #1
Story #2
Withdrawal of Structure Words & Visual Imagery

Number of words
Descriptive words

*** Different Story Starters
600 Same Story Starters
AM Same Story Starters with Structure Words & Visual Imagery

SUCCESSIVE CALENDAR DAYS

Think/Write words in context

Victor 11
4th grade
SD LALE COUNTED

Haertel
Spaulding
Spaulding
Spaulding
Spaulding/Cooper

SUPERVISOR
ADVISER
MANAGER
Ohio St. Univ.
Spaulding
Spaulding
Spaulding
Spaulding/Cooper

MIN HRS

COUNT PER MINUTE

COUNTING PERIOD FLOORS

0

2

4

6

8

10

12

14

16

18

20

22

24

0

1000

500

100

50

10

5

1

.5

.1

.05

.01

.005

.001
description of their results, but apparently they demonstrated no jumps or changes in celerations of number of descriptive words written.

**Discussion**

Two fourth-grade students and two fifth-grade students with specific learning disabilities served as participants for our inquiry into the effects of instruction using different story starters, same story starters, and same story starters with structure words and visual imagery. Before starting data collection, we anticipated that the students would produce personal best performances and learning during instruction that used structure words and visual imagery. These participants, however, improved their free writing under all three alternating instructional conditions.

Tccaro, Marquita, and Victor met the instructional aim of 200 to 250 for total words written during a 10-minute counting period (20 to 25 words written per minute) following the introduction of the alternating instructional conditions—different story starter, same story starter, and same story starter with structure words and visual imagery. Andy achieved a performance high of 17 total words per minute, but usually wrote between 5 and 6 words per minute below our performance standard. The acceleration of words written by Tccaro, Marquita, and Victor ranged from x1.1 to 1.2, even though they doubled their performance frequencies (x2) over the course of this analysis. These individual accomplishments highlight the continued need for identifying not only instructional procedures to improve free writing, but instructional procedures that result in achieving performance standards in fewer instructional sessions.

The free writing performances of these students produced similar celerations and session-by-session frequency bounce. Also, no consistent outlier frequencies correlated with any of the alternating instructional conditions. Our observations, however, cause us to believe that the improvement in students’ writing during the different story starters and the same story starter conditions improved because of the instruction that used structure words and visual imagery. We speculate that these positive instructional effects possibly transferred to the different story starters and the same story starters conditions, but we did not demonstrate instructional control over the possible transfer of effect. Future research will need to address this speculation.

We removed the instruction on structure words, visual imagery, and the written prompt sheet to end our analysis. The session-to-session bounce and frequency level of the descriptive words used by the four students in context writing continued as before when we gave instruction and response prompts for structure words. Importantly, the free writing performances of the students maintained without this intervention.

We gave a teacher of students with specific learning disabilities three undated and unmarked samples from the collection of each student’s free writing and asked her to rank them 1 through 3; one indicated the best of the three papers, two indicated the next best and three indicated the paper with the least amount of writing development. She ranked the May 18 papers of Andy and Marquita first, the April 27 papers second, and the March 2 paper third. These rankings provide the teacher’s independent perceptions that Andy and Marquita improved in free writing over the three months of this investigation. The teacher said Marquita’s first and second ranked papers showed a similar level of skill, but noted variations in the amount of descriptive language used in the May 18 paper. She ranked the April 27 papers of Tccaro and Victor first, the May 18 papers second, and the March 2, papers third. The teacher said she had difficulty identifying important differences between the papers ranked first and second. She also noted that Victor’s April 27 paper had clearer story content.

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Even though the students improved their free writing, we experienced several management problems during this inquiry. For example, special announcements, assemblies, community and special class changes frequently disrupted free writing instruction. Our four participants came from three different homeroom classes, and therefore, often experienced schedule conflicts between homeroom activities and the free writing instruction. Whenever these management issues interrupted our counting periods, we rescheduled those counting periods, usually on Fridays.

The other students in the classroom wrote in journals during the free writing sessions for the four participants. Sometimes these classroom students finished their writing before the end of the counting periods for our four participants, and toward the end of the school year, the non-participant students became distracting. These few distractions possibly reduced the total number of words the students wrote during their 10-minute counting periods.

For an accomplishment critique, we asked the students to tell us about their feelings about the free writing sessions. Three of the students reported that they liked having their writing timed very much, and one did not. For the instruction of structure words, three of the students indicated they liked it, and one student only somewhat liked it. As for the use of visual imagery, one student liked it, two liked it a little, and one student did not like using visual imagery. All four students strongly supported the teacher using a different story starter for each sample of free writing. They did not enjoy repeated free writing practice when we used the same story starter.

We continued by asking the students to tell us about their likes and dislikes during free writing. The students said they enjoyed trying to beat the clock and counting the number of words they wrote to see if they achieved a personal best performance. One student mentioned that he liked having extra individual attention at the writing table. Another student liked discovering interesting adjectives, especially new funny ones.

The students did not report many dislikes. Three of the four students mentioned they did not always want to stop when the timer went off, but sometimes they were stuck and wanted to stop before the end of the counting period. One student said he did not like the noise in the room and in the hall. Another student said he still felt frustrated trying to spell words quickly.

We asked if they could change anything about the experiences with free writing, what they would like to change? One student wanted to have his own personal timer, instead of a timer for the group; two students wanted instructional time to illustrate parts of their stories; and another student wanted longer counting periods.

Finally, we asked the students to say if they believed their free writing experience helped them to write other topics or to write for other subject areas. One student said he now writes better stories, and the written reading comprehension tests seem easier because of his writing practice. One student who attends a mainstream classroom for reading instruction said he received an "A" on his biography report on Jackie Robinson, and that maybe all this writing helped him get an "A". Another student reported that his free writing instruction helped him learn to use better and longer words when writing in his poetry book.

References


Use of Error Drill, Feedback, Praise, and Fading to Increase the Legibility of D'Nealian Handwriting with Two Special Education Students

Lisa DeAngelis, T. F. McLaughlin and William J. Sweeney

The effects of error drill combined with corrective feedback and verbal praise for improving the legibility of D'Nealian handwriting were evaluated with a male and female sixth-grade student identified as health impaired and learning disabled, respectively. The criteria provided for judgment of legibility were based upon variables related to individual handwritten letter formation: size, slant, and letter ending. After the initial error drill, a fading procedure was implemented on the probe sheets to fade out models of the individual letters. Precision Teaching techniques were used to count, record, chart, and make instructional decisions about the appropriate individual handwritten letters produced on probe sheets by the students. Results revealed an increase in the frequency of correct individual letters written for student 2, with differential effects appearing related to learning opportunities (i.e., incorrect size, slant, or individual letter endings) for the D'Nealian handwriting style for both participants. Important instructional implications related to measurably superior data-based procedures for improving handwriting legibility are discussed.

Written expression combined with legible, and more easily read handwriting are some of the most important modes of communication in our society (Helwig, Johns, & Cooper, 1976). Legible handwriting is viewed as a prerequisite skill for success in a variety of settings in our society. From filling out job applications, including writing one's name, to completing assignments in school, the legibility of an individual's handwriting plays an important role in determining how well a person functions in these settings. In fact, as McLoughlin and Lewis (1994) pointed out, illegible handwriting leads not only to academic performance problems in school, but may become a determining factor as to whether a student is referred, assessed, and eventually placed in a special education setting for students with learning disabilities. There are several commercially available handwriting programs for use in the schools. They range from systematic Direct Instruction programs in cursive handwriting (Miller & Engelmann, 1980) to more traditional approaches (e.g., Zaner-Bloser, 1984). One of the most successful handwriting programs to teach students cursive letter formation was the Write and See program developed by Skinner and Krakower (1968). Unfortunately, this program is no longer commercially available to the schools.

Incorrect letter formation is said to be one of the most probable causes of illegible handwriting (Hansen, 1978). Accuracy in formation of letters is the key to success in mastering the alphabet and producing readable handwriting (Helwig et al., 1976). Accuracy in the formation of cursive and manuscript letters is generally assessed by evaluating the size, shape, slant, spacing, and general appearance of individual letters (Johns, Trap, & Cooper, 1977; Peck, Askov, & Fairchild, 1980; Sweeney, Salva, Cooper, & Talbert-Johnson, 1993; Talbert-Johnson, Salva, Sweeney, & Cooper, 1991). Several authors have successfully employed a variety of procedures to improve the legibility of handwriting with students (Johns et al., 1977; McLaughlin, 1981; Talbert-Johnson et al., 1991). Self-evaluation procedures (Sweeney et al., 1993), academic positive practice and response cost (McLaughlin, Mabee, Byram, & Reiter, 1987), and Precision Teaching measurement strategies (Brunner, McLaughlin, & Sweeney, 1993) have
all been employed successfully to improve the legibility of difficult to read handwriting. All of these intervention approaches discuss the importance of ensuring correct letter formation through modeling, direct instruction and practice, and immediate error correction.

The majority of early instruction in handwriting in the primary grades tends to focus on the use of manuscript style, commonly known as printing (e.g., Askov, Otto, & Askov, 1970; Manning, 1986; Peck, 1980). However, Early, Nelson, Kleber, Tregoooh, Huffman, and Cass, (1976) discovered that beginning with and teaching cursive alone did not impair one's progress in the development of their writing skills. Further, Early et al. (1976) stated cursive writing may even lead to frustration if students are immediately expected to stop writing manuscript and learn “real handwriting.” The transition from manuscript to cursive handwriting can be a difficult and frustrating process for some students even though the differences in letter production and instruction, regardless of choice of alphabet, have been reported in the literature (Porter, Cooper, Hill, & Swisher, 1984).

Teachers report the main methods used for teaching handwriting are copying, exercises and drills, tracing, rhythm, and manual guidance. (Askov et al., 1970) found tracing or some variation of tracing to be most effective, and easier than freehand drawing.” Teachers also claim correct letter formation to be “the most important aspect of writing” (Hartley & Salzwedel, 1980). In the past, children have been given minimal assistance in recognizing and correcting/improving their own handwriting. A child needs “to be able to compare a letter made directly to the desired letter form expected by the teacher...to create development of correct perceptions of letter forms” (Hartley & Sratwedel, 1980). The teacher needs to provide immediate feedback (i.e., corrective feedback) as to where problems exist and how the learner can improve in his/her formation of individual letters. Steps should be presented in smaller/more component units at a manageable pace. Recent research in the areas of self-management and self-evaluation are beginning to address the issues related to accurate perceptions of correct and incorrect letter formation and handwriting legibility (Sweeney et al., 1993). Generally, most handwriting scales are un-reliable (Helwig et al., 1976) considering the subjective nature of the area of handwriting and the lack of measurement procedures sensitive enough to be able to discriminate discreet differences in letter formation and legibility. It is suggested that one measure handwriting by the following possible criteria: teacher judgment, the utilization of an individual thought to have expertise in handwriting, the adoption of a transparency template of handwritten letters, or employment of an evaluative strategy such as the block out procedure (Sweeney et al., 1993; Talbert-Johnson et al., 1991). The vital factor is that one must simply be consistent in which form of measurement is chosen (Talbert-Johnson et al., 1991).

