Behavioral Development Bulletin
2015, Vol. 20, No. 2, 168–172

1942-0722/15/$12.00 http://dx.doi.org/10.1037/h0101312

Putting the Precision in Precision Teaching: Using the Standard Celeration Chart for Ongoing Assessment

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Making programmatic decisions based on objective performance data is accepted as best practice by behavior analysts. Unfortunately, the data management system used can limit the rate of data based decisions. When assessment and intervention activities are discrete and consecutive, data-based decisions may be unnecessarily delayed. The Standard Celeration Chart affords immediate visual inspection of data, thereby allowing real-time decision making. When using the Standard Celeration Chart, assessment and intervention occur concurrently. A precise measurement tool gives practitioners the power to make an accurate data-based decision in the moment, rather than waiting for other data management processes to be completed. A Standard Celeration Chart demonstrating the benefit of frequent data based decisions is presented and illustrates how this analytical tool can be used to increase the efficacy and efficiency of treatment.

Keywords: assessment, data-based decisions, efficacy, intervention, Standard Celeration Chart

In typical applied behavior analysis settings the clinical process includes phases of (a) assessment, (b) quantifying desired achievement criteria, (c) pinpointing targets, (d) collecting data, and (e) follow-up or analysis and modification (Cooper, Heron, & Heward, 2007). The purpose of this sequence of events is to prepare the context in which clinicians can make data-based decisions about client programming. Specifically, it entails making data collected in clinical practice available for visual inspection and subsequent decision making.

An element of this standard approach is that tools commonly used for data collection are something separate from the tools used for visual inspection and decision-making. For example, Cooper, Heron, & Heward (2007, pp. 88–100) describe “Procedures for Measuring Behavior” including wrist counters, digital counters, pocket counters, and a wide variety of data sheets, all of which require additional steps to be taken to prepare data for post hoc analysis. At best, the transfer of data from one of these tools might occur immediately *after* an observation period (see Cooper, Heron, & Heward, 2007; p. 128). At worst, raw data might accumulate for days or weeks before being transferred en masse. In these scenarios, untold amounts of time and effort collecting data and implementing interventions are expended across long observation periods only to potentially discover in post hoc analysis that the effort was ineffective in relation to treatment goals. As such, the applied behavior analyst is precluded from making data-based decisions *during* the observation period because collected data must be transferred first.

If we presume clinical progress to be a function of data-based decision making, which we do as behavior analysts, then decreasing the latency between behavior observation and data-based decision is a logical goal. One potential solution might be to limit the duration of observation windows to increase the daily rate of data transfer and decision-making. However, practical considerations in clinical settings, such as staffing ratio limits imposed by funding sources, preclude behavioral clinician from the luxury of pivoting from client monitoring to data transferring while the client is still present. Therefore, tools and practices that unify phases of data collection and preparation for analysis into

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a single action can be seen as critical to reducing the latency to decision making. The Standard Celeration chart is such a tool.

When the Standard Celeration Chart (SCC) is used in the educational domain, the data can be utilized to powerfully inform real-time decision making. Moreover, the SCC can be used as an analytical tool for ongoing assessment of the effects of various manipulations (Binder, 1996; Kubina & Yurich, 2012). Real-time data collection permits assessment of behavior change in the setting and time where teaching occurs. This enables the front-line clinician contact with the behavior and treatment effects, allowing for frequent data based decisions and programmatic changes *during* the observation period. In this article, we will illustrate how the use of the SCC facilitated real-time assessment, decision making, and intervention to improve the learning gains of a student enrolled in a precision teaching center.

Method

Kyle is a 9-year-old boy diagnosed with Autism Spectrum Disorder. Kyle was referred to Fit Learning for language enrichment and reading remediation. In the SCC presented herein, a sight word acquisition program provides an example of the concurrent processes of assessment and intervention the SCC affords. For Kyle's sight word acquisition program, the instructor presented either a set of words on flashcards or words in isolation on a sheet for him to read.

Three front-line clinicians implemented the sight word acquisition program, analyzed data, implemented interventions, and determined when mastery criteria were met. One clinician held a Master's degree in Behavior Analysis, one clinician held a bachelor's degree, and one clinician was a second-year undergraduate student in psychology at a local university. Their experience with the SCC ranged from 10 months to 8 years. Their experience working with Kyle ranged from 1 month to 1 year. All instructors participated in the learning center's training program in which they were taught to recognize various performance patterns on the SCC and trained in a variety of intervention strategies that might be used dependent upon the learning pattern.

These front-line clinicians were encouraged, during sessions with Kyle, to determine whether mastery criteria had been met or to implement interventions based on the data available to them. Mastery criteria were determined based on precision teaching research (Haughton, 1972; Weiss, Fabrizio, & Bamond, 2008). For Kyle's sight word acquisition program, mastery criteria for stimulus sets presented on flashcards was 50 to 60 words per minute. Mastery criteria for words presented on a sheet was 60 to 80 words per minute.

