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AUTHOR GUIDELINES

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STATEMENT OF PURPOSE: As the official journal of the Standard Celeration Society the Journal of Precision Teaching and Celeration has dedicated itself to a science of human behavior founded on a technology of direct, continuous and standard measurement. This measurement technology includes: a standard unit of behavior measurement – frequency; a standard measure of change in behavior frequencies – celeration; a standard measure of the variability of behavior frequencies – bounce; and a Standard Celeration Chart to display frequency, celeration and bounce data. The Standard Celeration Chart enables chart based statistical procedures to determine changes in frequency-frequency jumps, changes in celeration – celeration turns and changes in bounce – bounce verge.
The current volume, 23, of the *Journal of Precision Teaching and Celeration* has one application article and five chart shares. The application article, by Syrek, Hixson, Jacob, and Morgan, compared the effectiveness and efficiency of two error correction procedures on word reading. A word supply error correction procedure and a multi-learning channel error correction procedure both improved reading performance. However, neither procedure appeared better than the other when comparing the acceleration of words read correctly. The word supply procedure, however, produced better time efficiency. The article by Syrek et al. reminds Precision Teachers to examine not only the correct performance but also the errors.

The five chart shares all have one thing in common: They demonstrate how effective techniques combined with Precision Teaching help children with autism. All of the participants in the chart shares have autism, and the skills taught range from teaching emotions and reading to story telling and motor behavior. The innovations and excellently charted behaviors serve as fertile ground for future research studies as well as directly communicating effective practices to teachers and others who help children with autism to learn.

Readers will also note an improvement in the charting conventions. These convention improvements came from the careful inspection and thoughtful suggestions of an ad hoc advisory group consisting of Steve Graf, Scott Born, and Regina Claypool-Frey; two associate editors, Clay Starlin and Alison Moors; and the editor, Rick Kubina. The conventions will undergo another revision in the 2009 volume, and readers interested in making further suggestions will have the opportunity to express their thoughts and ideas at a future International Precision Teaching Conference and through other media.
A Comparison of Error Correction Procedures on Word Reading

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The effectiveness and efficiency of two error correction procedures on word reading were compared. Three students with below average reading skills and one student with average reading skills were provided with weekly instruction on sets of 20 unknown words. Students’ errors during instruction were followed by either word supply error correction (the researcher said the word and the student was asked to repeat it) or a multilearning channel error correction procedure, which included four components: (a) hear word-say word, (b) see word-say letters (step repeated once), (c) think-say letters (spell without seeing word; step repeated once), and (d) think-write letters (write letters without seeing word). Both conditions generally improved reading performance, although one procedure was not clearly superior to the other in increasing the frequency of words read correctly. The word supply procedure was approximately twice as time efficient.

DESCRIPTORS: Error correction, reading, learning channels

Accurate and fluent oral reading is an essential skill for students to master in the elementary grades (National Reading Panel, 2000). According to the National Research Council Committee on the Prevention of Reading Difficulties in Young Children, the first through third grade curricula should include explicit instruction in letter-sound correspondences and common sight words, as well many opportunities for independent reading, including reading aloud (Snow, Burns, & Griffin, 1998, p. 7). Oral reading is important because it provides practice for students who might not read otherwise and is a means for teachers to evaluate the effects of their instruction on children's reading performance (Carnine, Silbert, & Kameenui, 2004; Jenkins, Larson, & Fleisher, 1983). Furthermore, by requiring students to read aloud frequently, those with difficulties can be identified early and provided individualized help before their problems become severe.

Teachers can use numerous strategies to help students achieve at an accelerated pace. Teaching phonics, preteaching words, and using immediate error correction have been identified as helpful (Jenkins, 1979; Parker, Hasbrouck, & Denton, 2002). Researchers have reported a positive relationship between the correcting of student errors and improved student performance (Carnine, 1980; Good & Beckerman, 1978).

Error Correction

Error correction has been defined as “instruction following an error that the learner fails to self-correct” (Rose et al., 1982, p. 100). Hansen and Eaton (1978) and Jenkins (1979) identified the following error correction procedures:

1. word supply—the teacher supplies the correct word and the learner repeats it,
2. review—word supply procedures are followed by the student reading the sentence or paragraph in which the error occurred,
3. word meaning—word supply procedures are followed by a brief discussion of the meaning of the incorrectly read word,
4. phonic analysis—the learner is encouraged to “sound out” varying portions of the incorrectly read word, and
5. drill—error words are compiled for review and drill at a later time (Jenkins, 1979).

There is a greater need to use error correction procedures with students who have reading disabilities.
because their reading errors make comprehension difficult (O’Shea, Munson, & O’Shea, 1984). Also, these students are less likely to reread passages and self-correct errors (Isakson & Miller, 1976).

Error correction methods that require active student responding have been shown to be more effective than those that require only inactive attendance to each word (e.g., Barbetta, Heron, & Heward, 1993; Singh, 1990). Immediate error correction is more effective than delayed correction (Barbetta, Heward, Bradley, & Miller, 1994). Corrections after every error are more effective than intermittent corrections (Iwata, Dozier, Johnson, Neidert, & Thomason, 2005). Drill procedures, which involve multiple practice trials in reading the words, are more effective than single-step procedures (Iwata, Dozier, Johnson, Neidert, & Thomason, 2005; Jenkins et al., 1983; O’Shea et al., 1984; Rosenberg, 1986). Additionally, research on learning channels indicates that including a writing output may produce better retention than those that involve only a say output (e.g., Spence et al., 2000; Uhry & Shepherd, 1993; Zanatta, 2000). Finally, teaching the spelling (hear-write) of words leads to better word reading than reading the words alone (Uhri & Shepherd, 1993). It is therefore proposed that an error correction procedure that includes multiple components and learning channels (what some educators call “multisensory” procedures, e.g., Combley, 2001; Gillingham & Stillman, 1997) may be more effective than one that involves only one learning channel (i.e., word supply).

The present study investigated the use of a procedure similar to Ian Spence’s 7-step error correction procedure (see www.learningincentive.com) because of its effectiveness with students at the Ben Bronz Academy (Spence et al., 2000). Ben Bronz Academy is a school for students in grades 2 through 12 with identified learning disabilities. Students enter Ben Bronz Academy with a median deficit of 3 years in reading. The academy utilizes daily fluencies, classroom exercises, the Lindamood Method, and a 7-step correction procedure. As a result, phonemic awareness skills and reading fluency are improved. Nine out of 10 students who attend Ben Bronz Academy return to or exceed normal reading growth during their first year of enrollment (see www.learningincentive.com). The present study seeks to utilize a multilearning channel procedure using 6 of the 7 steps. The shorter procedure used in the current study differed only in that each student was required to look at the word and spell it aloud once rather than twice (Table 1). The relative effectiveness of the procedure with 6 steps was compared to a more common word supply error correction method (Carnine, Silbert, & Kameenui, 2004).

