

AN EVALUATION OF TWO SUPPLEMENTAL SAFMEDS PROCEDURES

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## ABSTRACT

SAFMEDS, a fluency based intervention that often uses flashcards, stands for “say-all-fast-minute-every-day-shuffled.” It is typically used in rate building and as a knowledge based assessment across numerous settings. A review of the fluency and SAFMEDS literature shows a lack of empirical research with this commonly used intervention (Quigley et al., 2017). Many differences in SAFMEDS implementations exist, including numerous variations to the procedure itself. The purpose of this study is to evaluate the effects of the basic SAFMEDS procedure for learning Chinese characters when compared to two supplemental practice procedures. The basic SAFMEDS procedure did not appear to be effective in significantly increasing the rate of correct responding in participants learning Chinese characters. Rates of correct responding were greater with additional practice added to the basic SAFMEDS procedure; specifically, higher levels of responding were evident in conditions using the whole deck review supplemental practice procedure.

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## CHAPTER 1 INTRODUCTION

Precision Teaching is an approach to teaching that focuses on defining an observable behavior, monitoring the behavior daily (typically through the use of a Standard Celeration Chart), changing the program/intervention, and continuing to make changes to the intervention if the students' behavior does not change (Calkin, 2003). Programs such as the Seattle-Spokane-Tacoma Project (Kuzlemann et al., 1970), the Sacajawea Project in Great Falls, Montana (Beck, Clement 1991), and Morningside Academy (Johnson & Layng, 1992) have used Precision Teaching and fluency-based instructional strategies to help produce increases in student achievement with minimal programmatic additions to typical school programming.

The focus of Precision Teaching and other fluency-based interventions is to achieve behavioral fluency. Fluency is a combination of *accuracy* and *speed* that ultimately optimizes outcomes in a specific behavior class (Binder, 1987). Fluency has additionally been described as proficiency or “true mastery” of a behavior (Binder, 1996). While these explanations are helpful, taking an empirical approach to evaluate fluency has allowed for a better assessment of components and qualities of fluent behavior. Behaviors that have been deemed fluent include the maintenance of learned targets when accurately performed at high frequencies (Kelly, 1995), remaining on task with distractors present (Binder, Houghton, & Van Eyk, 1990), and applying what was learned to novel situations (Binder, 1993a; Johnson & Layng, 1992, 1994). This is known as REAPS, which specifies that true fluency is achieved when retention, endurance, and

application of performance standards is achieved (Haughton, 1980; 1981). Specifically, retention refers to learners' ability to recall information after a period without practice; endurance refers to the maintenance of performance for longer durations; application signifies using component behaviors learned to complete more complex skills. Additional evaluations of fluency include stability, when performance is maintained after the learner is faced with distraction, and adduction, which refers to the use of the component skill learned in a manner that was not previously taught (Johnson and Layng, 1996).

The measure of fluency (accuracy and speed) is a rate measure, which is count per unit time. Rate demonstrates the strength of a given operant (Skinner, 1938), and is often used in place of frequency (or count) measures in Precision Teaching. Data are often collected through one-minute trials, known as *timings*. These brief *timings* remain sensitive to assessing changes in behavior and allow for a rapid and inexpensive method of data collection (Binder, 1996; Haughton, 1972a; Kunzelmann et al., 1970; Starlin, 1972). Measuring rate over time (celeration) allows practitioners to better evaluate the dynamics of behavior change (Cooper, Heron, & Heward, 2007).

### **Fluency building interventions: SAFMEDS**

One strategy frequently utilized for instruction and assessment in building fluency is “say-all-fast-minute-every-day-shuffled,” or SAFMEDS. It is a rate-based technique that often uses flashcards, but with systematic procedural differences (Eshleman, 2000a; Graf & Auman, 2005). SAFMEDS rate building procedure began from the work of Ogden Lindsley in the 1970's (Calkin, 2003), and is frequently used in fluency building and Precision Teaching. SAFMEDS typically utilizes the “see/say” learning channel to

teach responses on the cards; this means that the learner “sees” the stimulus and “says” the presumed correct response. While the “see/say” learning channel is most frequently used in SAFMEDS, other learning channels can also be used. When referring to *learning channels*, the first word (i.e., “see”) refers to the sensory dimension of the stimulus observed on the front of the card, and the second word refers to the topographical dimension of the response emitted by the participant (i.e., “say) (Haughton, 1980).