The purpose of this study was to evaluate the effectiveness of Precision Teaching measurement procedures combined with error drill, immediate corrective feedback, praise and fading techniques in the development of D'Nealian handwriting skills. The investigation focused on the correct and incorrect letter formation of two sixth-grade students in a special education resource room.

Method

Participants and Setting

The two participants were a sixth-grade boy, identified as health impaired, and a sixth-grade girl who was receiving special education services and was labeled as learning disabled. Both students qualified for special education services pursuant to the state and federal definition for these two handicapping conditions (Washington Administrative Codes for Special Education, 1994). Assessment results indicated that both these students exhibited large deficits in academic achievement related to written language. The boy was 4.1 years below grade level, while the girl, 4.0 years below grade level in written language, according to the Woodcock-Johnson Tests of Academic Achievement-Revised (Woodcock & Johnson, 1990). Data from this assessment showed that letter identification was adequate for both participants, but slant, size, and ending needed improvement.
The study took place in a special education resource room, at a public elementary school, in the Northwestern United States. Along with the experimenter and students, the staff in this room consisted of two certified special education teachers and two teacher's aides.

Curricula Probe Sheets and Materials
The curriculum employed was composed of probe sheets with models for each of the individual letters of the cursive and manuscript alphabet. This instructional procedure was consistent with previous research related to instruction of D'Nealian handwriting (Porter et al., 1984). Probe sheets for error drills and time trials were developed prior to the beginning of the study. The sessions lasted a total of 15 minutes, three times a week (Monday, Wednesday, and Friday).

Movement Cycle and Measurement Procedures
The students participated in a see/write movement cycle evaluating the formation of individual handwritten letters on the basis of size, slant, and ending of D'Nealian handwriting. The three variables related to the evaluation criterion for letter formation and legibility consisted of size, slant, and ending and were each worth one point. Each handwritten letter was evaluated on the basis of these three legibility variables, therefore, each individual letter was worth a three possible points as they related to the individual legibility variables. These points were then totaled for all of the letters written during a given timed trial. The students participated in three time trials per session, using the probe sheets that were developed. The highest score, of the three timed trials per session, was recorded on the Standard Cel·eration Chart. The intermediate instructional aim was 75 correct responses based upon the evaluation criterion with no learning opportunities (i.e., errors) during the one minute timed trials. This practice period was implemented to ensure that the students, given adequate time, would be able to complete all the letters from the alphabet using D'Nealian handwriting. Letters needing improvement were selected from the three time trials and the separate writing of the alphabet.

Practice, error drill, and corrective feedback. During this intervention condition, students were instructed to concentrate on curve, slant, and ending in handwriting. Also, they were told to "make use of their lines." In other words, the researcher directed them to form each part of their letter stroke(s) to the appropriate top, bottom, and middle lines. Focus for improvement was placed on letters identified during Baseline, especially t, f, g, q, d, b, and p. Five minutes were allocated to the students to complete the error
drills. During these error drills, specific letters selected previously for remediation were dispersed in three separate segments of four or five letters for each student to work on during this phase. Three one minute time trials followed the error drills. These time trials were then evaluated, and the highest score was selected and plotted. This condition was in effect for two school weeks.

Error drill, corrective feedback, praise and fading of the model. The same basic conditions and procedures employed in the first intervention were continued, but the models of the letters employed on error drills and time trials were gradually faded. Traditionally, in Precision Teaching, three consecutive days, with the number of corrects above the instructional aim and the minimum rate of progress line and the learning opportunities below 5 per minute, inform the researchers that students are making satisfactory progress towards mastering the skill (Sweeney, Omness, Janusz, & Cooper, 1992). In this case, however, the authors were concerned about ensuring mastery and transfer of learning from probe sheets with models of the letters written on the lines above, to actual assignments with no model. Thus, probe sheets, error drills, and time trials were presented with faded lettering in conjunction with praise statements for increasing corrects responses and decreasing learning opportunities. This condition was in effect for five school days.

Results

Male Participant

The data on Chart 1 indicated improvement in the legibility of D'Nealian handwriting with the use of error drill, feedback, praise, and fading with the male participant. During 3 baseline sessions, the median number of correct responses related to size, slants, and individual letter endings for D'Nealian handwritten letters was 57 per minute, with scores ranging from 38 to 69 per minute. This was compared with the 5 sessions conducted during the practice, error drill and corrective feedback condition that resulted in a median number of learning opportunities for D'Nealian handwritten letters of 4 per minute, with scores ranging from 2 to 6 per minute. Finally, data from the 4 sessions during the error drill, corrective feedback, praise, and fading of the model condition showed the male participant's median performance for the number of learning opportunities related to size, slants, and individual letter endings as 3 per minute, with scores ranging from 2 to 9 per minute.

Data from Chart 1 indicated a slightly improvement in performance of the number of correct responses related to size, slants, and individual letter endings accelerating at $x^{1.25}$, while learning opportunities decreased by $+3.8$ during baseline. Results from the 5 sessions conducted during the practice, error drill, and corrective feedback condition, indicate an accelerating data trend for the number of correct responses related to D'Nealian handwriting. The initial accelerations for number of correct responses related to size, slants, and individual letter endings for the male participant showed an increase of $x^{2.5}$ for the first 2 sessions, with the data path leveling off for the remainder of the condition resulting in an overall celeration of $x^{1.4}$ during this condition. Learning opportunities also accelerated by $x^{1.8}$ during this condition. Finally, the data from the 4 sessions during the error drill, corrective feedback, praise, and fading of the model condition revealed an accelerating data path of $x^{1.25}$ for the male participant. Celerations for learning opportunities related to D'Nealian handwriting showed a turn-up phenomena for the male participant during this condition. Data showed an initial deceleration during the first 2 sessions of $+4.0$, with a turn-up in learning op
portunities during the final 3 session, resulting in acceleration of x4.0. Overall performance changes for correctly written D’Nealian letters across the three conditions accelerated at a x1.9, x1.7, and x5.0, respectively, for the male participant. Overall performance changes for learning opportunities related to D’Nealian letter writing across the three conditions accelerated at a x1.9, x2.5, and x5.0, respectively.

Female Participant

Data from Chart 2 showed accelerating learning trends for corrects across baseline and practice, error drill, and corrective feedback conditions, with a stable learning trend during the final experimental condition. Further, while learning opportunities were below 5 per minute throughout the study for the female participant, data revealed an important deceleration during the practice, error drill, and corrective feedback condition. This decrease in learning opportunities, with the exception of the final session, maintained below the record floor during the error drill, corrective feedback, praise, and fading of the model condition.

During 3 baseline sessions with the female participant, the median number of correct responses related to size, slant, and individual letter endings for D’Nealian handwritten letters was 36, with a range of 33 to 39 responses per minute. In the second experimental condition (i.e., practice, error drill, and corrective feedback), the median frequency for correctly written D’Nealian letters for the female participant was 54, with a range of 38 to 60 responses per minute. In the final experimental condition, (i.e., error drill, corrective feedback, praise, and fading of the model), the median frequency for correctly written cursive handwritten letters for the female participant was 60 with a range of 52 to 60 response per minute.

During 3 baseline sessions, the median number of learning opportunities related to size, slants, and individual letter endings for D’Nealian handwritten letters was 36, with a range of 33 to 39 responses per minute. In the second experimental condition (i.e., practice, error drill, and corrective feedback), the median frequency for correctly written D’Nealian letters for the female participant was 54, with a range of 38 to 60 responses per minute. In the final experimental condition, (i.e., error drill, corrective feedback, praise, and fading of the model), the median frequency for correctly written cursive handwritten letters for the female participant was 60 with a range of 52 to 60 response per minute.

Data from Chart 2, for the female participant, showed celerations of performance for the number of correct responses related to size, slants, and individual letter endings accelerating at x2.5, while learning opportunities decreased by +1.7 during the baseline condition. Results from the 5 sessions conducted during the practice, error drill and corrective feedback condition indicated an accelerating data trend for the number of correct responses related to the D’Nealian handwriting of x1.5, with learning opportunities decelerating at a +3.0. Finally, the data from the 3 sessions during the error drill, corrective feedback, praise, and fading of the model condition revealed an accelerating data path of x1.00 for the female participant. Celerations for learning opportunities related to D’Nealian handwriting for the male participant during this condition remained below the record floor, with the exception of the final day of the study where 2 learning opportunities appeared. Overall performance changes for correctly written D’Nealian letters across the three conditions accelerated at a x2.0, x1.7, and +1.25, respectively for the female participant. Overall performance changes for learning opportunities related to D’Nealian letter writing across the three conditions accelerated at a +1.5, +5.0, and x2.0, respectively.

Discussion

Both the male and female students in this study successfully improved their D’Nealian handwriting legibility through the use of error drills combined with corrective feedback and verbal praise. The remediation of size, slant, and individual letter endings to improve the individual letter formation was consistent with previous studies focusing on improving handwriting legibility (Brunner et al., 1994; Early et al., 1976; Porter et al., 1984; Sweeney et al., 1993; Talbert-Johnson et al., 1991). The male participants’ learning picture appears to show a more consistent celeration of corrects across both intervention conditions, when compared to baseline scores. His learning opportunities did show an
accelerating learning trend in both the error drill and the error drill combined with corrective feedback and verbal praise experimental conditions. Since the corrects continued to improve, and the learning opportunities never exceeded 10 per minute, it was decided to continue with the program that was then in place with this student. Even though this was the case, the first author believed it was advisable to conduct a further error analysis in an effort to decrease the learning opportunities in the future.

The female participant's learning picture also showed improvements in both the number of correctly written D'Nealian handwritten letters, as well as in a decrease in learning opportunities to almost zero by the end of the study. Unfortunately, these results need to be interpreted cautiously because of the accelerating learning picture in baseline. It could be assumed that just the opportunity to have supervised practice in handwriting skills, as evidenced by the improving learning pictures in all three experimental conditions, may have been adequate for improving this student's handwriting legibility. Further, one may cautiously assume that the intervention conditions may have been more related to decreasing learning opportunities, rather than functioning to improve the number of correct responses. Additionally, although the male participant met the instructional aim of 75 or more individual letters formed correctly per minute, the female participant was not able to meet this goal by the conclusion of the study. Therefore, it was recommended that further fluency training (i.e., speed and accuracy combined) be implemented in an effort to make the correctly formed handwritten letters become automatic.

Although both participants improved their D'Nealian handwriting legibility during this study, the authors were unable to discern whether these students were able to transfer the skills learned over to their daily work in the regular classroom. It would be beneficial for future research to probe the legibility of the students' handwriting on their daily classroom work to determine whether any of the skills taught with the probe sheets had generalized to other settings, people, and assignments (Cooper, Heron, & Heward, 1987; McKenzie, & Budd, 1981; Stokes & Baer, 1977). This future research would bolster the assumption that increases in fluency of skills are related to generalization of skills to across other conditions (Howell & Lorson-Howell, 1990).