METHOD

Participants and Setting

The participants were three third-grade boys and one second-grade girl who attended a summer program to improve academic skills and provide enrichment opportunities. The research took place in the computer lab at an elementary school in Michigan. At the request of the experimenter, the principal selected participants who were below average readers. Selected students were administered three oral reading fluency (ORF) passages from the Dynamic Indicators of Basic Early Literacy Skills (DIBELS; Good & Kaminski, 2002) at their grade level. The median words read correctly per minute and percentile rank (PR) scores were: Student JOURNAL OF PRECISION TEACHING AND CELEBRATION, VOLUME 23, 2007, PAGES 2-13 3

Table 1

<table>
<thead>
<tr>
<th>Seven-step Procedure vs. Multilearning Channel Procedure</th>
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<tbody>
<tr>
<td>Seven-step Procedure</td>
</tr>
<tr>
<td>1. Look at word, say word</td>
</tr>
<tr>
<td>2. Look at word, spell it aloud</td>
</tr>
<tr>
<td>3. Look at word, spell it aloud</td>
</tr>
<tr>
<td>4. Cover word, spell it aloud, uncover, check</td>
</tr>
<tr>
<td>5. Cover word, spell it aloud, uncover, check</td>
</tr>
<tr>
<td>6. Cover word, write word</td>
</tr>
<tr>
<td>7. Look at word, check spelling</td>
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</tbody>
</table>

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METHOD

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1: ORF = 115, PR = 45; Student 2: ORF = 47, PR = 5; Student 3: ORF = 0, PR = <1; and Student 4: ORF = 57, PR = 7. Students 2 and 3 were eligible for special education services as cognitively impaired.

Procedure

The main portion of the study occurred over a 3-week period. The first day of each week, the students were presented with words on flashcards until 20 words were misread two times. Words used with students 2 and 3 were generated from the Fry (1980) and Dolch (1936) word lists, which are frequently used in schools. Students 1 and 4 were presented with additional words found in a reading improvement textbook (Shanker & Ekwall, 1998). Incorrect words were defined as any mismatch between the word on the card and an oral response to that word, including substitutions, omissions, and mispronunciations. Furthermore, the word was counted as incorrect if it was not read within 3 seconds. The following two or three days of the week, the students were taught to read the words. The 20 words were randomly assigned to either a word supply or a multilearning channel error correction procedure.

Word Supply Error Correction Condition.

When a student made an error in this condition, the researcher said the word and asked the student to repeat it. Specifically, the teacher said, “This word is [teacher says correct word]. What word?” The student then repeated the word or the error correction procedure was repeated. This is a common correction format used in direct instruction programs (Carnine, Silbert, & Kameenui, 2004).

Multilearning Channel Correction Condition.

Errors in this condition were followed by a multilearning channel error correction procedure very similar to the one used at Ben Bronz Academy. The correction procedure consisted of the following:

1. The researcher told the student the word and the student repeated the word. This step was identical to the word supply error correction procedure.
2. The student was asked to spell the word out loud, while looking at the word. The researcher said, “Spell _____.”
3. The student covered the word, spelled it aloud, and uncovered the word to check the spelling. The researcher said, “Cover _____ and spell it out loud.” If the word was spelled incorrectly, this step was repeated.
4. Step #3 was repeated.
5. The student covered the word and wrote the word on a sheet of paper. The researcher said, “Cover _____ and write it.”
6. The student checked the spelling. If the spelling was incorrect, this step was repeated.

An alternating-treatments design was used to compare the effectiveness of the two error correction procedures on the sight-word reading of flashcards. The presentation of the words in each condition was alternated daily to control for order effects. At the beginning of each teaching session, the researcher showed each of the 10 unknown words on flashcards to the participant and read them aloud one at a time. Next, the researcher said, “I am going to show you some cards with words on them. When I ask, ‘What word?’ please say the word aloud.” The researcher shuffled the cards and re-presented each card to the student. Correct responses were followed by verbal praise, such as “good!” or “right!” Incorrect responses were followed by either the word supply procedure or the multilearning channel error correction procedure. The researcher continued through the stack of cards two times. After the researcher had gone through each set of words two times using the appropriate error correction, the flashcards were shuffled and re-presented to the student. At this time, no consequences were provided (i.e., no praise or error correction). The number of words out of 10 read correctly was recorded. Next, the researcher showed the student a sheet that contained each of the 10 words randomized and repeated to form 100 words in five columns. The examiner said, “Try to read each word. Read the words down [the researcher demonstrated by pointing down the first column]. If you come to a word you don’t know, I will tell it to you.” If students were stuck on a word for 3 seconds, they were told the word. The students were given one minute to read the words. The number of words read correctly and incorrectly per minute was recorded.

Maintenance

Four to 5 weeks after the final instruction, three of the students were retested on all of the
words from each condition. One of the students was not available for the maintenance test. The researcher randomly determined whether the word supply or the multilearning channel words would be presented first. All of the words from the condition were printed in columns on a page. The student was asked to read each word. The researcher had an identical sheet and marked those words that were misread. The percentage of correctly read words was recorded. Next, the examiner presented a sheet with the same words as those just tested, but the words were randomized and repeated to fill the entire page. The student read the words for one minute, and the number of words read correctly and incorrectly per minute was recorded.

Interobserver Agreement

A second trained independent observer recorded each student’s performance on all dependent measures, that is, percent of word cards read correctly and number of words read correctly on random word sheets for 54% of the sessions. This observer sat near the student and in full view of the presented word cards and random word sheets. Percentage of agreements was calculated by using a word-by-word method, dividing the total number of agreements by the total number of agreements plus disagreements and multiplying by 100%. The overall agreement for the word cards was 99.8%. The overall agreement for the random word sheets was 99.4%.

Treatment Integrity

A trained observer recorded the occurrence or nonoccurrence of critical instructional procedures on 14 trials (4 trials for three students and 2 trials for one student). The observer recorded whether or not the researcher (a) waited 3 seconds before correcting a student error, (b) provided verbal praise following all correct responses, and (c) properly implemented the error correction procedure for each word. When students did not initially respond correctly to a sight-word card, the researcher waited for 3 seconds before providing error correction on 100% of all observed trials under both error correction conditions. The researcher praised 100% of all correct responses in both the word supply and the multi-learning channel error correction conditions. The researcher correctly provided error correction on 98.2% of the total student errors in both conditions.

RESULTS

The number of words learned over the course of the study based on the word card assessments in the word supply procedure versus the multilearning channel procedure was 18 vs. 20 (Student 1), 29 vs. 29 (Student 2), 12 vs. 14 (Student 3), and 30 vs. 29 (Student 4). One procedure was not clearly superior to the other in the number of words learned.