The acronym SAFMEDS outlines the specific procedures used; SAY: participant vocally states out loud what is observed on the front of the card; ALL: all cards are to be used, rather than only focusing on a portion of the topic; FAST: responses should be quick; MINUTE: practice should be brief; EVERY DAY: practice should occur over days rather than crammed into one day; SHUFFLED: cards should be shuffled to prevent learning by rote memorization (Lindsley, 1996a). Eshelman (2000a) and Graf and Auman (2005) further outlined procedures to help ensure proper instructional control when utilizing and creating SAFMEDS. This includes keeping the text brief, avoiding unusual marks and placement of text, replacing cards with tears and smudges, and having the learner manipulate the cards. Combining the procedures above with those outlined by Lindsley (1996a), the steps of the basic SAFMEDS procedure are as follows (Quigley et al., 2017):

1. Learner holds the complete deck
2. Learner shuffles the cards
3. Learner starts the timer for 1-minute
4. Learner “sees” the front of the card and vocally “says” a presumed response

for the back of the card

5. Learner turns card to check answer correctness
6. Learner sorts card into appropriate pile (correct, incorrect, pass)
7. Learner counts cards in each pile when time expires
8. Learner charts performance; data are reviewed for changes,
9. SAFMEDS timings are repeated daily

Like other fluency-based procedures, SAFMEDS has also been used in rate building and to assess fluency via REAPS, which stands for retention, endurance, and application of performance standards (Haughton, 1980). The evaluation of outcomes that define fluency are a common focus of SAFMEDS literature. Retention has been evaluated via post treatment probes of varying lengths (Hughes et al., 2007; Olander et al., 1986; Stockwell & Eshleman, 2010; Togade, Ormandy, & Stockwell, 2012, Kubina, et al., 2015). Endurance has been assessed via extended test timings of three minutes (Hughes et al., 2007) and twenty minutes (Kim et al., 2001). The former study also assessed stability with distraction in a busy classroom (Hughes et al., 2007), while the latter (Kim et al., 2001) evaluated stability with the distraction of others speaking Hindi and also assessed endurance with classroom distraction during twenty-minute timings. Application has been evaluated by measuring correct and incorrect words read by participants, after providing learners with passages of novel words (Hughes et al., 2007), and by attempting to evaluate the equivalence class of symmetry, when assessing the application of teaching two textual relations to teach French (Polson, Grabavac, and Parsons, 1997).

The SAFMEDS procedure in its literal form would involve conducting a single daily timing using the guidelines previously outlined. However, many studies have used supplemental or altered SAFMEDS procedures for instruction and assessment.

Alterations from the original procedure include multiple daily timings (Beverley, Hughes, and Hastings, 2009), changes to the duration of the test timing (Byrnes, Macfarlan, Young, & West, 1990; Kubina et al., 2015), providing participants assistance with card manipulation (Kubina, Ward & Mozzoni, 2000), as well as conducting SAFMEDS trials with partial, rather than whole, SAFMEDS decks (Kim, Carr, & Templeton, 2001; Quigley, 2014). Supplemental changes to the original SAFMEDS procedure include altering practice prior to the 1-minute test (Casey et al., 2003; Quigley, 2014), allowing students to conduct practice timings, prior to test timings (Meindl et al., 2013; Quigley, 2014), and the addition of error correction procedures (Beverley, Hughes, and Hastings, 2009).

The most common supplemental change to SAFMEDS is the addition of practice. McDade et al. (1985) and Olander et al. (1986) provided participants with unlimited time to review their SAFMEDS prior to timings; researchers in Byrnes et al. (1990) provided children with learning disabilities twenty minutes to review SAFMEDS of governmental facts prior to conducting a timing. More structured practice in the literature includes conducting practice timings prior to a test timing. Stockwell & Eshelman (2010) used three practice 1 minute timings, including an error correction practice timing to help a PhD student learn verbal behavior terms using SAFMEDS. Meindl, et al. (2013) allowed learners to use a 2 minute pre-timing review and 6 thirty second practice timings, prior to the test timing with a new deck containing the same content but written in different font,