The use of error drill combined with corrective feedback and verbal praise are low cost, effective, and efficient strategies for improving the handwriting legibility of students. These strategies, augmented with data-based measurement tactics such as Precision Teaching and the Standard Celeration Chart, provide a powerful means of evaluating the effectiveness of specific instructional strategies currently employed in the classroom. Further, the development of probe sheets and other materials commonly found in the classroom, as well as short but intense instructional and assessment periods (Miller & Heward, 1992; Whalen, Willis, & Sweeney, 1993) could produce important instructional gains without greatly taxing a teacher's time and resources. Training students in the classroom to count, record, and chart their own data on Standard Celeration Charts could further reduce the teacher's cost by reducing the time needed to implement such a procedure. Finally, public posting of the Charts could serve as a reinforcer for students' performance, as well as a evaluative tool for the teacher to determine if the current instruction is effective (Van Houten, 1980).

Some may claim that focusing remedial instruction on improving handwriting is unnecessary and a waste of valuable instructional time in light of the prevalence of mechanical communication devices such as word processors, typewriters, and computers. No one will argue the increasing importance of mechanical and technological modes of communication within our society. However, the importance of legible handwriting remains an important means of individual expression, creativity, and competence. The legibility of an individual's handwriting, whether it be on a job application or a personal communication, is one way we are perceived and thereby, communicate with the world around us (Brunner et al., 1993; Manning, 1986; McLaughlin et al., 1987). Legible handwriting, will in all probability, continue to be an important and functional skill in the future; thus, it would be prudent to continue to encourage, assist, and remediate students' handwriting legibility in the classroom (Brunner et al., 1993; Manning, 1980; Nelli, 1982; Peck et al., 1980).
References


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The Effect of Music on Head Posturing of a Student with Cerebral Palsy: A Case Study

V. Timmons, T. F. McLaughlin, and V. Kinakin

This study investigated the effects of music on the head posture of a profoundly handicapped cerebral palsied individual. An ABCABC single case design consisting of two baseline conditions, two treatment conditions (physical assistance which activated music), and a third condition. Head raising contingent on music was used to evaluate the effects of the treatment procedures. The subject wore a mercury switch device attached to headphones secured to a baseball hat. The mercury switch activated the music. A digital tape counter monitored the length of time the head was raised. Results indicated that music became an effective reinforcer for head lifting. Data were also collected on number of head lifts during feeding. An improvement during feeding was also evident. Questionnaires given to teachers, family, and the respite care worker demonstrated that the program had a slight effect on significant others' perceptions and on the subject's awareness of his environment.

The number of children with disabilities served in a classroom setting has increased dramatically (Bigge, 1993; Heward & Orlansky, 1992; Kirk & Gallagher, 1994). The passing of Public Law 94-142 and Individuals with Disabilities Education Act (IDEA) mandated that schools integrate students with special needs (Hallahan & Kauffman, 1994; Heward & Orlansky, 1992; Jellison, 1977). The Mills case secured the right of all individuals, despite their degree of impairment, to an appropriate education (Alley, 1977). Teachers are responsible for implementing effective programs for children with severe disabilities. They need programs to model and access to equipment that is easily constructed and effective in a classroom situation (Bigge, 1993).

The first significant stage in a child's motor development is that of mid-line orientation and the start of head control. Both of these activities make it possible for the baby to begin to make contact with his/her environment. By definition and common usage, cerebral palsy is a nonprogressive disorder of movement or posture beginning in childhood, due to a malfunction or damage of the brain (Bigge, 1993; Bleck, 1975). When observing the motor development of the cerebral palsied child, the head control is often delayed and abnormal (Finnie, 1975). Non-traditional teaching methods may need to be implemented to develop this behavior (Bigge, 1994).

The use of music as a reinforcer has been used extensively for persons with disabilities. Music can be administered and withdrawn immediately, and it may be paced continuously thus making possible a longer period of response (Metzler, 1974). Presentation of music listening strengthens the auditory attending processes and brings the subject one step closer to accepting verbal reinforcers. Music also eliminates many of the problems found with using food as a consequence (Saperston, 1980). Also, many severely handicapped individuals with severe cerebral palsy have difficulty in swallowing.

Studies which focused on the use of music for children with cerebral palsy have generally reported positive outcomes (Micollet, 1974). Also, a mercury switch has been widely used with music for people with severe handicaps. Mercury switches can promote correct head posture (Ball & McCrady, 1975; Wolfe, 1980). Earphones cut down on distracting noises and help the subjects to be more aware (Greenwald, 1978). In the present research, the behavior that was attempted to be developed was that of head posturing in an individual with cerebral palsy using music as a reinforcer. A treatment phase was implemented using physical assistance to teach the connection that erect head position was contingent on music. The research project was also carried out in a special education classroom in a regular elementary school, rather than in an institution or special day school. Finally, a
measure of social validity or clinical significance (Wolf, 1978; McLaughlin, 1981) was obtained from the subjective impressions of persons who worked with the student, as to changes in the participant’s behavior.

Method

Participant and Setting

The participant was a seventeen-year-old male with cerebral palsy. He was also clinically diagnosed by medical doctors with microcephalia, profound mental retardation, spasticity, and quadriplegia. The participant spent the school day in a Mulholland seating system. This allowed him to be comfortable throughout the school day. He received physiotherapy maintenance treatment twice daily. The physical therapist felt that the subject was physically able to exhibit an erect head position, but due to the severity of the cerebral palsy, emitted little voluntary behavior. Music was selected as a reinforcer because the subject’s auditory sense was strongest. This was supported by the parents’ and physiotherapist’s recommendations.

The study was conducted in a segregated classroom in a public elementary school in rural British Columbia, Canada. The participant’s classroom contained four additional students who were able to work independently. The data were collected during math period (10:30 a.m. and 1:00 p.m.), which was a quiet, structured time.

Apparatus

A mercury switch head device was used to monitor erect head position (See Figure 1). The switch was attached to Walkman head phones sewn on a baseball cap which insured the head phones were stable (See Figure 2). The head phones plugged into a small, pocket-sized Sony tape recorder that rested on the subject’s lap. Tape recorded music was produced when the mercury wasn’t touching a wire which activated the relay, which turned off the music and stopped the digital tape counter. A stopwatch was used to time the program to exactly ten minutes.

Dependent Variables and Measurement Procedures

The first dependent variable was the length a tape ran as measured by a digital tape counter on the tape recorder. The counter was set at zero before each session, and the number on the digital tape counter was recorded at the conclusion of each session. Data were gathered in the morning and afternoon for a total of 20 minutes. Feeding occurred after the music during the first stage of the program and before the music, when the procedure was repeated.

During the treatment phase, the teacher aide physically lifted the subject’s head. Both the number of head lifts and the number on the digital tape counter were recorded. The subject was fed twelve spoonfuls of food each feeding time. The number of times he raised his head or his head was erect during feeding was also recorded. Before each spoonful, the aide said the subject’s name clearly. Data were collected by a teacher’s aide. The aide kept a daily journal noting the subject’s performance and the type of food provided.

Subjective Data

Questionnaires were distributed to all the significant persons (e.g., family members, teacher, and respite care worker) in the subject’s life. They were asked to rate the subject’s awareness of his environment and his alertness. People received the same questionnaire at the beginning and the end of the study. The questionnaire employed can be seen in Figure 3.

Experimental Design and Conditions

An ABCABC single case design (Barlow & Hersen, 1984; Kazdin, 1982) was employed to examine the effects of music contingent on erect head posture. A description of the experimental conditions follows.

Procedure

Baseline 1 and 2. During this condition the teacher aide collected data on how often the subject’s head was erect. Data were collected by scoring the number on the digital tape counter at
Figure 2. Walkman head phones attached to a baseball cap.
Figure 1.
Mercury switch head device
<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>How often does he lift his head voluntarily?</td>
<td>Not at all, sometimes, all the time</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>2.</td>
<td>Does he lift his head more often during specific times of the day?</td>
<td>Check: yes, no</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>How would you rate his overall awareness of his environment?</td>
<td>Not aware at all, Aware sometimes, Always aware</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 2 4 5</td>
</tr>
<tr>
<td>4.</td>
<td>Are there certain times when he seems more aware?</td>
<td>Check: yes, no</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>How would you rate his overall alertness during the day?</td>
<td>Not alert at all, Alert sometimes, Always alert</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 2 4 5</td>
</tr>
<tr>
<td>6.</td>
<td>Is he more alert during certain times of the day?</td>
<td>Check: yes, no</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 3. Questionnaire used to rate the subject's general awareness and alertness.

the end of a ten-minute session. A blank tape was used. The subject was fed before the baseline data were taken during the first baseline condition, and following the program during the second baseline condition. Baseline data were gathered for four weeks during the first phase and for three weeks during the second baseline phase.

Physical assistance. The treatment condition consisted of the teacher aide physically raising the subject’s head to activate the music. A tape with music was used during this phase. If the subject dropped his head, it was lifted again. The sessions were twice each day for a ten-minute duration at 10:30 a.m. and 1:00 p.m. The feeding was after the treatment for the first stage and before the treatment during the second stage. Both the number of physical prompts and length of the digital tape counter ran were recorded. The first treatment condition lasted seven weeks; the second ran six weeks.

Contingent on music 1 and 2. During the third stage, a tape with music was placed in the tape recorder. Lifting of the head turned the music on. The sessions ran for ten minutes at 10:30 a.m. and 1:00 p.m. Feeding was done after the music during the first condition and before the second. The length of time the head was lifted was recorded from the number on the digital tape counter. The first response contingent on music ran two weeks and the second five weeks.

Follow-up. To assess the maintenance of treatment effects, data were collected five weeks after the research project was completed, for six days, five weeks after the research project. Follow-up data were collected the same as Baseline 1 and 2.

Reliability. Reliability of measurement was taken by another teacher in the building three times a week. An independent scoring of the number on the tape recorder was made.
For the number of head lifts on whether or not the subject's head was erect, a simultaneous but independent tally was made. The speech therapist randomly dropped in to assess if the program was carried out as outlined. If the number on the digital tape counter and number of head lifts were found to be consistent by all three people, this was defined as an agreement. Any difference was defined as a disagreement. Reliability of measurement for the length the digital tape counter traveled and the number of head lifts was always 100 percent between the speech therapist and the classroom teacher.

**Results**

**Tape Length**
There was a marked increase in the length of time the subject's head was raised at the completion of the study. As Table 1 indicates, the mean length of time the tape ran was low during both baseline phases.

During the first Physical Assistance phase, the average length that the tape ran was 71.3 (range 66 to 156). The use of Contingent Music without physical prompts generated a decrease in the mean length of time that the tape ran (Mean 5.6; range 0-53). During the second Physical Assistance phase, a reduction in the mean length of time the tape ran was noted, especially when compared to the first Physical prompting phase 52.6 (range 63-175). The last phase (Response Contingent Music), the mean length of time the tape ran increased to 46.1. As Charts 1 and 2 show, there was a great deal of variability in the subject's performance.