Figures 1-4 show each student’s performance on frequency of words read correctly and errors on the fluency sheets. Within a week’s set of words, the number of words read correctly increased and errors decreased for all students except Student 3. Student 3 had a much greater number of errors than the other students and performed at a much slower frequency. A “jaws” pattern of increasing correct responses and decreasing errors is evident for students 1, 2, and 4, indicating that they were learning the sets of words with daily practice. As with the word cards, the students’ performances on the fluency sheets were not significantly better using either procedure. The performances often overlapped or one procedure was more effective one week but not the next. For Students 1, 2, and 4, the acceleration of corrects was high across students and weeks. Decelerations usually divided at a similar rate, except that errors accelerated for Student 2 in Week 1 of the multilearning channel condition. Given the variability within and across students, neither procedure appears more effective than the other.

Students 1, 2, and 3 were available for the maintenance test. Each student was tested on the word cards and fluency sheets. Considering the results across all three students, one procedure was not superior to the other in terms of either percentage of words read correctly (Table 2) or the frequency of words read correctly or incorrectly per minute (Figures 1-4).

The average amount of time per session teaching the words in the word supply and multilearning channel procedures was recorded for each student. For all four students, the multilearning channel procedure was more time consuming than the word supply procedure (average across all students equaled 11 minutes vs. 5 minutes).
The average time spent within the multi-learning channel versus the word supply procedure was 8 vs. 4 minutes (Student 1), 8 vs. 5 minutes (Student 2), 18 vs. 6 minutes (Student 3), and 10 vs. 5 minutes (Student 4).

**DISCUSSION**

The results show that both the word supply and the multilearning channel error correction procedures helped to increase the percentage and frequency of words read correctly by each student. However, the multi-learning channel correction condition, which included the hear word-say word, see word-say letters (step repeated once), think-say letters (spell without seeing word; step repeated once), and think-write letters (write letters without seeing word) learning channels, was no more effective than the single learning channel, hear word-say word.

In general, Students 1, 2, and 4 learned the words better on both the word cards and the random word sheets than Student 3. The fluency sheet data show an open “jaws” pattern for Students 1, 2, and 4, in which correct responses increase and incorrect responses decrease over the course of the week. It is hypothesized that Student 3 was less proficient because she lacked necessary prerequisite reading skills. She had an oral reading fluency score of 0, so it was difficult to judge whether she was able to demonstrate mastery of letter names and sounds and whether she had any prior sight word knowledge. It would make sense that with deficiencies in these skills, Student 3 would struggle with the multi-learning channel error correction procedure. Additionally, Student 3 was frequently off-task and inattentive. For all four students, the time required to implement the multilearning channel procedure was considerably more than the word supply procedure. The current findings indicate that word supply is a more time-efficient teaching procedure than the multi-learning channel procedure. It may also be more useful and motivating for students who tend to be distractible.

With respect to motivation, it would have been interesting to explore each student’s acceptance of each of the error correction procedures. In addition, the role of metacognition could be investigated. For example, when a student is asked to learn a new word, is the student able to identify a strategy for learning? What steps does the student take, and do these steps include multi-learning channel methods such as spelling the word aloud or writing the letters?

The inclusion of more learning channels (or more “senses”) in the error correction did not improve performance over a single learning channel error correction. Past research has focused on the importance of a drill component, which was not directly included in the present study. It is suspected that the multi-learning channel procedure would be enhanced by the requirement that the word be repeated aloud following Steps 2 through 6.

Past research has examined the importance of interspersing known words and unknown words when teaching vocabulary or spelling (Burns, Tucker, Frame, Foley, & Hauser, 2000; Cooke, Guzauskas, Pressley, & Kerr, 1993; Gickling & Havertape, 1981; Neef, Iwata, & Page, 1980; Roberts & Shapiro, 1996; Roberts, Turco, & Shapiro, 1991). Gickling and Havertape (1981) suggested a 70% known to 30% unknown ratio for improving performance. Roberts and Shapiro (1996) and Roberts et al. (1991) found the 70:30 ratio to improve retention, although a more frustrating ratio of 50% known to 50% unknown and 10% known to 90% unknown, respectively, improved acquisition. In 2000, Burns et al. were also able to provide studies that supported

<table>
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<tr>
<th>Table 2</th>
<th>Percentage of Word Supply and Multi-learning Channel Words Read Correctly in the Maintenance Test</th>
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<tbody>
<tr>
<td>Student</td>
<td>Word Supply</td>
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<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>1</td>
<td>90%</td>
</tr>
<tr>
<td>2</td>
<td>50%</td>
</tr>
<tr>
<td>3</td>
<td>13%</td>
</tr>
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</table>
the reliability of Gickling and Havertape’s (1981) 70:30 ratio. The current study used all unknown words. Thus, interspersal methods, or “incremental rehearsal” (Burns et al., 2000), may have improved the reading performance and retention of words for students in the current study.

Implications from the present study suggest the need for future research involving error correction. The effects of a multistep procedure could be evaluated in terms of its impact on the reading improvement of multisyllable words versus short, single-syllable words. There may have been benefits of using the multilearning channel procedure that were not evaluated in this study. For example, the multi-learning channel procedure may have helped students spell the words better than the word supply procedure.

The present results may be relevant to multisensory teaching methods that are often recommended in the teaching of reading (Uhri & Sheperd, 1993). These methods should be evaluated against methods that use fewer learning channels to systematically determine whether they produce more rapid or better learning.

REFERENCES


Using Direct Instruction to Teach a Nonvocal Student with Autism to Read Through Discrimination Training

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Extensive previous research has shown the effectiveness of Direct Instruction reading curricula for teaching decoding skills to students. Similarly, previous research has also shown discrimination training to be a highly effective teaching procedure. We combined these two areas of research to ask the question: Can we teach a nonvocal child with autism to decode using discrimination teaching procedures with direct instruction reading curriculum? We found the answer to be yes.

Spencer is a nonvocal, 9-year old boy with severe autism who communicates through his augmentative communication device and gestures. He has no intact speech and can imitate only a very small number of sounds accurately. Spencer received prior fluency-based instruction on reading-related skills such as Hear/Touch sounds, Hear a Consonant-Vowel or Vowel-Consonant word/Type the word, and See word/Match to picture. Given the nature of his communication delays, we wanted to design an instructional program that would allow him access to the greatest variety of text in the most efficient instructional arrangement. Given his preference for and experience with spelling tasks, we wanted to try to teach Spencer to decode phonetically rather than through a sight-word-based approach.

Because Spencer lacked all of the required component speaking skills needed to benefit from direct instruction reading curricula, we created a modified instructional script that we based on the direct instruction curriculum *Teach Your Child to Read in 100 Easy Lessons*. This modified instructional script relied on discrimination teaching techniques rather than on Spencer producing sounds to indicate the correct answer. In the script, the teacher would say, “Tell me if this is right” and then he or she would read the sound, word, or sentence correctly or incorrectly. Spencer responded either “Yes” or “No” by touching the appropriate symbol on his augmentative communication device, depending on whether his teacher said the sound, word, or sentence correctly or incorrectly.