to evaluate stimulus control when using SAFMEDS. Kubina, et al. (2015) provided therapists 2 twenty second practice timings, including an error correction practice timing, before conducting a real timing, when using SAFMEDS to develop fluency with commonly used movement cycles. Quigley (2014) evaluated the effects of different practice when using SAFMEDS during a 10 minute practice timing with the entire deck, a 10 minute practice timing with portions of the SAFMEDS deck, three practice 1 minute timings with the entire deck, or three practice 1 minute timings with portions of the SAFMEDS deck, to teach college students Russian or Chinese characters. While all of these studies saw favorable results, none followed the presumed SAFMEDS procedures created by Lindsley (1996a), Eshelman (2000a) and Graf and Auman (2005), as was outlined in the Quigley review (2017). Changes include increased timing duration (Byrnes et al., 1990), decreases in timing duration (Kubina, et al., 2015), multiple daily timings (Stockwell & Eshelman, 2010), and using portions instead of the entire SAFMEDS deck (Meindl, et al., 2013; Quigley, 2014). The variations are plenty.

### **Review of criticism surrounding fluency-based instruction and SAFMEDS**

Fluency-based instructional strategies, such as SAFMEDS, are often credited with producing fluency and high rates of responding in learners. While these claims are vast, there are many critiques of these instructional strategies. First, it is important to note that while Precision Teaching and the interventions used within it have existed since the late 1960's, there remains a lack of published literature in the field. This may be credited to differing goals between early and present day practitioners (Binder, 1996), as the focus was primarily application rather than research. Results of behavioral change due to

fluency procedures were often shared through word of mouth or via data share events, rather than through publication (Binder, 1996).

After the inception of the *Journal of Precision Teaching and Celeration* in 1980, publications increased but many remained conceptual with descriptions of previously used methods rather than empirical procedures. In a formal analyses of published literature, Doughty, Chase, & O'Shields (2004) found only 29 articles containing empirical research relating to fluency-based instructional strategies. This number is surprising given the significant claims put forth by rate-building procedures. The same criticism can be extended specifically to SAFMEDS. A review of SAFMEDS literature found only 53 published articles, 27 of which were classified as "peer reviewed" and "data driven" (Quigley et al., 2017). This number is underwhelming and suggests a need for additional research and publication.

An additional criticism of fluency-based instruction is the lack of clear procedures (Doughty et al., 2004). Procedures used for rate and fluency building are regularly adjusted based on learner performance. While making teaching adjustments based on learner performance is a key feature of Precision Teaching, there are more differences than similarities in SAFMEDS procedures used. Of the 27 peer-reviewed articles found in the Quigley et al. (2017) literature review, none followed the proposed basic SAFMEDS technique set forth by Lindsely (1996a), Eshleman (2000a, b), and Graf and Auman (2005). Further critiques of fluency-based instruction include the lack of control for confounds (Doughty et al., 2004). Practice and reinforcement are generally associated with rate building interventions, and often come in the form of additional practice

opportunities and feedback or reinforcement via verbal praise, graphing, or self-charting. Rate and fluency building procedures typically incorporate these strategies in treatment packages, but often do not systematically control for each. The findings of Quigley et al. (2017) revealed a lack of experimental control in published SAFMEDS literature; zero articles controlled for practice or reinforcement effects. These findings and criticisms suggest the need for more systematic research.

Future research in SAFMEDS should hold certain variables constant, allowing for systematic replication and a thorough analysis of the procedure and the variables in use. The present study will closely replicate and extend some of the procedures found in Quigley, et al., (2014). Quigley et al., (2014) evaluated the effects of a proposed basic SAFMEDS procedure and four supplementary practice SAFMEDS procedures to teach college students Chinese and Russian symbols and found that the basic SAFMEDS procedure did not produce high rates of correct responding, but significant increases were seen in all procedures using supplemental practice procedures.

The purpose of this study is to evaluate the effects of two supplemental SAFMEDS procedures (whole deck practice and whole deck sprints), and compare them to the basic SAFMEDS procedure including the number of correct, incorrect, and pass responses during a timed one-minute trial, and measure celeration for correct responses, for each supplemental procedure in learning Chinese characters.



## CHAPTER 2 METHOD

### Participants

The participants were employees at a human services provider in South Eastern Pennsylvania. Nine employees were recruited via in-office recruitment scripts read at training meetings. Participants held varying levels of education, were both male (1) and female (8), and ranged in age between 24 years and 58 years as shown in Table 1. They completed a questionnaire (Appendix A) and brief pretest (Appendix B) to determine eligibility. Those who answered fewer than 20% of questions correctly were included in the proposed study. Exclusionary criteria included having a history of learning related to the Chinese language, speaking Chinese at home, or living in an area where the Chinese language was used.