Clinicians working with Kyle were trained to analyze learning trends. They were required to identify which learning patterns warranted intervention and which patterns did not warrant any change. Examples of learning trends that warranted intervention included performance on the word sheets that was below aim and not increasing toward aim for three consecutive days, errors occurring above 8 words per minute for three or more consecutive days, or the first timing on a set was more than 50% below the aim. Frequent assessment of data (e.g., accuracy and fluency of performance) yielded repeated and immediate data-based decisions and interventions.

Three interventions were used across different phases of Kyle's sight word acquisition program. The particular intervention implemented was dependent on the analysis of error and learning trend displayed on the SCC. If the first timing on a new stimulus set was more than 50% below the aim, an intervention of repeated practice on the same words in the same order for each timing that day (i.e., random between) was implemented. If errors were occurring consistently above 8 words per minute, a timing of frequently missed words was conducted before the training timing (i.e., priming of frequently missed words). If data were below the frequency aim and not increasing toward aim for four consecutive days, the stimulus set was limited to fewer targets and presented on flashcards.

Results

Kyle's sight word acquisition data are displayed in Figure 1. The dots represent the number of words read correctly per minute within a 15 second timing. The '×' represents the number of words read incorrectly per minute within the timing. The '×' under the record floor indicates a timing in which no errors were re-

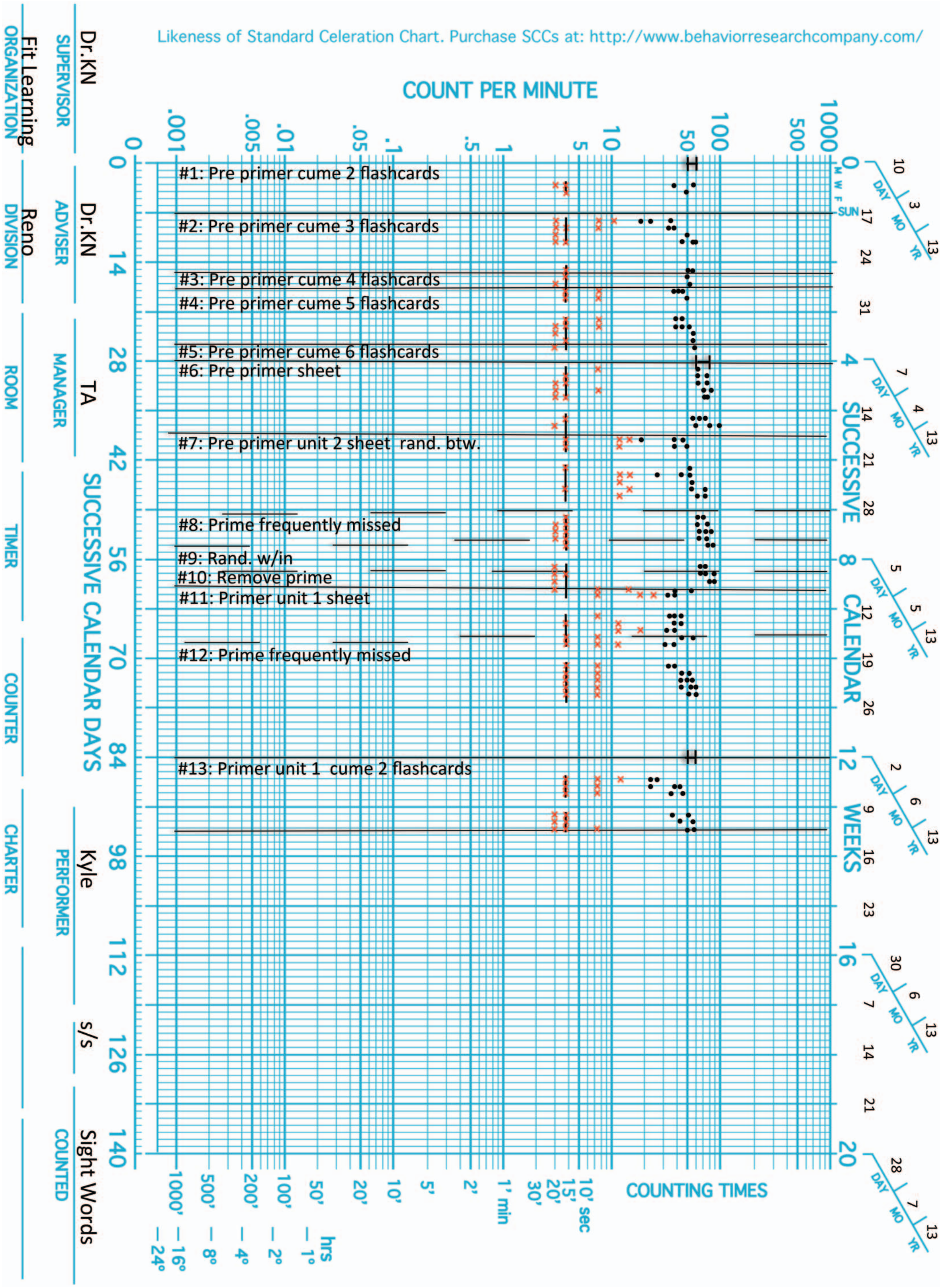

Figure 1. Frequency of correct and incorrect words read on Kyle's sight word acquisition.