We tracked Spencer’s progress though the curriculum by charting the number of exercises he completed per day during the designated 10 minutes of instruction. In addition, we counted the number of correct and incorrect responses he made during each 10-minute instructional session.

In a 10-minute session, Spencer completed between one and six exercises from the curriculum and typically responded between 20 and 60 times per 10 minutes (two to six times per minute). We required the instructors to provide correct and incorrect discrimination opportunities on each sound presented in isolation, on each phoneme within individual words, and on each word presented in each sentence. We also required his instructors to present Spencer with (a) correct models and (b) incorrect models that were both very similar to the correct models (close-in nonexamples) and very dissimilar from the correct models (far-out nonexamples). The number of responses Spencer expressed during any given exercise was a minimum of x3 the number of required responses in the original teaching script, because of the need to present Spencer with a full range of correct and incorrect models.

Now that we have evidence that discrimination training can be an effective tool to allow nonvocal students to access high-quality decoding curriculum, we plan to incorporate into Spencer’s intervention program discrimination-based instruction that targets intermediate and advanced reading comprehension skills.

AUTHOR NOTE: Correspondence regarding this article should be sent to: Michael Fabrizio, 1110 24th Avenue South, Seattle, Washington, 98144-3037 or via Internet to: michael@fabriziomoors.com
Since the early work of Anne Desjardin (1980) and others, Precision Teachers have developed Big 6+6 skills in their students’ repertoires when needed. The Standard Celeration Chart (SCC) that we present here documents how we analyzed the Big 6+6 skill of squeeze in terms of arranging sequences of instruction. The SCC shows the progress of a student named Joshua as he learned to squeeze various objects.

Before beginning to work on Joshua’s squeezing, we conducted an analysis of the skill to determine what important features of the instruction we would like to control and thus ensure that Joshua experienced. We identified (a) the hand that Joshua squeezed with, (b) the length of time for which he squeezed, and (c) the difficulty of the objects that he squeezed as important features of the instruction. Which hand Joshua used to squeeze objects was important because we wanted to ensure that he was equally facile with both hands; the length of time for which he squeezed was important because we wanted Joshua to be able to squeeze objects for as long as needed to enjoy an activity and because we predicted that we would need to start his instructional sequence using very short timing intervals to avoid overly fatiguing him; and the difficulty of the object he squeezed was important because we wanted to ensure that he would squeeze objects that offered varying degrees of resistance, rather than only squeezing objects that offered little resistance.

After determining that Joshua would squeeze with each hand separately, we then arranged the other two important features of the instruction (the length of the timings and the difficulty of the objects used) into an instructional sequence that we would use to guide Joshua through the development of his squeezing skill. The following sequence comprises the steps we planned for Joshua:

- **Slice 1**: Easy squeeze/short timing
- **Slice 2**: Hard squeeze/short timing
- **Slice 3**: Hard squeeze/long timing
- Outcomes checks

The SCC is divided in half, with the left side of the Chart showing Joshua’s squeezing performance with his left hand and the right side of the Chart showing his performance with his right hand. The dots on the Chart show Joshua’s frequencies of squeezing, and the triangles in the lower cycle of the Chart show his practice frequencies (number of timings completed per 16 hours). We did not count incorrect squeezes.

Joshua began timed practice squeezing on November 11, 2002. The first phase for each hand shows his performance during the first step in the instructional sequence we outlined. This step required Joshua to squeeze objects that offered little resistance (“Easy Squeeze”) for rather short timing intervals (six seconds). Joshua completed a total of 10 six-second timings with his left hand across six days of timed practice, and 11 six-second...
timings total across six days of timed practice with his right hand. His frequency of correct responses accelerated at x3.5 with his left hand and x7.0 with his right hand, and each ended at final frequencies of 120 squeezes per minute.

Because his performance accelerated so quickly during the first instructional phase on each of his hands, we elected to skip the second instructional phase we had planned (Hard squeeze/short timing) and progressed instead to the third planned instructional phase, squeezing objects that offered more resistance (Hard Squeeze) across a longer timing period (20 seconds).

Joshua’s frequency of correct responses stepped down for each hand when we changed the instructional phase. His acceleration of correct responding changed by ÷1.2 for his left hand and ÷5.5 for his right hand. During this harder phase of instruction, Joshua’s frequency of correct responding accelerated by x2.0 for his left hand and x1.4 for his right hand. The number of practices he completed each day for each hand did not change significantly during the second instructional phase when compared to the first instructional phase.

After 7 days of timed practice for both his right and left hands, Joshua reached the targeted frequency aim we set for him of 150 squeezes per minute. At this point, we began testing for the outcomes of fluent performance following the procedures outlined by Fabrizio and Moors (2003). During the fluency outcomes checks, Joshua’s performance clearly demonstrated stability (performance in the presence of distraction; Johnson & Layng, 1992) but did not show the features of skill retention, endurance, stability, and application; and (c) a demonstration of one of the ways we use celeration as a basis for data-based decision making. Although we had planned an intervening instructional step between the first and second phases for both Joshua’s right and left hands, his performance accelerated so quickly during the initial phase (x3.5 for his left hand and x7 for his right hand) that we omitted the planned second phase of instruction (Easy squeeze/short timing) and proceeded to the third planned phase. This omission of the second phase resulted in savings of both time and effort for Joshua and his therapists as well as money for his family, thus improving the efficiency of the instructional sequence.

Although we could not empirically demonstrate that Joshua’s performance showed all of the hallmarks of fluency, we happily report that the progress Joshua made in his squeezing was sufficient to allow him to play with toys that required that skill and to engage in a wider range of activities of daily living. Joshua is now almost 5 years old and will start kindergarten with his typically developing peers in the fall of 2005. He continues to squeeze when and where appropriate, and he has recently used the skill to begin to learn to play the guitar.

REFERENCES


Teaching Emotions to Children with Autism: Identification, Demonstration, and Explanation of Occasioning Stimuli

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Seattle, Washington

Teaching children to identify emotions is a common practice within the field of autism intervention. However, skills that are not often taught include identification of emotions within a situational context, and identification and discrimination of environmental events that occasion the emotions (with corresponding explanations). This article illustrates several responses measured through Precision Teaching that address these skills across several learning channels.

Leila was almost 7 years old when we began this Chart. She had a diagnosis of high-functioning autism and received 20-25 hours per week of behavior analytic intervention in both her home and school. Leila was extremely interested in others’ emotions, but she had difficulty correctly identifying them and explaining the events that may have caused the emotions. Therefore, we decided to approach instruction with a heavy emphasis on pragmatic language related to emotions.