**Head Raising During Feeding**
There was gradual improvement in head raising during feeding. The first Baseline indicated the subject's head was lifted or erect on an average of 1.9 (range 1-6) during feeding. This behavior increased to 3.5 (range 1 to 10) during the Physical Assistance phase. There was an additional increase in the first Contingent Music condition to 4.9 (range 1-12). The number of times the subject lifted his head or kept it erect stabilized in the replications of the last three conditions: (a) Baselines (Mean 4.3; range 2-9), (b) Physical Assistance 4.4 (range 1-10) and (c) Contingent Music 4.5 (0 to 12). Charts 3 and 4 reveal there was again variability in the subject's performance during feeding.

**Follow-up**
In the Follow-up condition, the length of time the subject's head was raised, as indicated by length of time a blank tape ran, decreased to a mean of 29.7 (range 0 to 122). The number of times the subject's head was erect or lifted during feeding maintained at 4.9 (range 2-7). There was still variability in the subject's performance.

**Subjective Data**
There was improvement in all the ratings from the first questionnaire to the second. For question 1, the average rating went from 2.3 to 2.9 out of a possible 5. Question 2 changed from 5 yes to all yes (7 out of a possible 7). Question 3 increased from 2 to 2.9 out of a possible 5. Question 4 increased from 5 yes to 6 yes out of a possible 7. All increases were slight, but were evident in every question. The general consensus of those surveyed indicated that the subject was more alert and aware during contact time with people.

**Discussion**
This study indicated that music can increase the length of time the subject's head was raised during the day. It is important to note that improvement was most evident for head raising during music in the final condition. In working with persons with severe disabilities, improvements are slight and many times difficult to identify. The program had to be carried out twice and for an extended length of time before any change was noted.

This study is similar to the study carried out by Wolfe (1980). The apparatus used in the present study was a mercury switch similar to the one Wolfe employed with slight variations in the construction. Also, headphones were added to eliminate the difficulty Wolfe encountered with outside noises distracting some of his subjects. Wolfe stated that "correct head posturing and associated movements can be promoted through the use of an assistive conditioning device such as the mercury switch head apparatus" (p. 194).
Table 1
Summary of Results

<table>
<thead>
<tr>
<th>Conditions&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Length of Tape Runs</th>
<th>Head Raises during Feeding&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Range</td>
</tr>
<tr>
<td>A&lt;sub&gt;1&lt;/sub&gt;</td>
<td>9.4</td>
<td>0 - 140</td>
</tr>
<tr>
<td>B&lt;sub&gt;1&lt;/sub&gt;</td>
<td>71.3</td>
<td>66 - 156</td>
</tr>
<tr>
<td>C&lt;sub&gt;1&lt;/sub&gt;</td>
<td>5.6</td>
<td>0 - 53</td>
</tr>
<tr>
<td>A&lt;sub&gt;2&lt;/sub&gt;</td>
<td>6.6</td>
<td>0 - 53</td>
</tr>
<tr>
<td>B&lt;sub&gt;2&lt;/sub&gt;</td>
<td>52.6</td>
<td>63 - 175</td>
</tr>
<tr>
<td>C&lt;sub&gt;2&lt;/sub&gt;</td>
<td>46.1</td>
<td>0 - 209</td>
</tr>
<tr>
<td>Follow-up</td>
<td>29.7</td>
<td>0 - 122</td>
</tr>
</tbody>
</table>

<sup>a</sup>A<sub>1</sub> and A<sub>2</sub> = Baseline 1 and 2
B<sub>1</sub> and B<sub>2</sub> = Physical Assistance 1 and 2
C<sub>1</sub> and C<sub>2</sub> = Contingent Music 1 and 2

<sup>b</sup> out of 12 possible

The results from the present study would support this statement. There was some difficulty with the subject knocking off his headphones, but use of the baseball cap eliminated that problem. The earphones were small and light and cut down on distractions. The same music tape was used during the entire program. A variety of music will be tried in consultation with a music specialist to detect any preferences. This should have been done before the project, but the music was selected on the recommendations of the family.

There was only a slight improvement of perceptions by individuals, or the social validity of the participant's behavior change (Wolf, 1978). Since the program showed improvement at the end, the final questionnaire may have reflected that. The participant has no communication skills and often can be overlooked due to his quiet nature. If people perceive him to be more aware, they will interact more, thus, possibly encouraging more responses.

The research project also provided the teachers with a day-to-day illustration of the subject's general health. He was often absent or too physically rigid to carry out the program. Improvements shown in head raising were indicative of improvement in his general health. The project had to be carried out for a long period of time because many days were lost during the year due to absenteeism or the subject being too physically rigid. The variability in the results indicated a fluctuation in the subject's health. The participant's health was reflected in the performance and therefore in the results.

The follow-up condition showed that effects from the program were still evident in feeding, but the length of time the subject's head was raised was decreasing. The physical assisting of the subject's head may have to be done more often during the day to see more of an improvement.

The project was easy to employ in the classroom setting and gave the staff satisfaction from implementing a program that may indicate the subject's abilities. The program was essential to constructively fill the subject's school day. When the subject's head is raised during the day, his peers notice and would speak to him. This may have been an additional factor in the improvement.

Music, and a device, such as the mercury switch in this study, could be used to improve head posture. As head posture improves, a program to reinforce the focusing of vision could be implemented. When the head is raised, it is easier to see and be engaged by stimuli.
DAILY BEHAVIOR CHART (DCM-9EN)
CALENDAR WEEKS

Cycle: 140 Days (20 Wks)
Behavior Research Co

Baseline 2
Physical Prompts 2
X = 6.6

X = 2.6

Response Contingent on music 2
X = 46.1

X = 29.7

Successive Calendar Days

Count per Minute

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140

Superintendent Adviser Manager
Depositor Agency Timer Counter Charter

MIN HRS
-¼ ¼ ½ 1 2 5 10 20 50 100 200 500 1000 16 24
Baseline 1
\[ X = 1.9 \]

Physical Prompts
\[ X = 3.5 \]

Response Contingent on music
\[ X = 4.9 \]
This study can be easily modeled within any classroom setting with minimal cost and time to set up. Detailed data collection provide staff with an indication of any slight improvement.

References


Using Precision Teaching to Enhance Direct Instruction
Sight-Word Reading

Michele Morrell, Robert Morrell, Richard M. Kubina Jr.

This study assessed the effects of using Precision Teaching techniques with Direct Instruction to teach sight-word reading with three students in a rural elementary school. All three students used practice cards and showed an acceleration in learning to read sight-words.

In America, there has been a growing concern about the lack of "basic skills" taught in public schools as well as the weakening in the education system. Some believe that the current state of affairs in education represents "...an authentic crisis in our society" (Dubross, 1995, p. 1). However, possible solutions to the crisis have been in measurably superior instructional technologies which have existed for over 20 years: Direction Instruction (DI) and Precision Teaching (PT) (Binder & Watkins, 1990).

Direct Instruction, founded by Siegfried Engelmann, is a researched based approach to educational instruction and implementation. Rosen- shine (1976) summarizes the variables that are associated with DI as a "high level of student engagement within academically focused, teacher-directed classrooms using sequenced, structured materials" (p. 17). Instructional objectives are made clear to students and amount of time allocated for instruction is prescribed. Student performance is monitored and feedback to students is immediate and academically oriented.

Precision Teaching, founded by Ogden Lindsley, has proven that it can greatly strengthen any curriculum (Beck & Clement, 1991; Lindsley, 1991). When Precision Teaching is used with Direct Instruction, "a powerful combination" is achieved (Desjardins & Slocum, 1993).

One area that benefits from the combination of DI and PT is reading. Systematically establishing the basic components of reading and then bringing those skills to fluent levels creates a solid foundation for reading. If component skills are not fluent, moving on to tasks predicated on those skills makes learning more difficult for the learner which may ultimately lead to dysfluency in that subject (Snyder, 1992).

Arguably the most basic component of reading is decoding single letters. This first step is crucial in reading due to its central recurrence (Perfetti, 1986). A collateral basic skill is reading sight-words. The general notion is that if students can identify key sight-words in a sentence or passage, they will spend "less time and effort...directed to recognition activities" (Gunderson, 1984, p. 267).

Words lists have been a popular way to teach sight-words. Usage of sight-word lists preceded 20 B.C. and has changed in forms numerous times (Otto, 1975). A few of the many popular word lists are the Dolch list, the Great Atlantic and Pacific Sight-Word list, and the Thorndike Word list. However, none of these word lists is included in a curriculum that provides practice and application of the words in the list. One curriculum that does is Direct Instruction. This curriculum uses word list exercises to systematically introduce and teach sight-word reading (Carnine, Silbert, & Kameenui, 1990). The words in the list comprise extensions of the beginning sounds necessary for decoding.

Augmenting DI with PT allows the acceleration of learning through daily practice and frequent feedback to learners and teachers. The purpose of this study was to determine if the learning of Direct Instruction sight words could be accelerated by Precision Teaching techniques.
Method

Participants
The participants in this study were three students in the second grade. Each student was diagnosed at the beginning of the school year as Learning Disabled and attended a special education classroom part-time. The students were Michael, an African-American 8 year old male, Joseph a Caucasian 8 year old male, and Wendy an African-American 8 year old female. The participants were selected on the basis of projected benefit from the intervention. Before the study began, all three students expressed fear and dislike when told they would be timed on reading words.

Setting. The study took place in a midwestern, rural public school. The setting was in the special education classroom. Teaching sessions were held Monday through Friday at 12:45 to 1:15 p.m. when the students were present at school. The classroom door was kept closed during class times.

Students sat at a table during instruction. When the timed trials occurred, each participant sat alone with his/her teacher, the first author, while the other students moved to another table to practice with each other.

Measurement. Practice cards were printed on standard 3 by 5 note cards. The front side had first grade level sight words, and the back was left blank. Words used were taken from Direct Instruction Reading Mastery 1 lessons, (Engelmann & Bruner, 1995).

A digital stopwatch was used to conduct one-minute timings. The first author scored corrects and learning opportunities during the one-minute timings. Students recorded their data on a spreadsheet and then transcribed them to Standard Celeration Charts (Pennypacker, Koenig, & Lindsley, 1972).

Procedures

Entry Assessment. The Reading Mastery 1 placement test was administered at the beginning of the study to determine where in the program each student should begin. All three students placed at lesson #11 of Reading Mastery 1 (first grade level). It was decided at that time not to begin to use practice cards until approximately two weeks later. During those two weeks, students learned beginning sounds and Vowel-Consonant (CV) and Consonant-Vowel-Consonant (CVC) words in small group Direct Instruction. For the remainder of the study, daily Direct Instruction lessons were used to introduce new sounds and sight words.

Instruction The practice card timings occurred an average of three to five times per week before the daily DI reading lesson. Each student sat next to the instructor with the deck of practice cards in hand. The student was told to shuffle the cards before the timing began.

During the first phase for all three students, the deck consisted of 10 cards. Each individual student began the one-minute timing by first shuffling the practice cards. The student then was instructed when to begin by the signal, "Go". As the student orally responded, the teacher would tally corrects and incorrects by placing a hash mark into the appropriate column of a data sheet.