Table 1: <i>Participant Demographic Data</i>		
Participant	Age (Years)	Level of Education
Participant #1	26	Bachelor's Degree
Participant #2	24	Bachelor's Degree
Participant #3	25	Master's Degree
Participant #4	25	Bachelor's Degree
Participant #5	31	Bachelor's Degree
Participant #6	28	Master's Degree
Participant #7	29	Master's Degree
Participant #8	29	Bachelor's Degree
Participant #9	58	Associate's Degree
<i>Note.</i> Participant demographic information.		

### Materials and Setting

All sessions were conducted in a windowless training room in the main administrative building of a human services facility where the participants were employed. Items in the room included a table and chairs for the participant and

researcher(s) to use during each session. Materials consisted of a timer, four different decks of SAFMEDS cards (i.e., training deck, and three Chinese decks), a datasheet, a questionnaire and pretest used to assess inclusionary criteria, and video recording equipment. SAFMEDS cards were printed with the relevant content (Mandarin Chinese characters) on one side and with the English translation on the opposite side. Chinese translations were determined using the Google Translate search engine. One hundred and eighty different cards were created and randomly sorted into three different decks; a cumulative word list is provided in Appendix C. Cards were approximately 3 inches x 5 inches in size. To avoid potential issues with stimulus control, decks were regularly examined for damage (tears, smudges, folds), and cards were replaced as needed.

### **Procedures**

*Training Session.* Training procedures used were similar to those used in Quigley (2014). Each participant attended a SAFMEDS training session prior to intervention. The focus of training was to allow the participant to practice holding the deck, shuffle the cards, start the timer, “see” one side of card, “say” response on back of card, and sort to appropriate piles. The researcher met with each participant to review a SAFMEDS training video (Sparks et al., 2013) and model the appropriate SAFMEDS procedure with a practice deck.

The training deck consisted of 20 cards. Cards had pictures on one side, and their corresponding label on the other side. In an effort to train correct responses, 10 cards in the training deck had common pictures with corresponding common labels on the opposite side. To train incorrect responses, five cards had common pictures with less

common labels for the corresponding image on the opposite side (i.e. picture of a cat, with “feline” written on the other side). To train pass responses, five cards held unfamiliar pictures with the corresponding labels on the opposite side (i.e. picture of an “eight track tape”). Participants practiced this procedure with the practice deck for a 1-minute timing. Researchers collected participant integrity data on the SAFMEDS procedure using participant integrity datasheet shown in Appendix D. Criterion for participants to pass the training phase included correctly responding to 20 practice SAFMEDS with 80% integrity. Once they successfully demonstrated competency with the SAFMEDS procedure, they were eligible to participate in the treatment sessions.

*SAFMEDS Procedure.* Data were collected on performance in daily 1-minute timings. Three sessions were completed daily. Experimenters stood next to participants during one minute timings, to video record all sessions for data collection purposes. Frequency data were collected on the number of correct, incorrect, and pass responses.

Each session utilized a different deck of Chinese SAFMEDS cards and a different treatment, which were counterbalanced across participants. Conditions consisted of a control condition (Basic SAFMEDS), Treatment Condition 1 (Whole Deck Practice Procedure) and Treatment Condition 2 (Sprints Practice Procedure), which are outlined further below. All Chinese SAFMEDS decks were kept locked in the researcher’s office when not in use. Participants were not permitted to take the cards home, nor could they review them outside of sessions; this was done as to not provide participants with external practice outside of sessions.

A variation of the basic SAFMEDS procedure (Lindsley, 1996a; Eshelman, 2000a, b; Graf & Auman, 2005) was utilized in the present research. In an effort to control for reinforcement, the researcher did not have participants count cards in each pile at the end of the 1-minute timings, nor were participants allowed to chart and view their progress. Additionally, no vocal feedback was provided during 1-minute timings. Withholding both graphic and vocal feedback allowed the researcher to control for the possible confounds of reinforcement and feedback, and their effects on participant behavior during timings. The steps of the basic SAFMEDS procedure used in the present study are as follows:

1. Participant holds the complete deck of card
2. Participant shuffles cards
3. Participant starts the timer for 1-minute
4. Participant “sees” the front of the card and vocally “says” a presumed response for the back of the card
5. Participant turns card to check answer correctness
6. Participant sorts card into appropriate pile (correct, incorrect, pass)
7. Repeat timings daily

When utilizing SAFMEDS, participants held and shuffled their cards and started a countdown timer at the beginning of the 1-minute timing. Participants responded to the visual stimulus on the front of the card by providing a vocal response (see-say learning channel) (Haughton, 1980), and checked their answer by reviewing the back of the SAFMEDS card. Participants sorted cards into appropriate piles, and repeated this process for the remainder of the one-minute timing. Cards answered correctly were to be

placed in a “correct” pile; cards answered incorrectly were to be placed in an “incorrect” pile; cards skipped were to be reviewed (turned over and say answer on back of card) and placed in a “passed” pile. This procedure was used during training, and during all three conditions of the study.