Leila worked on this skill for no longer than 10 minutes each day. Her therapist (the second author) set a daily improvement goal each day based on Leila’s best previous performance. When she met her daily improvement goal, Leila earned a self-chosen reward, such as reading a book or playing a game with the therapist.

We first introduced a set of five emotions in a pure See-Say learning channel, in which the therapist demonstrated an emotion and Leila labeled it. A dot in the fourth and fifth cycles of the Standard Celeration Chart (SCC) represented a correct response. Across both SCCs, dots in the first cycle show the number of timed practices required for Leila to achieve the performance charted in the other cycles. For Leila, the timing charted in the middle cycles was the one during which her frequency of correct responding was highest.

We proceeded through the next phase, Hear situation-Say emotion and why, and then moved to Hear emotion-Say situations and why. We then combined all three sets of emotions and had Leila provide multiple
situations and explanations for all 15 emotions. Although her number of syllables per minute dropped between the second and fourth days of this phase (perhaps because of length of time between practices), her performance eventually rebounded to above her syllable frequency aim during the last session of this slice.

During the next phase, we implemented a timings goal, a common practice that has been very important for Leila historically, given that she often achieved her daily improvement goal in multiple timings due to the extra practice she received during error corrections. Therefore, to pass her outcomes checks (retention, endurance, stability, and application), we established a two-part contingency for her in which she must meet her correct frequency performance aim in one timing for at least two consecutive days. In this particular chart, it took her six sessions to achieve this two-part contingency.

Leila’s endurance check performance was just slightly below her frequency aim of 70-90 correct syllables per minute, while her stability check performance was within that frequency range. She also passed her retention check after we had stopped practice on this skill for 1 month. We did not conduct an application check for this skill because every session consisted of a sample of new situations supplied by the therapist when applicable. Although emotions were taught in sets of five and did not vary within the slice, Leila’s novel situations and explanations were differentially reinforced throughout the entire chart.

Now that Leila has demonstrated fluent performance when identifying emotions, identifying corresponding situations, and providing explanations for both, we plan to move on to teaching more cause-and-effect relationships involving multiple agents and their emotions, different perspectives or feelings about a single topic, and other more advanced perspective-taking skills.
Using Precision Teaching to Teach Story Telling to a Young Child with Autism

Kristin Schirmer, Holly Almon-Morris, Michael A. Fabrizio, Brenda Abrahamson & Katie Chevalier

Fabrizio/Moors Consulting
Seattle, Washington

Story telling is a very important skill for children to have. The ability to recall information as well as to infer, embellish, and make up stories is critical to living as a successful social member of society. This Chart demonstrates the progress one child with autism made in telling both fiction and nonfiction stories.

When we introduced this skill to Jonathan, he was 3 years and 1 month old. He had a diagnosis of high-functioning autism and had begun behavior analytic intervention 10 months earlier. Jonathan received one-on-one instruction, which included Precision Teaching and Direct Instruction for 15 hours each week.

Jonathan began working on Hear Information-Say Story about the Information on May 6, 2004. He worked on this skill for a maximum of 10 minutes each day. Closed circles on the Standard Celeration Charts (SCC) represent Jonathan’s frequency of related details said, the open circles represent his frequency of syllables said, the X’s represent his frequency of details unrelated to the story, and the triangles represent the number of practices he completed each day charted as frequencies per 16 hours. Each day, Jonathan’s therapists set a daily improvement goal for him based on his previous best performance. Jonathan practiced each day until he met or exceeded his daily improvement goal or 10 minutes had passed, whichever came first. The data shown on the SCCs represent Jonathan’s performance during the timing in which he expressed the highest frequency of correct responses.

Initially, we described a scenario for Jonathan and he told a story that involved the given information. The scenarios in this initial phase involved a girl at a baseball game, a boy at a farm, and a dog getting a bath. Jonathan had some history with these events through personal experience, books, and previous sequencing work that we had completed with him as part of his intervention program. Jonathan had very strong reading skills, and we used this strength to help build Jonathan’s speaking frequency. In this phase of timed practice, Jonathan’s frequency of correct syllables began at 21 per minute and reached 90 per minute within 5 days (less than 50 minutes) of instruction.

The next phase allowed Jonathan to make up a silly story about anything he chose. His syllable frequency grew at x2 over 5 days, reaching 150 per minute. We wanted to increase the number of words Jonathan said in each story, so we next increased the timing interval from 20 seconds to 30 seconds.

At this same time, Jonathan was working on labeling (tacting) and describing emotions separately in his program. We brought these skills into his story-telling work by having Jonathan include how people felt in his stories. He continued to be very successful, even passing a mini (and unplanned) retention check that occurred because his family took a vacation.

Next, we focused on teaching Jonathan to use in his stories information given to him and to expand upon that information in his stories. In this phase, the therapist began a story, using between one and three sentences, and Jonathan embellished upon and completed the story. Again, he reached the frequency aim in only a few days of practice, and we lengthened the timing interval to 1 minute. This change in the length of the timing proved difficult for him, so we changed the timing interval to 45 seconds before again trying a 1-minute timing.

In the next phase, Jonathan’s therapists used conversations in their story starters. For example, the therapist would say, “A boy and a girl were playing at a park. The boy said to the girl, ‘I like to play on the slide.’ The little girl said…” Here, Jonathan was to continue the conversation between the characters in his stories. Previously, Jonathan had learned how to use information to formulate a story and the conversations were not difficult for him, so we changed the learning channel from a Hear-Say to a See-Say. With this new learning channel, Jonathan saw a picture and told a story based on the information he gathered from the picture. Again, his frequency of correct responses dropped very little when we began this phase and it reached the frequency aim quickly, so we moved the Chart into outcomes checks (retention, endurance, stability, and application) to evaluate the fluency of his
behavior.

To evaluate the application of Jonathan’s story telling, Jonathan read a story starter and finished the story orally. He matched his previous performance in one timing, and we moved next to a stability check. To check for stability, Jonathan completed one timing away from where he normally worked, and instead completed the timing in the kitchen with the television on so that we could evaluate Jonathan’s ability to complete the task in the presence of distractions.