During this phase, a correct was determined by correctly saying the sight-word. An incorrect was making an incorrect pronunciation, or word, for the sight word. In all phases, skips were not counted as incorrect. The student would recycle through the deck if he/she went beyond the number of cards it contained.

Results

Charts 1, 2, and 3 show the count of correct responses and learning opportunities of sight-word practice cards for each student. These data present acceleration in all phases for the students.

Wendy
Chart 1 shows the results for Wendy. During the first phase, the deck consisted of 10 sight-word practice cards. Wendy's corrects accelerated x1.5. Total bounce for corrects was x2.6. She reached her aim of 20 corrects in three and a half weeks.
At the onset of all three subsequent phases, 10 new cards were added. In each of these phases her frequency aim was 40 words per minute. During the second phase Wendy took two and a half weeks to reach aim and her corrects accelerated by x1.6. The total bounce was x1.6. For the third phase, it took one week to reach her aim of 40 cards correct per minute. Corrects accelerated by x3.0 with a total bounce of x1.2. In the fourth phase, corrects multiplied by x1.8 during the one and a half weeks it took to reach aim. Total bounce was x1.0. For the final phase, before aim could be reached, school was out for summer vacation. Corrects were accelerating at x1.8, and total bounce was x1.0.

Michael
Chart 2 shows the results for Michael. During the first phase, Michael's deck consisted of the same 10 sight-word practice cards as the other students' decks. Aim for the first phase was set at 20 correct per minute which was reached in four and a half weeks. The corrects accelerated x1.7 during this period. The total bounce for the corrects was x3.3.

In the second phase, 10 new sight words were added to the deck and the aim was raised to 40 corrects. In the three and a half weeks of using sight-word practice cards, corrects accelerated by x1.2 with a total bounce of x1.8. Before aim was reached, school dismissed for summer vacation.

Joseph
Results for Joseph are displayed in Chart 3. In the first phase the practice card deck consisted of 10 cards. It took Joseph five and a half weeks to reach aim of 20 per minute. The overall acceleration was x1.4, and the total bounce was x1.2. For the second phase Joseph was also out of school before aim could be reached. His corrects were accelerating at x1.1 with a bounce of x2.3.

Discussion

Young children are usually anxious to read; however, for some children who have been in an unproductive environment, reading becomes something to avoid. The children in our study not only wanted to avoid reading, they were initially convinced they would never read. When told they would be timed using practice cards, the children appeared very apprehensive, and one student began to cry.

The children were introduced to the Chart and its uses. After one week of charting, the children not only wanted to practice more, they supported each other and acted like a team. The Chart was very motivational for the children. It was important for the students to see that they could learn, since they were halfway through 2nd grade and could not read any sight words prior to the intervention.

In this study we have coined the term practice cards, as opposed to word cards, for several reasons. First, word cards are typically used in a drill and practice format. The problems with the drill and practice format are "the learner does not have a specific GOAL and that it tends to be prescribed in intervals that are too long" (Binder, 1990). Second, we wanted to differentiate practice cards from SAFMEDS, even though they are similar. Practice cards are used like SAFMEDS (Potts, Eshleman & Cooper, 1993). They are "Say All Fast Every Day Shuffle", but differ in that the item on the front does not correspond with information on the back.

Using practice cards as opposed to word lists has various advantages. For instance, a word list can produce a serial position effect. Serial position is "an ordinal location an item occupies in a sequence" (Saufley, 1975, p. 418). In turn, this position can provide a cue to the particular list item. Shuffling practice cards controls for serial position.

A final advantage of practice cards is they require complete student attention and Active Student Response (ASR). ASR is defined as "...an observable student response made to an instructional antecedent" (Barbetta, Heron, & Heward, 1993, p. 111). With practice cards the instructional antecedents are the sight words and the students' responses are the correct pronunciation.

Direct Instruction sight-words formatted into practice cards created a potent mechanism to teach a basic reading skill. The DI reading program ensured the sight-words used would be encountered in other exercises, thereby giving context to the words. In the practice card exercises,
students learned the words quickly and soundly. By the end of the intervention, all students had the beginnings of a firm foundation for further reading instruction and eagerly anticipated the next school year.

Limitations. This study had several limitations. First, the beginning practice card deck contained only 10 cards which allowed students to recycle through the deck. This could have produced a serial position effect. However, shuffling the practice deck before each session minimized the serial position effect.

Students skipped the cards that were difficult and responded to the ones they knew. They should have been encouraged to have learning opportunities. Attempting to respond to skipped words may have increased the probability of an eventual correct response. Further, if skips were counted, a learning pattern could have been attained. But at the request of the children, skips were omitted.

Finally, aims should have been set at a higher frequency. They were set at a low rate as the students were apprehensive about using practice cards and the Standard Celeration Chart. Students could have been encouraged by their own progress which may have mitigated their anxiety.

Future Research. In subsequent research, the use of practice cards can be applied to different topic areas. For instance, practice cards may be used with the instruction of decoding basic sounds. Further generalization measures could include using practice cards with regular education students, emotionally impaired students, people with mental retardation, and students of varying ages. Research might also investigate the degree to which practice cards could improve the acquisition of composite reading skills subsequent to learning a component skill with practice cards.

Summary

This study presented the effects of Precision Teaching techniques, practice cards, used with a Direct Instruction reading curriculum. These methods were combined to improve sight-word reading with three students with Learning Disabilities. For each of the three students, learning in each phase showed acceleration in sight-word reading. Our results demonstrated that in a short amount of time our intervention could rapidly increase basic reading skills.

References


Richard M. Kubina and Robert Morrell are associated with Mediplex Rehabilitation Center, Battle Creek, MI, and Michelle Morrell is a special education teacher with Dowagiac Union Schools in MI.
Use of Daily Measurement, Standard Celeration Charting, and a Nicotrol Patch to Reduce Cigarette Smoking with a Female College Student: A Case Study

Susan Abba and T. F. McLaughlin

The purpose of this study was to determine the efficacy of Precision Teaching with daily charting using a Standard Celeration Chart with an adult female college student to reduce her rate of smoking cigarettes. The number of cigarettes smoked per day was measured and graphed in order to provide the participant with feedback as to her daily performance. An ABCD design was used to evaluate the various interventions. The first two procedures were unsuccessful, but the third intervention was the use of Nicotrol Patch, a chemical aide to reduce the chemical craving for nicotine. The patch is designed to be worn 16 hours a day while 15 mg. of nicotine are absorbed through the skin over that period of time. This is employed to reduce any withdrawal symptoms typically associated from the addictive chemical found called nicotine, in cigarettes. The results of wearing the patch were very impressive, bringing the average number of cigarettes per day from 12.5 to 1.0. At the end of formal data collection, the subject was still reporting a desire for cigarettes first thing in the morning and has been able to just smoke one cigarette per day.

Smoking is the leading cause of preventable death, killing over 400,000 people each year and costing as much as 65 billion dollars a year in deaths, lost wages, and smoking-related illness (Leventhal & Cleary, 1980). Cigarettes contain a highly addictive drug called nicotine, but it is only one of many chemicals found in them (American Cancer Society, 1994). Once addicted to the drug nicotine, it is often difficult to give up (Lichtenstein, 1982, Shiffman, 1982). However, it can be done and every effort should be made to do so as early as possible. Of course, the best solution is to never start.

While nicotine is the chemical that addicts persons to cigarettes, the other chemicals are generally what may cause cancers, emphysema, heart disease, and strokes. For example, Pyrene, a main constituent of coal tar is produced when the tobacco is burned. Several other harmful chemicals are produced when cigarettes burn, such as: DDT, a pesticide that has been banned from use; Carbon Monoxide (CO) found in car exhaust; Cresol, used in roach sprays; Ammonia, found in cleaners used to remove wax from floors and varnish; and Hydrogen Cyanide, a fumigation poison banned from international use. In addition, Isoprene, a natural base for tire rubber; Acetone, main ingredient in fingernail polish remover; Methanol, used as rocket fuel; Vinyl Chloride, the main ingredient in the manufacture of PVC; and Arsenic, a poison, are found in tobacco. A shocking fact is that these are only a few of the chemicals that cause increased heart rate, high blood pressure, increased respiratory rate, restricted blood flow throughout the body, and that all are found when tobacco is ingested (American Cancer Society, 1994).

An approach that has shown success in reducing the number of cigarettes smoked has been controlled smoking (CS). Controlled smoking is a procedure where persons are taught to smoke cigarettes with low levels of nicotine, smoke just one cigarette per hour, keep their cigarettes in a locked drawer or in the trunk of their car making it effortful to find and smoke cigarettes. Controlled smoking has been a somewhat successful method in reducing the number of cigarettes smoked, as well as the amount of CO ingested by the smoker. The controlled smoking method has suffered from high relapse rates common in most research on addictions (Leventhal & Cleary, 1980).
The purpose of the present case report was to examine the effects of several intervention strategies to reduce the number of cigarettes smoked by a university student. Several strategies suggested by the controlled smoking literature such as smoking in only one place, making cigarettes effortful to locate, and reducing the amount of nicotine ingested by smoking cigarettes low in nicotine. Finally, the use of a nicotine patch was evaluated using daily measurement (Lindsley, 1991). The eventual goal of the research was to have the participant completely smoke-free by the end of data collection.

Method

Participant and Settings
The participant of this study was an adult female undergraduate student enrolled in a private university. The participant is also a parent of a young child. The participant was selected for this particular experiment because of her lack of success with several other treatment plans to stop smoking including hypnosis and various alternative methods such as chewing gum, and a strong personal desire to quit smoking. The participant had smoked cigarettes for more than 20 years and had averaged smoking one pack per day. The settings for data collection and smoking included the participant's home (front porch), on the campus, and when her daughter was not with her, in the participant's automobile.

Movement Cycle and Dependent Variable
The behavior measured was the number of cigarettes smoked per day. Data were collected on the number of cigarettes smoked for seven consecutive weeks.

Experimental Design
An ABCD single case replication design (Kazdin, 1982) was used to evaluate the effectiveness of three different interventions.

Baseline. During baseline, the participant recorded every cigarette she smoked without altering her previous smoking behaviors. The data were recorded on three-cycle graph paper and then transferred to a line graph and to 6-cycle movement Standard Celeration Chart. This phase was in effect for 3 days.

Exercise. The first attempt at reducing the amount of cigarettes smoked was to begin a regular exercise program for 20 to 30 minutes for at least three times per week. This phase was in effect for 7 days.

Smoke in one place. Still recording and plotting daily, the subject began to implement a plan to smoke in only one place. The subject chose to do this at her home on her front porch, since she spent so little time at home. This condition was in effect for 26 days.

Nicotrol patch. The subject still recorded her smoking habits daily, and for the third time tried something different. She went to her physician to get a nicotine supplement in the form of gum. Due to the expense, the participant opted for the Nicotrol Patch. The subject began wearing the patch the following week. Also, the participant smoked a nonpreferred cigarette each morning. This condition was in effect for 7 days and ended the last day of the semester.