corded. Phase change lines on the chart represent instances when data-based decisions were made. A solid phase change represents the introduction of a new stimulus set. A dashed phase change indicates an intervention was either implemented or removed. The time between programmatic changes, either passing a limited stimulus set or an intervention designed to accelerate acquisition, ranged from 2 to 7 session days.

In the course of Kyle's sight word acquisition, various suboptimal performance patterns were observed and corresponding interventions were implemented. Programmatic decisions were made every 2 to 7 sessions when data warranted, and as these manipulations were made the effects of those changes could be readily assessed. Based on assessment data, Kyle was reading preprimer sight words at 12 words per minute and with 60% accuracy. This level included 18 different exemplars. As a result of performance that was below criteria in both fluency and accuracy, stimulus sets were modified to include fewer exemplars presented on flashcards (Phase 1). Phases 1–5 included limited sets of words presented on flashcards. These phases were moved to the next stimulus set once the fluency criteria (i.e., 60–50 words per minute) had been met. In Phase 6, the same words from Phases 1–5 were presented on a sheet and the aim increased to 60 to 80 words per minute. This phase was also moved to the next stimulus set, Pre-Primer Unit 2, once the fluency aim had been attained.

In Phase 7, Pre-Primer Unit 2 words were presented on a sheet starting with an intervention of random between because of low base frequency. After several performances with errors above 8 words per minute, the instructor determined that an intervention was needed. A priming of frequently missed words was implemented (Phase 8) and a decrease in errors was immediately observed. During the end of Phase 8, Kyle's performance was at aim with 0 to 1 error per timing. Therefore, the intervention of random between was removed (Phase 9). Kyle continued to preform with frequencies that met criteria in frequency and errors, and within two sessions, the priming of frequently missed was removed (Phase 10) allowing Kyle to move on to the next level of words, Primer Unit 1.

In Phase 11, the Primer Unit 1 words were implemented. After five sessions with errors above 8 words per minute, the instructor determined that an intervention was needed. A priming of frequently missed words was implemented (Phase 12). Again, a decrease in errors was immediately observed and Kyle's performance began to accelerate toward aim. However, during the last three sessions of Phase 12, data were below the frequency aim and no longer increasing toward aim. Therefore, the stimulus set was limited to fewer targets and presented on flashcards in Phase 13.

Discussion

Use of the SCC facilitates real-time assessment, decision-making, and intervention to improve the learning gains of students by enabling the front-line clinician contact with the behavior and treatment effects *during* the observation period. The chart presented herein demonstrates the rate of decision-making on a sight word acquisition program during 14 weeks of an enrollment. This chart demonstrates two benefits of the ongoing assessment provided by the SCC: allowing clinicians to assess interventions in a timely manner such that treatment is effective and efficient and facilitating front-line clinicians to make decisions moment-by-moment. Additionally, the ongoing recording and assessment of behavior allowed for the pinpointing of successful instructional strategies that accelerated the acquisition of new skills.

The results here have implications for the design of effective and efficient interventions in the classroom. The methodology employed demonstrates how the use of the SCC can optimize educators' ability to dynamically adapt the environment to occasion efficient skill acquisition by students. In this demonstration, 100% of the data-based decisions (indicated with phase change lines) were made and implemented by the front-line clinician *during* the ongoing observation window. At no point were data-based decisions delayed while waiting for data to be transferred, nor were any of the decisions deferred for manager or supervisor input.

Although the results are promising, the limitations of this study warrant discussion. This study included only one demonstration and no control participants. Future research should include controls not exposed to the standard charting procedures.

To summarize, the SCC allows for a pragmatic approach where assessment and intervention can be ongoing and concurrent activities; these evaluations, moreover, can be carried out in the teaching environment. When these activities are discrete and infrequent, data-based decisions may be unnecessarily delayed. When the SCC is used, data can be analyzed on a moment-by-moment basis, reducing the latency between interventions and the assessment of their effectiveness. In this example, the use of the SCC in an educational setting enabled timely decisions to aid in faster acquisition of target skills. The chart presented herein illustrates how the use of the SCC can facilitate evidence-based decision making for a learner when learning gains are assessed to be inadequate. This close contact with performance data afforded by the SCC empowers educators to precisely and dynamically alter the learning environment in real-time and, thereby, optimize the rate of student skill acquisition.

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Received December 19, 2014
Revision received May 13, 2015
Accepted May 14, 2015 ■