Jonathan matched his previous performance under these conditions, so we tested for endurance. To pass the endurance check, Jonathan needed to match his previous performance when we tripled the timing interval from 1 minute to 3 minutes. Jonathan achieved this on his first timing, so we paused all timed practice on the skill for 4 weeks to evaluate Jonathan’s retention of the skill. After 4 weeks, Jonathan matched his previous performance in one timing, and we stopped the Chart. Jonathan is now quite a little storyteller!
Dpmin-11EC 19 Sep 04 23 Oct 04

SUCCESSIVE 8 CALENDAR 12 WEEKS 16

COUNT PER MINUTE

1000

500

100

50

10

5

1

Standard

celebration

X16

X4

X2

X1.4

X1.0

X1

X1/2

X1/4

X1/8

per week™

5000

1000

500

100

50

10

5

1

0.005

0.01

0.05

0.1

0.5

1

2

5

10

20

50

100

500

1000

15

30

1 min

1 sec

COUNTING TIMES

SUCCESSIVE CALENDAR DAYS

28

42

56

70

84

98

112

126

140

H. Almon M. Fabrizio K. Schirmer B. Abrahamson
SUPERVISOR ADVISER MANAGER

JONATHAN Z.
PERFORMER

B. Abrahamson & K. Chevalier

FABRIZIO MOORS CONSULTING
ORGANIZATION DIVISION ROOM TIMER COUNTER CHARTER

4.2 Hear Information/Say Story About Information
Tracking Teachers’ Behavior to Concurrently Decrease Punishment Use with and Problem Behavior in a Child with Autism while Decreasing the Child’s Frequency of Negative Statements

Krista Zambolin, Michael Fabrizio, Kelly Ferris, Suzanne Barclay & Dana Carrier

Fabrizio/Moors Consulting
Seattle, Washington

Intervening with children’s problem behavior can be tricky business. Adding punishment procedures into a child’s intervention plan can not only add to the trickiness but also switch the attention of on-line staff members away from what should be the goal of any intervention for misbehavior-preventing the misbehavior and teaching functionally equivalent adaptive skills. The Chart we present here documents one intervention we have tried to help direct care staff members focus on preventing misbehavior rather than punishing it.

Patrick is a 10-year-old boy with moderate autism who has received fluency-based instruction since May 2003. He attends school with his typically developing peers, but he also receives 4 to 5 hours of one-on-one teaching daily under the direction of the first three authors. The fourth and fifth authors implement his one-on-one teaching program, which consists of Precision Teaching and Direct Instruction curricula for reading skills, language skills, and math.

When Patrick began a Precision Teaching based intervention in May 2003, he often displayed high frequencies of very problematic misbehavior. Patrick’s aggressive and destructive behavior served the functions of gaining attention and escaping tasks. For example, to escape tasks or difficult situations, Patrick threw objects such as toys and furniture, screamed, used profanity, yelled, kicked, punched, ran away, fell to the ground, or grabbed people.

After completing a functional assessment, we developed a comprehensive behavior support plan that included a behavior reduction procedure using negative punishment.1 If Patrick swore, broke an object, or hit one of his therapists, siblings, or parents, he lost access to the television, computer, and his X-box video game for the rest of that day. Because of our concern with using a punishment-based procedure, we tracked the number of times his therapists delivered this consequence per week starting in September 2003. These data are shown on the left side of the Monthly per Month Standard Celeration Chart (SCC) we present here. At first, the data showed quite a bit of bounce, with Patrick losing his electronics privileges one to three times per month.

In March 2004, we reexamined which problem behaviors occasioned the punishment procedure. It was at this time that we added behaviors such as jumping out of his chair or leaving the table unannounced as causes for the “no TV, no video, and no X-box” consequence. On the left side of the SCC, we noted these behaviors as outbursts. Once these behaviors were added, the number of times Patrick received the consequence began to increase precipitously.

To help address this alarming increase in how often Patrick lost his electronic privileges, in May 2004 we addressed the training procedures in place for Patrick’s therapists by having them begin to track the number of times they caught Patrick in an agitated state before he displayed any of the very problematic behavior that occasioned losing his TV, computer, and video games for the day. When Patrick was agitated, we trained his therapists to offer things or help Patrick choose things that might decrease his frustration and help him avoid displaying severe misbehavior. Examples of frustration reducers for Patrick included: (a) Patrick asking to stop the task, (b) Patrick asking for help with the task from his therapist, (c) Patrick asking for the task to be made easier, or (d) Patrick asking to take a break. Once his therapists started charting their own behavior, the number of times Patrick lost his TV, computer, and video game privileges deceased dramatically.

Prior to developing and implementing Patrick’s behavior intervention program, we also began counting the number of negative statements Patrick made while he worked with his therapists. We show these data on the right side of the Monthly per Month SCC. Initially, Patrick expressed negative statements at a frequency of 600 per month. We used changes in these data as

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1 We would like to stress that the punishment procedure we describe here comprised only one part of the behavior support plan we developed for Patrick.
one indication of Patrick’s unhappiness with the intervention program, as we changed varying aspects of the program throughout the summer and fall of 2003 to continue to reduce the number of negative statements he made. In December 2004, we implemented an intervention to try to decrease Patrick’s frequency of saying negative statements. This intervention involved, we thought, reinforcing longer and longer intervals that passed without Patrick making a negative statement. When we implemented this procedure (which we labeled as “R+ increased time without negative statements”), Patrick’s monthly frequency of negative statements immediately increased and continued to accelerate even after we stopped the procedure. His frequency of negative statements did not decrease until we implemented a new chart in his program—Free-Say Positive Things. Here, Patrick practiced saying positive things about himself, his skills, and his therapists each day for a maximum of 10 minutes. This intervention appears to have dramatically decreased his frequency of negative statements.

Patrick has now gone for an entire year without losing his television, computer, and video game privileges. His frequency of making negative statements about himself and the people who work with him has decreased from 600 per month initially to a very tolerable 3 per month. His skills continue to progress nicely, and both he and his therapists seem much happier.
Journal Description

The Standard Celeration Society publishes the Journal of Precision Teaching and Celeration (JPTC) two times a year. JPTC provides a forum for research, practical applications and discussions of Precision Teaching and Celeration technology. JPTC has dedicated itself to the promotion and diffusion of Precision Teaching and Standard Celeration technologies.

Journal Sections:

Authors may submit their original contributions to one of five sections of JPTC:

I. Application Articles: “Application articles” require:
(1) Use of Standard Celeration Charts;
(2) Use of basic charting conventions;
(3) Description of variables or procedures supporting the interpretation of the data.

“Application articles” usually represent data from applied settings such as schools, clinics, human service agencies.

II. Research Articles: “Research articles” require:
(1) The use of Standard Celeration Charts;
(2) Descriptions of the collection and analysis of data;
(3) Use of basic and advanced charting conventions and analysis;
(4) Description of variables or procedures supporting the interpretation of the data;
(5) Control for extraneous variables or report of their influence.

III. Discussion Articles: “Discussion articles” offer explanations, reviews, and extensions of Precision Teaching and Standard Celeration concepts.

IV. Chart Shares: “Chart shares” contain data displayed on Standard Celeration Charts along with brief descriptions of the performer, what occurred, and other relevant observations. [Note: We encourage performers (e.g. students, clients, patients) to submit their own charts to the chart share section.]

V. Technical Notes: Brief technical descriptions clarifying, elaborating, or reporting upon Precision Teaching and Standard Celeration concepts.