Results and Discussion
The results of this study showed a significant decrease in the amount of cigarettes smoked during the implementation of the Nicotrol Patch. A Friedman Two-Way-Analysis of Variance (Siegel, 1956) across phases was calculated. Differences between phases, corrected for ties, were found to be significant ($\chi^2 = 8.7; \alpha = .032$).

For baseline the number of cigarettes smoked ranged from 11 to 12 with a mean of 11.3. For the exercise program the number of cigarettes smoked remained stable, range 11 to 13 with a mean of 12.85. During the smoke in one place phase, the number of cigarettes smoked daily ranged from 9 to 15 with a mean of 12.5 cigarettes smoked per day. The number of cigarettes smoked per day during the Nicotrol Patch phase was 1.71.
The participant in this study had smoked cigarettes for more than 20 years and was actually unsure of her desire to really quit smoking. This may have been largely due to the belief that it was impossible to quit, especially after the several previous attempts at quitting. However, the results of this study show that it can be done. Though the results are not completely satisfactory, they have shown the third intervention to be very effective in greatly reducing the amount of cigarettes smoked each day. The procedure has been effective in the subject believing that she can stop smoking. Considering that the third procedure was implemented one week before college finals and still had a considerable success rate, the subject has considered that during less stressful times, the intervention would have had complete success. The subject has now set a new goal to completely quit smoking cigarettes by the last day of school. A recent check indicated that this goal has not been achieved. However, the student is smoking only one cigarette per day, again providing additional evidence as to the relapse rates in smoking cessation research (Marlatt & Gordon, 1980; Shiffman, 1982).

An implication of this case study is that no matter how long a person has smoked, or how many cigarettes a person smokes, it is quite possible to reduce the number of cigarettes smoked, no matter how hard one has tried to stop smoking and failed in the past. This outcome is supported by the literature on controlled smoking because nicotine was gradually withdrawn, and the participant still consumed some cigarettes (Glasgow et al., 1983). Also, quitting without the assistance of Nicotrol, or some other form nicotine, may not be a wise procedure since relapse rates have been so high.

The use of continuous measurement provided the student with feedback as to the effectiveness of the various interventions. Also, when the smoking in place intervention was not successful, data plotted on Standard Celeration Chart could be used to convince the participant to try another strategy, which in this case, was the Nicotrol Patch.

The use of the patch still allows nicotine to be absorbed into the circulatory system. However, its use does keep the other harmful chemicals such as tars, etc. out of the person's lungs.

References


Susan Abba and T. F. McLaughlin are associated with the Department of Special Education, School of Education, Gonzaga University, Spokane, WA.
The Effects of Precision Teaching and a Token Economy on Handwriting Skills: A Case Study

Christine Bashore and T. F. McLaughlin

The purpose of this case report was to determine the effectiveness of a token economy program with a second grade student who was exhibiting skill deficits in the area of cursive writing. The participant was enrolled in the second grade and was a focus of concern for the classroom teacher. The major dependent measure was correct rate in handwriting. The effects of an individualized token program were evaluated in an ABAB experimental design. For scoring, each written letter was awarded with one point (token) for appropriate legibility, ending, size, and slant. This yielded a total score of four points for each letter. During the token reinforcement phases of the study, these points were then converted to tokens and used to purchase back-up reinforcers such as candy, pencils, cream soda, lunch out, milkshakes, a movie, and a shopping trip to a local sporting goods or toy store. Overall outcomes indicate an increase in appropriate cursive letter ending, legibility, size, and slant when the token economy was in effect. There was a decline in rate, but not in celeration for the second baseline condition. Suggestions for use of token programs to assist children with their handwriting were made.

Precision Teaching has a strong data base which has been effective in improving the academic skills of children and youth and in assisting teachers making instructional decisions based on rates of child progress (Lindsay, 1991; Lovitt, 1988; White & Haring, 1980). Precision Teaching methodology has merit for use in today's schools.

Developing basic skills in the early elementary grades is very common and necessary for a successful educational career; however, many times, for a variety of reasons, these skills are not learned appropriately and correctly. Therefore, it is essential to reexamine the situation and provide adequate resources for students to obtain the required skills.

Handwriting is viewed as an important communication skill (Hansen, 1978, Sweeney, Salva, Cooper, & Talbert-Johnson, 1992, 1993, McLaughlin, 1981). It can be difficult for a person reading a message to comprehend it if the writer has written the message in an illegible manner.

One of the major goals in handwriting research concerns legibility (e.g. Brunner, McLaughlin, & Sweeney, 1993; Hansen, 1978, Talbert-Johnson, Salva, Sweeney, & Cooper, 1991). Intervention strategies to assist and improve legibility have ranged from error drill (Brunner et al., 1987), academic positive practice (McLaughlin, Mabee, Byram, & Reiter, 1987), to self-management strategies (Sweeney et al. 1993).

Handwriting, in particular, is very important to master at a young age (Peck, Askov, & Fairchild, 1980). If difficulties arise, many problems will occur when trying to communicate through writing (Hansen, 1978). Individuals may become frustrated if nobody can understand their writing (McLaughlin et al., 1987). Writing is also been suggested as important for proficient reading (Smith, 1976). The more students write and read, the more accurate their reading becomes (Smith, 1976). It is obvious that reading, writing and handwriting skills are essential for a successful educational career (Bushell, 1978; Slavin, Madden, Dolan, Wasiak, Ross, & Smith, 1994).

One of the most effective and data-based ways to improve classroom behaviors has been to implement a classroom token economy. Token systems have been effective across various grade levels, school populations, and academic and social behaviors (e.g. Kazdin, 1977, 1982b; McLaughlin & R. L. Williams, 1988; O'Leary & Drabman, S. G. O'Leary & K. D. O'Leary, 1981).
The purpose of this case study was to increase a second-grade male student's cursive handwriting abilities through Precision Teaching and a token economy. Hopefully, this program would enable the student to communicate clearly and efficiently on paper because of increases in legibility and speed.

**Method**

**Participant and Setting**

The participant of this study was a male elementary student enrolled in an urban public school of 672 students in the Pacific Northwest. The student was chosen because he exhibited severe difficulty in the area of handwriting. His teacher and school administrator suggested that he receive tutoring because they felt that the pupil was at-risk for school failure. The child was assigned to a regular second grade classroom and received two 30-minute sessions of handwriting assistance in the hall outside of his assigned classroom each week. This tutoring was provided by an undergraduate special education major completing a course in Precision Teaching at a local university.

**Dependent Variables and Measurement Procedures**

The dependent variable was the frequency of movements per minute for legibility, size, slant and endings of cursive letters during a 30 minute tutoring session. The student practiced a new letter through air writing, tracing and independent practice. After the timing, the letters were given points legibility, size, slant, and ending. The letter was legible if the tutor could recognize which letter the student's sample represented. For size to be scored, the letter had to contain the correct height and not be above or below the line on the paper; for slant to be scored, the letter had to contain the appropriate slant. For an ending point to be given, the letter had to contain the correct ending (e.g. curl, upward movement, etc.). Frequency of these correct movements in handwriting was determined by dividing the number of correct letter points by the total number of minutes in the tutoring session.

In addition, data were also calculated as percent correct. Accuracy data were gathered despite its problems with ceiling effects, providing a distorted picture of acquisition, fluency, and mastery (White & Haring, 1980). This was done to provide the student, parent, and teacher a more familiar form of data to evaluate student progress. Percent correct was calculated by dividing the number of correct components per letter by the number of letters completed and multiplying by 100.

**Experimental Designs and Conditions**

An ABAB single case design (Kazdin, 1982a) was employed to evaluate and establish a functional relationship as to the effects of a token economy and Precision Teaching on handwriting skills.

**Baseline 1.** The initial baseline was established during four sessions over a two week period. During Baseline 1, the following routine was followed. The subject was shown a new letter, through verbal prompts, he was then asked to air write it, trace it, and then write it independently. The tutor then scored each letter for accuracy according to the four parts (legibility, size, slant, and ending).

**Token economy 1.** During this phase, a token economy program was implemented. During the program, the tutor and subject met six times. The student was introduced to two new cursive letters per session. The subject was expected to follow the same routine that was completed in Baseline 1, which was air writing, tracing and independent practice. Air writing is where the student writes the letter in the air for the tutor. After each page was completed, the tutor scored each individual letter or word for a total of four points per letter. Letters were scored on the basis of legibility, slant, size and ending. The student earned a token for each point earned. With his tokens, the student was able to purchase a variety of back-up reinforcers. These back-up reinforcers and their respective prices are shown in Figure 1.

**Baseline 2.** To test the effects of the token program, a return to baseline was carried out. During Baseline 2, new letters were still introduced to the student, but he was told he would not be receiving tokens for the points he made from
<table>
<thead>
<tr>
<th>Back Up Item</th>
<th>Cost in Points (Tokens)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candy</td>
<td>20</td>
</tr>
<tr>
<td>Pencils</td>
<td>30</td>
</tr>
<tr>
<td>Milkshake</td>
<td>50</td>
</tr>
<tr>
<td>Lunch Out with Tutor</td>
<td>80</td>
</tr>
<tr>
<td>Nintendo Game</td>
<td>90</td>
</tr>
<tr>
<td>Movie</td>
<td>100</td>
</tr>
<tr>
<td>White Elephant</td>
<td>140</td>
</tr>
<tr>
<td>Toy Store Trip</td>
<td>180</td>
</tr>
<tr>
<td>Toy's &quot;R&quot; Us Trip</td>
<td>180</td>
</tr>
<tr>
<td>Star Wars Movie Video</td>
<td>200</td>
</tr>
</tbody>
</table>

Figure 1. Back-up reinforcer items and their respective costs.

Token economy 2. A second token economy was implemented. The same type of routine was followed which included air writing, tracing and independent drill and practice. The subject again earned points that were exchangeable for tokens for his accuracy in writing cursive letters. The participant was able to choose back-up rewards from the same menu that was used during the first token economy intervention.

Results and Discussion

Frequency and Celerations

The subject’s handwriting showed improvement over the course of eight weeks. During baseline, the student had an average legibility rating in handwriting of 35.25 points. His celeration for Baseline 1 was x1.01. During the first token program, the student’s performance increased (X = 56.83 points; Celeration = x1.5). A return to Baseline resulted in a decrease in the counts per minute (X = 45.0 points). However, there was not a corresponding decline in celeration (x2.0). With the introduction of the token system (Token 2) increases in the frequency of correct aspects of handwriting accuracy were noted (X = 56.5). However, no such change in celeration was found (x1.01).

Percent Correct

The percent correct for these same data can be seen in Figure 2. As these data show, percent correct can provide a very different picture for these outcomes. The subject’s handwriting showed improvement over the course of sessions. During baseline, the participant had an average of 54% for accurate ending, legibility, size and slant of cursive letters. During the first token economy, the subject generated an average of 76% for slant, size, legibility, and ending of cursive letters. For the second baseline, the average percent correct fell to 68%. However, this was still higher than that found in Baseline 1. During the second token economy, the student increased his accuracy to an average of 76%.

The token economy increased accuracy of cursive letters a total of 12 percentage points. The ending percentage of 76% is not as high as desired, but the teacher and school administration were happy with these outcomes. At this writing, the token economy was continued, along with verbal prompting to increase accuracy Chart 1 concerning legibility, size, slant and endings of cursive letters.

The results of this study indicated that a token economy program, verbal prompting, and Precision Teaching procedures were effective strategies in improving the handwriting skills of the subject. However, the results were not totally satisfactory. It would be ideal if the subject could have achieved a writing accuracy percentage of at least 90%. In addition, increases in celeration during the token program phases would have been desirable. Through practice and time, the subject will be able to improve his cursive writing to an acceptable degree of accuracy. Token economy and verbal prompting encouraged the subject to stay on task, as well as keep him motivated. The student’s handwriting decelerated during the first token program. The pupil simply slowed down when he worked on his practice sheets trying to be more accurate, since accuracy led to points exchangeable for various activities and items. He could obtain four points per letter, rather than just two or three, if he
Figure 2
wrote more letters faster which were illegible, containing the wrong slant, etc.

The token program continues to be implemented for this student. The classroom teacher felt it important to reward improvements in handwriting by reminding him that he would still receive back-up reinforcers for good handwriting. At times, young children may fail to remember that they are receiving back-up reinforcers for previous work. Overall, this study implied that a token economy accompanied with verbal prompting and tutoring can be helpful when improving the handwriting of second grade students.

The separate contributions of the Precision Teaching procedures and the token economy cannot be singled out. Additional research where both procedures could be evaluated in either a multi-element or a counterbalanced multiple baseline design (Kazdin, 1982) could be performed. The present design, ABAB, did not allow such a comparison to be made. After treatment is withdrawn in this design, then the behavior under investigation should revert to baseline levels. Teachers and others working in school settings dislike the difficulty of reverting to a baseline condition and prefer the use of designs that do not require return to baseline. (McLaughlin, 1983).

It is important to note that percentage measures did not accurately portray this student’s progress. When one views these data from celeration changes, a very different picture of outcomes emerges. Though accuracy did decline, celerations did not. Therefore, using precision measurement can change one’s views as to the outcomes of learning.

References


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We hear much about the national debt. For decades, Democrats and Republicans have sparred over it. Since 1929, the United States has had eight years of a budget surplus and 50 years of a budget deficit. To see the problem clearly, we must look at yearly data on standard multiply/divide charts across a long period of time.

To chart the budget receipts and outlays, the budget surplus and deficit, and the gross national product across years gives the clearest picture. Further, we know that interest grows by multiplying, not by adding. Perhaps because of what we learned as children: Put money in the bank and each month, they give a statement that shows the interest added--some think assets and debts grow by adding. The statement never says, however, that the interest accumulates by multiplying. And the same is true of a debt.

A Few Definitions
The United States gross national product, the GNP, is the value of all goods and services produced in the country, from socks and ceilings to surgery and social work services.

The budget receipts are the monies the government receives, usually through taxes. The budget outlays are the monies it spends on highways, disasters, education, welfare, art, health, etc.

A budget surplus occurs in a year when the receipts are greater than the outlays--when the money earned is greater than the money spent. A budget deficit occurs when the outlays are greater than the receipts--when the government spends more than it has.

Using the World Almanac, I charted these five items across 50 years.

A Few Observations
♦ The national debt in September 1992 was four trillion dollars ($4,000,000,000,000). In June 1993 it was 4.3 trillion ($4,300,000,000,000).

♦ For the last 45 years, the gross national product has grown at x1.6 per five years. On the Standard Celeration Chart, x1.0 would be maintaining; x2.0 would be doubling every five years.

♦ The budget receipts are now growing at x1.4 per five years, the budget outlays at x1.7 per five years. This means that we the people, through the federal government, are spending more than we earn. (As an individual or as a family, how long would we allow that to go on?)

♦ For the past twenty-five years, the budget surplus has maintained at zero while the budget deficit grows at x2.3 per five years--more than double.

♦ Our last budget surplus was in 1969. I read somewhere that President Johnson and Congress, anticipating the continuation of the Vietnam War, had budgeted for it. 1969 saw a slowing of the war and therefore an overbudgeting, or a surplus.

♦ The party of the president or of the congress is irrelevant to the increases and decreases of the surplus and deficit. Not surprisingly, the Great Depression and World War II are the two events with the greatest financial impact in the last 50 years.

♦ Most surprising and alarming, there has been little variability in the deficit since 1969, and our receipts and outlays have even less bounce. It is easier to change the behavior of a person when the behavior bounces a lot--more opportunity to reward the desired behavior and punish the undesired. The same may be true of the budget sur-
plus and deficit—the behavior of millions of people: Little variability may make this very difficult to change.

Using the yearly Standard Celeration Chart for these data, makes it clear we are in a crisis—we spend more than we earn and the difference between the two continues to increase. Meager steps, such as cutting the very small NEA budget, are laughable. Cutting a million here, a million there, will do, as the British say, damn all. It is directly analogous to a family saying, "We owe $100,000. We better start a penny jar to pay it off." To save the financial life of this country, we must bite the bullet and take billions of dollars of cuts. Now.

In future articles, I shall look at different parts of the federal budget and at the data back to 1776.

References


PT Data Lands in Fiction
Abigail B. Calkin

I believe it was at an ABA meeting in Nashville, Tennessee in the mid-80's when we talked about getting Precision Teaching and Direct Instruction into more areas than behavior analysis and public education.

Carl Binder has taken fluency into private business. Hank Pennypacker founded MammaCare. A number of precision teachers have private schools (Kent Johnson, Michael Maloney, Ian & Aileen Spence, Elizabeth Haughton, and Annie Desjardins). We are beginning to publish more in the journals other than Journal of Precision Teaching.

In my most recent novel, The Carolyne Letters, the main character counts fetal movement. I used the data from my son’s fetal movement chart (Calkin, 1983) with an exception. I had a cesarean section two weeks early; Amelia, the mother in the story, did not. To compute the possible final seven data points I used in the novel, I compared my son’s fetal movement with that from the dozen or so other fetal charts I have (including one of his cousin’s). I then projected proportionately what my son’s fetal movement would have been if I had not had an early, no-labor cesarean section. I used seven of these projected data points for the final ten days of Amelia’s pregnancy.

I believe this is the first use of Standard Celeration Chart data in fiction.

References

Standard Celeration Society Meeting
27 May 95
ABA, Washington, DC

Executive Board
John Cooper
Carl Binder
Abigail B. Calkin
Claudia McDade

President
Vice President
Secretary
Treasurer

Clerk
Kent Johnson

Members-at-Large
John Eshelman
Chuck Merbitz

(The Membership and Marketing Committees are listed because they were not abolished at the May 1995 meeting.)

Membership Committee
Diane Hendrickson & Michael Maloney, Co-chairs
Claudia McDade
Carl Binder
Steve Kukic

Present:
Carl Binder (MA)
Kirby Brown (PA)
John Cooper (OH)
Steven A. Graf (OH)
Ogden R. Lindsley (KS)
Chuck Merbitz (IL)
Ann Poe (AL)
Chet Starlin (OR)
Julie S. Vargas (WV)

Marketing Committee
Carl Binder, Chair

John Brown (AL)
Abigail B. Calkin (KS)
John Eshelman (GA)
Kent Johnson (WA)
Claudia McDade (AL)
Hank Pennypacker (FL)
Jim Pollard (MA)
Bob Stein (PA)
Bob Worsham

Representation:
Northeast: MA 1
PA 2

South: AL 3
FL 1
GA 1

Midwest: KS 2
IL 1

Northwest: OR 1
WA 2

(Copies of minutes also sent to Ray Beck & Owen White)
1. **Should the SCS meet at ABA?** Ray Beck is trying to organize a Precision Teaching Conference in Seattle. Ray Beck has $15,000 planning money to fly people to Seattle during the summer '95 to plan a 1996 Precision Teaching Conference. CEC will provide someone to do the legwork. We need to use the Bostos Manual and talk to a Salt Lake City person in the planning. Those present chose the following to be the Planning Committee: Ray Beck, Carl Binder, Abigail B. Calkin, Kent Johnson, Owen White. It passed unanimously that the SCS will meet annually at ABA.

2. **Should we become an ABA special interest group (SIG)?**
   - In favor—9
   - Opposed—4
   - Abstain—3
   - Name: Standard Celeration Charting
   - Co-chairs: Steve Graf, Chuck Merbitz

3. **All-day Fluency Research Symposium at 1996 ABA**
   Kent Johnson & Carl Binder will conduct this, probably on the first day at the pre-conference workshop day.
   We have yet to examine endurance, application, standards.

4. **Regular and charter member dues**
   - $100—were the Charter Member dues
   - We decided
   - $100—a sustaining member who will receive two issues of each *JPT*.
   - $50—a regular member who will receive one issues of each *JPT* and have a reduced conference fee.
   - $25—a person who receives *JPT* only.
   We need a directory. Claudia McDade and Ann Poe will do this.
   This entire item passed unanimously.

5. **Notification of dues**
   Ann Poe will send three reminders.

6. **Need a computerized list of *JPT* subscribers & SCS members.**
   Ann Poe will do the list. The date-paid will go on the address label.
   Ogden Lindsley passed out the current SCS membership list. Lists attached.

7. **Rotate officers**
   The following people were nominated, then elected unanimously:
   - Executive Board
     - President: John Cooper
     - Vice President: Carl Binder
     - Secretary: Abigail B. Calkin
     - Treasurer: Claudia McDade
   - Members-at-Large
     - John Eshelman
     - Chuck Merbitz
     - Clerk: Ann Poe
     - Kent Johnson

8. **ABA program—we need a sub-category of SCS to prevent simultaneous sessions.**
   We decided in #2 to become an ABA SIG.

Meeting adjourned.

For correction, please contact Abigail B. Calkin, Secretary SCS
631 SW Lane
Topeka, KS 66606-1536
(913-354-7018)
Standard Celeration Society

A professional organization for all those who use the Standard Celeration Chart in education, therapy, economic analysis, marketing, financial planning, quality improvement, performance management or science.

Why Join?
The Standard Celeration Society provides a “home” for Precision Teachers and others who apply standard measurement. It is a network of colleagues and friends devoted to improving monitoring of changes in performance – regardless what is counted. A variety of benefits to members includes:

* a year’s subscription to the *Journal of Precision Teaching and Celeration*
* reduced conference fees for the International Precision Teaching Conference
* periodic mailings and notices about developments in Standard Celeration

History
The Society evolved from a 25-year history, beginning with the founding of Precision Teaching (PT) by Dr. Ogden Lindsley, supported by the Precision Teaching Project in Great Falls, Montana, and maintained with eleven international Precision Teaching Conferences. In 1990, PT leaders from around North America decided it was time for an organization with expanded scope—to serve a broader range of needs for communication and networking among Precision Teachers and to make PT methods available to those seeking measurably effective educational alternatives. The Standard Celeration Society will address those needs with more than a conference, including the *Journal*, a membership directory, and opportunities to serve on committees and special projects.