Submission Guidelines:

To submit a manuscript authors must conform to the following guidelines:
(1) If submitting by postal mail*, submit three typewritten, doubled spaced copies of the manuscript without author’s names or affiliations. If submitting by email, send to rmk11@psu.edu.
(2) If submitting electronic manuscripts, we recommend OpenOffice Writer (v3 or higher), Word Perfect (v4), Apple iWork, or Microsoft Office 2003. We discourage Microsoft Office 2007 and will not accept pdfs.
(3) Follow the format outlined in the Publication Manual of the American Psychological Association (5th edition, 2001);
(4) Do not exceed 20 words in the article title;
(5) Include an abstract and do not exceed 250 words in the abstract (Technical Notes do not require an abstract);
(6) Select 3 to 5 key words that describe the manuscript;
(7) Secure permission for use of copyrighted materials;
(8) Send all charts and graphics in vector format or as 600 dpi bitmapped images, uncompressed;

*Dr. Richard M. Kubina Jr., The Pennsylvania State University, Department of Educational and School Psychology and Special Education, 231 CEDAR Building, University Park, PA 16802-3109

Editors reserve the right to edit all material accepted for publication.
## BASIC CHARTING CONVENTIONS for the DAILY STANDARD CELERATION CHART

<table>
<thead>
<tr>
<th>TERM</th>
<th>DEFINITION</th>
<th>CONVENTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. CALENDAR SYNCHRONIZATION</td>
<td>A standard date for starting all charts.</td>
<td>The synchronization date begins on the first Sunday before Labor Day. The second chart begins 20 weeks after the synchronization date. The third chart begins 40 weeks after synchronization date. Three charts cover a full year.</td>
</tr>
<tr>
<td>2. CHARTED DAY</td>
<td>A day the charter records and charts a behavior.</td>
<td>1. Chart the behavior frequency on the chart on the appropriate day line.</td>
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<tr>
<td></td>
<td></td>
<td>2. Connect charted days.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Do not connect charted days across phase change lines or no chance days.</td>
</tr>
<tr>
<td>a) ACCELERATION TARGET FREQUENCY</td>
<td>Responses of the performer intended to accelerate.</td>
<td>Chart a dot (●) on the appropriate day line.</td>
</tr>
<tr>
<td>b) DECELERATION TARGET FREQUENCY</td>
<td>Responses of the performer intended to decelerate.</td>
<td>Chart an (x) on the appropriate day line.</td>
</tr>
<tr>
<td>3. NO CHANCE DAY</td>
<td>A day on which the behavior had no chance to occur.</td>
<td>Skip day on daily chart. (Do not connect data across no chance days).</td>
</tr>
<tr>
<td>4. IGNORED DAY</td>
<td>A day on which the behavior could have occurred but no one recorded it.</td>
<td>Skip day on daily chart. (Connect data across ignored days).</td>
</tr>
<tr>
<td>5. COUNTING-TIME BAR (aka Record Floor)</td>
<td>Designates on the chart the performer’s lowest possible performance (other than zero) in a counting time. Always designated as “once per counting time.”</td>
<td>Draw solid horizontal line from the Tuesday to Thursday day lines on the chart at the &quot;counting-time bar.&quot;</td>
</tr>
<tr>
<td>TERM</td>
<td>DEFINITION</td>
<td>CONVENTION</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>6. ZERO PERFORMANCE</td>
<td>No performance occurred during the recording period.</td>
<td>Chart on the line directly below the &quot;counting-time bar.&quot;</td>
</tr>
<tr>
<td>7. PHASE CHANGE LINE</td>
<td>A line drawn in the space between the last charted day of one intervention</td>
<td>Draw a vertical line between the intervention phases. Draw the line from</td>
</tr>
<tr>
<td></td>
<td>phase and the first charted day of a new intervention phase.</td>
<td>the top of the data to the &quot;counting-time bar.&quot;</td>
</tr>
<tr>
<td>8. CHANGE INDICATOR</td>
<td>Words, symbols or phrases written on the chart in the appropriate phase to</td>
<td>Write word, symbol and/or phrase. An arrow (↑) may be used to indicate the</td>
</tr>
<tr>
<td></td>
<td>indicate changes during that phase.</td>
<td>continuance of a change into a new phase.</td>
</tr>
<tr>
<td>9. AIM STAR</td>
<td>A symbol used to represent: (a) the desired frequency, and (b) the desired</td>
<td>Place the point of the caret...</td>
</tr>
<tr>
<td></td>
<td>date to achieve the frequency.</td>
<td>A for acceleration data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V for deceleration data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>...on the desired aim date. Place the horizontal bar, — , on the desired</td>
</tr>
<tr>
<td></td>
<td></td>
<td>frequency. The caret and horizontal line will create a &quot;star.&quot;</td>
</tr>
<tr>
<td>10. CELERATION LINE</td>
<td>A straight line drawn through 7 to 9 or more charted days. This line</td>
<td><img src="" alt="Graph" /></td>
</tr>
<tr>
<td></td>
<td>indicates the amount of improvement that has taken place in a given period</td>
<td>Acceleration Target</td>
</tr>
<tr>
<td></td>
<td>of time. A new line is drawn for each phase for both acceleration and</td>
<td>Deceleration Target</td>
</tr>
<tr>
<td></td>
<td>deceleration targets.</td>
<td></td>
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<tr>
<td></td>
<td>*(Note: For non-research projects it is acceptable to draw free-hand</td>
<td></td>
</tr>
<tr>
<td></td>
<td>celeration lines.</td>
<td></td>
</tr>
</tbody>
</table>
BASIC CHARTING CONVENTIONS

1. Calendar synchronization
2. Charted days
3. No-chance day
4. Ignored days
5. Counting-time bar or Record Floor
6. Zero performance
7. Phase change line
8. Change indicator
9. Aim star
10. Celeration line

The name of the person who works with the performer on a daily basis.
The name of the person who advises the manager or performer on a weekly basis.
The name of the person who sees the performer's chart on a monthly basis. The person may give advice to the Adviser or Manager.
The name of the person who times the performer.
The name of the person who counts the performer's behavior.
The name of the person who charts the performer's counted behavior.
The name of the person whose performance appears on the chart.
OPTIONAL: The age of the performer when the chart begins. If not filled in, draw a line through the space.
A clear description of the performer's counted behavior. Use a learning channel and active verb and noun (e.g., SeeSays counts block).