Membership Categories

<table>
<thead>
<tr>
<th>Membership Category</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Charter Member</td>
<td>Membership before March 1, 1993</td>
</tr>
<tr>
<td>Sustaining Member</td>
<td>$100 Membership dues, for those wishing to provide an extra contribution to the success of SCS. Membership includes 2 issues of each <em>Journal of Precision Teaching and Celeration</em>, and have a reduced conference fee.</td>
</tr>
<tr>
<td>Regular Member</td>
<td>$50 Membership dues. Member will receive one issue of each <em>Journal of Precision Teaching and Celeration</em> and have a reduced conference fee.</td>
</tr>
<tr>
<td>Subscriber</td>
<td>$25 Subscription fee. Receives <em>Journal of Precision Teaching and Celeration</em>.</td>
</tr>
</tbody>
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Standard Celeration Society
Membership Application

Name: ________________________________

Title: __________________ Organization: __________________

Street: ________________________________

City: __________________ State/Province: __________________

Zip/Postal Code: __________ Country: ______________

Home Phone: (___) __________ Work Phone: (___) __________

E-Mail __________________ Fax __________________

Type of membership:

_____ Sustaining Membership $100
_____ Regular Membership $50
_____ Subscriber $25

Membership Directory:
In 255 characters (including spaces) or less please write any description of yourself--interests, professional activities, etc.

________________________________________
________________________________________
________________________________________

Make annual dues check in U. S. funds payable to the Standard Celeration Society. Membership dues are renewable September 1 of each calendar year.

Mail application and dues to:

Claudia E. McDade, Treas.
Standard Celeration Society
Center for Individualized Instruction
Jacksonville State University
Jacksonville, AL 36265

72
Twelfth International Precision Teaching Conference  
University of Washington, Seattle, WA  
October 9 - 12, 1996

PRECISE SOLUTIONS  
FOR THE NEEDS OF A DIVERSE SOCIETY

Plan on attending a conference presenting solutions to the educational crisis, that increasingly worries American educators and the general public --- Violence, Inclusion, School Improvement and Plugging the Hole in Whole Language

Increase your effectiveness by attending this conference to learn strategies for developing competent students.

Pre-conference workshops:  In-depth application training sessions.
Conference:  Presentations, mini-workshops, and demonstrations.
Poster Sessions:  Informal data share.
Cracker Barrel:  Special opportunity to talk with the experts and leaders about specific methods. Lots of ideas and professional contacts.

For additional information, write or call:
Claudia McDade, Ph.D., Chair, Publicity Committee
Center for Individualized Instruction
Jacksonville State University
Jacksonville, AL 36265
Fax (205) 782-5321  (205) 782-5570    E-mail CMcDade@jsucc.jsu.edu
We invite your participation in the 12th International Precision Teaching Conference to be held at the University of Washington, Seattle, WA, October 9 - 12, 1996.

HOW TO SUBMIT A PROPOSAL:

The International Precision Teaching Conference is designed to bring practical and relevant information to our audience. The convention features "program tracks," based on current and future education trends. Your program proposal should be designed for one of the following tracks: School improvement, Inclusion, Violence, Plugging the Hole in Whole Language (and other basic skills). To be considered as a speaker, your proposal must reach the Program Committee no later then June 1, 1996.

Speakers: All program presenters should have experience presenting programs on the proposed topic. New presenters are encouraged to team up with veterans.

Exhibitor Showcase: A limited number of tables will be available for commercial displays at 8:00 a.m. on October 10, 1996. One covered table will be furnished for each display. Contact Abigail Calkin, (913) 354-7018 or (913) 575-6834 (Fax) or 631 SW Lane, Topeka, KS 66606-1536.

Team Presentations: The 12th International Precision Teaching Conference encourages "teams" of speakers for the program sessions. These teams could be comprised of principals, teachers, superintendents, professors, or curriculum development specialists.

Registration Fees: All presenters must pay the appropriate registration fee.

Dianne Barr-Cole, Chair
Program Committee
Eatonville School District
P. O. Box 698
Eatonville, WA 98326
(360) 832-3308
(360) 832-3224 (Fax)
CRITERIA FOR ACCEPTANCE:

All proposals are competitively reviewed through a careful and systematic peer review process. They are evaluated on the relevance, scope, clarity, and practicality of their content, and the specificity, and clarity of their objectives. This includes the possibility for audience participation, and the use of audio-visual materials, handouts and references.

The following criteria for acceptance MUST be met to be considered:

- The form must be accurately completed.
- The form SHOULD be either typed, or printed from a computer.
- The name of the PRIMARY SPEAKER must appear on the form.
- The form should present concise objectives.

ABSTRACT CONTENT:

Your abstract paragraph should be a summary of the objectives in your presentation. Do not list your objectives here. Please elaborate. The paragraph should contain pertinent details of your presentation.

OBJECTIVE:

At least three objectives should be listed which describe the learning outcomes, such as “At the end of the session, participants will be able to demonstrate, identify, complete, etc...”

HELPFUL TIPS:

- Use of audio-visual equipment enhances your presentation.
- Group involvement, such as hands-on participation, enhances your presentation.
- Clear, concise proposals are an important part of the selection process.
- You may submit as many proposals as you like (on individual forms). Please COMPLETE EACH FORM.
PROGRAM DESCRIPTION (Please type all information):

Program Title: ____________________________________________________________

List in one clear sentence the goal of the session and list up to 3 objectives:

Goal: ________________________________________________________________

Objectives:
1. ________________________________________________________________
2. ________________________________________________________________
3. ________________________________________________________________

Program Abstract: a) Provide a short description of the program, and b) include a description (or charts) of Standard Celeration Charted data or other data that you plan to share supporting your conclusions or demonstrations.

Conference Program Copy: Provide no more than a 3-sentence description to be used in the final conference program, subject to editing.
SPEAKER INFORMATION (Please Type):

Primary Speaker Name __________________________ Title __________________________
Organization __________________________ Address __________________________
City __________________________ State _______ Zip __________________________
Telephone: Office _________________ Telephone: Home _________________ E-Mail: _________________

Have you presented a session on this topic before? □ Yes □ No
If so, when and where? ___________________________________________________________

Note: All additional speakers should be contacted by you prior to submitting this proposal. The Program Committee will only correspond with the primary speaker. All other participants should be informed of program status by the primary speaker.

ADDITIONAL SPEAKERS (Use additional pages if necessary):

Name __________________________ Title __________________________
Organization __________________________ Address __________________________
City __________________________ State _______ Zip __________________________
Telephone: Office _________________ Telephone: Home _________________ E-Mail: _________________

PRESENTATION:

Your program should relate to one of the following program educational tracks. Please check the track which is most closely related to your program. Choose one category only.

☐ 1. School improvement
☐ 2. Inclusion
☐ 3. Violence
☐ 4. Plugging the Hole in Whole Language (and other basic skills).

PRESENTATION FORMATS:

☐ Pre-conference workshops: 3 to 6 hour in depth application training sessions on a selected topic.
☐ Full session: 50-minute presentations, mini-workshops, demonstrations, etc.
☐ Poster session: Informal 50-minute session providing an opportunity to share data and written summary text on track boards with others.

Poster Session proposals will be accepted up until August 31, 1996

AUDIO-VISUAL EQUIPMENT:

Each meeting room will be set theatre style with a lectern, head table, overhead projector and screen. Speakers are responsible for other audio-visual equipment.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Acceleration Target</td>
<td>- a movement the behavior, manager, advisor, or supervisor expects to accelerate; the frequency is symbolized by placing a dot on the chart.</td>
</tr>
<tr>
<td>Accuracy Celeration Multiplier</td>
<td>- a measure of change in accuracy over time; celeration correct/celeration incorrect.</td>
</tr>
<tr>
<td>Accuracy Frequency Multiplier</td>
<td>- measure of accuracy: frequency correct/frequency incorrect; distance from frequency incorrect to frequency correct; also called the accuracy ratio.</td>
</tr>
<tr>
<td>Accuracy Pair</td>
<td>- two movements, usually correct and incorrect, charted simultaneously.</td>
</tr>
<tr>
<td>Add-Subtract Scale</td>
<td>- any measurement scale on which adding and subtracting by a constant amount is represented by a constant distance. (e.g. the &quot;up the left&quot; scale on an equal interval chart.)</td>
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<tr>
<td>Advisor</td>
<td>- a person who advises a manager, usually viewing Charts on a weekly basis.</td>
</tr>
<tr>
<td>Aim</td>
<td>- an ending goal set for an individual; expressed as a specific frequency; symbolized by drawing an &quot;A&quot; at the expected frequency.</td>
</tr>
<tr>
<td>Aim Star</td>
<td>- an ending goal indicating an aim date as well as an aim or frequency; symbolized by drawing an &quot;A&quot; at the expected frequency on the aim date.</td>
</tr>
<tr>
<td>Behaver</td>
<td>- a person whose behavior is displayed on the Chart.</td>
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<tr>
<td>Behavior Floor</td>
<td>- the lowest daily frequency possible for a particular behavior; l/number of minutes behavior can occur, symbolized by drawing a solid horizontal line on the Chart.</td>
</tr>
<tr>
<td>Bounce Around Celeration</td>
<td>- up bounce and down bounce combined; the range of deviations of frequencies from the celeration line.</td>
</tr>
<tr>
<td>Celeration</td>
<td>- unit of measurement of behavior change; change in frequency per unit time.</td>
</tr>
<tr>
<td>Celeration Aim</td>
<td>- the expected celeration for a given movement.</td>
</tr>
<tr>
<td>Celeration Line</td>
<td>- a best-fit, straight line constructed through frequencies of a given movement on the Standard Celeration Chart (minimum number of data parts 7-10).</td>
</tr>
<tr>
<td>Celeration Multiplier (turn up or turn down)</td>
<td>- value by which one celeration is multiplied or divided to obtain a second.</td>
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<tr>
<td>Change Day</td>
<td>- first day of a phase change, symbolized by drawing a vertical line covering that day line on the Chart.</td>
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<tr>
<td>Counted</td>
<td>- the behavior being measured.</td>
</tr>
<tr>
<td>Counting Period Ceiling</td>
<td>- the highest frequency observable under a given counting procedure; symbolized by drawing a dash line on the Chart connecting the Saturday and Monday lines.</td>
</tr>
<tr>
<td>Counting Period Floor</td>
<td>- 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.</td>
</tr>
<tr>
<td>Cycle</td>
<td>- distance on the Chart between consecutive powers of 10.</td>
</tr>
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</table>
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:

```
  x
```

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; number of minutes spent behaving.

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

Freehand 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; 1/time from signal to start of movement.

Learning - a change in performance frequency per unit time.

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

```
  x
```

Manager - a 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 rovement in a specific time period, such as bi-weekly or monthly.

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

**Quarter-Intersect 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 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.

**SAFMEIS** - 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, 

\[ \text{X} \quad \text{X} \quad \text{X} \text{X} \quad \text{X} \]

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

**Standard 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 furthest above it.

The multidisciplinary journal of standard behavior measurement published by the Standard Celeration Society.

Volumes I and II (April, 1980–January, 1982)
Available only as reprints of individual articles

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Mailing Address: ________________________________
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