LIKENESS OF DAILY per minute CHART™

Labelled Blanks (Adapted from Pennypacker, Gutierrez, & Lindsley, 2003)

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<table>
<thead>
<tr>
<th><strong>TERM</strong></th>
<th><strong>DEFINITION</strong></th>
<th><strong>CONVENTION</strong></th>
<th><strong>CALCULATIONS:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CELERATION FINDER</strong></td>
<td>A translucent tool (often Mylar) with celeration lines or calibration lines used for computing celeration line values. One edge of the celeration finder has the vertical axis of a Standard Celeration Chart, called a frequency finder, to assist in plotting frequencies and other common charting practices, including alternate techniques to compute celeration line values.</td>
<td>Bought commercially. For a frequency finder, one can copy and cut out part of the vertical axis on the Standard Celeration Chart.</td>
<td><strong>Tools:</strong>&lt;br&gt;See advanced charting conventions sample chart.</td>
</tr>
<tr>
<td><strong>CELERATION CALCULATION</strong> (Quarter-Intersect Method)</td>
<td>The process for graphically determining a celeration line (aka &quot;the line of best fit&quot;). Divide the frequencies for each phase into four equal quarters (include ignored and no chance days), locate the median frequency for each half, and then draw a celeration line connecting the quarter intersect points.</td>
<td>Calculations:&lt;br&gt;&lt;br&gt;[ \text{Celeralation} = \frac{\text{frequency of first quarter phase}}{\text{frequency of fourth quarter phase}} ]</td>
<td><strong>1. CELERATION</strong>&lt;br&gt;Calculate the celeration for each phase by dividing the frequency at the beginning of one phase by the frequency at the end of the next phase. Place a &quot;FC =&quot; in the upper left cell of the analysis matrix. Indicate the value with a &quot;x&quot; or &quot;÷&quot; sign (e.g., FC = x 3.0).</td>
</tr>
<tr>
<td><strong>FREQUENCY CHANGE</strong> (aka frequency jump up or jump down)</td>
<td>The multiply &quot;x&quot; or divide &quot;÷&quot; value that compares the final frequency of one phase to the beginning frequency in the next phase. Compute this by comparing the frequency where the celeration line crosses the last day of one phase to the frequency where the celeration line crosses the first day of the next phase. Place a &quot;CC =&quot; in the upper middle cell of the analysis matrix with the value indicated with a &quot;x&quot; or &quot;÷&quot; sign. (e.g., CC = ÷ 1.7).</td>
<td><strong>2. FREQUENCY CHANGE</strong> (FC)&lt;br&gt;(aka frequency jump up or jump down)</td>
<td><strong>FC</strong>&lt;br&gt;Place an &quot;FC =&quot; in the upper left cell of the analysis matrix. Indicate the value with a &quot;x&quot; or &quot;÷&quot; sign (e.g., FC = x 3.0).</td>
</tr>
<tr>
<td><strong>CELERATION CHANGE</strong> (aka celeration turn up or turn down)</td>
<td>The multiply &quot;x&quot; or divide &quot;÷&quot; value that compares the celeration of one phase to the celeration in the next phase (e.g., a celeration turn down from x1.3 to ÷ 1.3. CC= ÷ 1.7). Place a &quot;CC =&quot; in the upper middle cell of the analysis matrix with the value indicated with a &quot;x&quot; or &quot;÷&quot; sign. (e.g., CC = ÷ 1.7).</td>
<td><strong>3. CELERATION CHANGE</strong> (CC)&lt;br&gt;(aka celeration turn up or turn down)</td>
<td><strong>CC</strong>&lt;br&gt;Place a &quot;CC =&quot; in the upper middle cell of the analysis matrix with the value indicated with a &quot;x&quot; or &quot;÷&quot; sign. (e.g., CC = ÷ 1.7).</td>
</tr>
<tr>
<td>TERM</td>
<td>DEFINITION</td>
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<td>-----------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>4. PROJECTION LINE</td>
<td>A dashed line extending to the future from the celeration line. The projection offers a forecast that enables the calculation of the celeration change value.</td>
<td>See advanced charting conventions sample chart.</td>
<td></td>
</tr>
<tr>
<td>5. BOUNCE CHANGE (BC)</td>
<td>The multiply &quot;x&quot; or divide &quot;÷&quot; value that compares the bounce of one phase to the bounce in the next phase. Computed by comparing the total bounce of one phase to the total bounce of the next phase. (e.g., a bounce change from x 5.0 to x 1.4, BC = ÷ 3.6).</td>
<td>Place a &quot;BC=&quot; in the upper right cell of the analysis matrix with the value indicated with a multiply &quot;x&quot; or divide &quot;÷&quot; symbol (e.g., BC ÷ 3.6).</td>
<td></td>
</tr>
<tr>
<td>6. CELERATION FAN</td>
<td>The nine-blade celeration fan shows nine reference celerations used to quickly provide a visual estimate of any celeration value by using modifiers of &quot;equal to,&quot; &quot;greater than,&quot; or &quot;less than.&quot;</td>
<td>Celeration fans are printed on all commercial standard celeration charts.</td>
<td></td>
</tr>
<tr>
<td>7. CELERATION COLLECTION</td>
<td>A group of three or more celerations for different performers relating to the same behavior over approximately the same time period.</td>
<td>Numerically identify the high, middle and low celeration in the celeration collection and indicate the total number of celerations in the collection.</td>
<td></td>
</tr>
<tr>
<td>8. ANALYSIS MATRIX</td>
<td>The analysis matrix provides the numeric change information regarding the effects of the intervention(s) on frequency, celeration and bounce between two phases.</td>
<td>Place the analysis matrix between the two phases being compared. For acceleration targets place the matrix above the data. For deceleration targets place the matrix below the data.</td>
<td></td>
</tr>
</tbody>
</table>
### LIKENESS OF DAILY per minute CHART™

1. **Celeration Calculation**
   - Celeration calculation (quarter intersect method)

2. **Frequency Change (FC)**
   - Frequency change = x 1.65
     - 14 / 8.5 = 1.65

3. **Celeration Change (CC)**
   - Celeration change from x 1.15 to x 3.25
     - 3.25 / 1.15 = x 2.82

4. **Bounce Change (BC)**
   - Bounce change from x 1.9 to x 3.1
     - 3.1 / 1.9 = x 1.63

5. **Analysis Matrix**
   - Acceleration Target
     - FC = x 1.65
     - CC = x 2.82
     - BC = x 1.63
   - Deceleration Target
     - FC = ÷ 1.22
     - CC = ÷ 2.22

6. **Celeration Fan**
   - Standard celeration
     - x 2.00
     - x 1.70
     - x 1.45
     - x 1.15
     - x 1.05
   - Celeration line = x 2.35 (per week™)

7. **Celeration Collection**
   - Low = x 1.05
   - Middle = x 1.45
   - High = x 2.35
   - Cluster celerations at their actual frequencies.
   - The orders of celerations are independent of frequency.

8. **Analysis Matrix**
   - Cluster celeration collections at their actual frequencies.
   - Label:
     1. The steepest celeration
     2. The middle celeration
     3. The least steep celeration
   - The steepest celeration
   - The middle celeration
   - The least steep celeration

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