*Control Condition: Basic SAFMEDS Procedure.* The researcher instructed participants to complete a 1-minute timing using the SAFMEDS procedure previously described. No practice was provided.

*Treatment Condition 1: Whole Deck Review Supplemental Procedure.* Participants were instructed to spend a maximum of 10 minutes (or less if desired) reviewing the cards in their SAFMEDS deck any way they chose to do so. The length of time of deck review for each participant was recorded during each session. This supplemental practice procedure was conducted once daily, prior to participants completing a one-minute timing utilizing the SAFMEDS procedure previously described.

*Treatment Condition 2: Sprints Supplemental Procedure.* Participants were given a SAFMEDS deck and instructed to complete three one-minute practice timings prior to completing their one-minute test timing. This supplemental procedure was conducted once daily, prior to participants completing a one-minute timing utilizing the SAFMEDS procedure previously described.

## **Experimental Design**

An alternating treatments design with a treatment control condition (standard SAFMEDS procedure) was used to determine the effects of two supplemental practice SAFMEDS procedures and the standard SAFMEDS procedure on the rate of correct, incorrect, and pass responses. Three different Chinese SAFMEDS decks were used. Each

SAFMEDS deck was paired with an assigned treatment and assigned to each participant in rotating order of study enrollment. Table 2 demonstrates SAFMEDS deck and treatment assignments. A total of six different possible SAFMEDS deck/treatment order sequences were calculated, as shown in Appendix E. In an effort to control for order effects, each participant randomly contacted each possible deck/treatment sequence order every six sessions during treatment (see Appendix E for sample). Deck assignments and treatment sequence order were randomly selected per participant, prior to the beginning of treatment.

Table 2 <i>Participant Deck/Treatment Assignments</i>			
Group	Participants	Deck	Treatment
1	Participant #1	Chinese Deck 1	Basic
	Participant #4	Chinese Deck 2	Sprints
	Participant #7	Chinese Deck 3	Whole Deck
2	Participant #2	Chinese Deck 1	Whole Deck
	Participant #5	Chinese Deck 2	Basic
	Participant #8	Chinese Deck 3	Sprints
3	Participant #3	Chinese Deck 1	Sprints
	Participant #6	Chinese Deck 2	Whole Deck
	Participant #9	Chinese Deck 3	Basic
<i>Note.</i> Chinese SAFMEDS deck and treatment assignments across participants.			

*Dependent Variable.* Rate data were collected for correct responses, incorrect responses, and passes, based off of the vocal responses emitted by the participant. Correct responses were scored when the participant vocally stated the correct term associated with the SAFMEDS card. If the participant stated more than one vocal response prior to checking the back of the SAFMEDS, their final vocal statement was scored. When the participant's last vocal statement prior to checking the back of the card did not match

what is written on the backside of the card, the response was scored as incorrect.

Responses were also scored as incorrect if the participant checked the back of the card prior to stating a vocal response. Pass responses were scored in a similar manner. When the participant vocally stated “pass” and flipped the card over to see the correct response, they skipped that SAFMEDS card. This response was scored as a pass. The frequency total of responses (correct, incorrect, and pass) was calculated for each category, and was reported per 1-min timing.

### **Measurement**

Data were collected on a datasheet during live observations of each session or via video review, and graphed on a standard celeration chart. Data were collected once daily for each deck (3) using the standard procedure and two supplemental practice procedures, until stability was reached. Stability was defined as the last 3 data points falling within 12.5% of the mean of the previous 3 data points.

Independent observers were trained to collect observer agreement data (IOA). Training was provided prior to the start of the current research, and consisted of providing independent observers with a description of the dependent variables mentioned above, modeling correct, incorrect, and pass responses, providing observers with role play data collection opportunities, and providing feedback as needed. Independent observers needed to correctly identify 90% of SAFMEDS responses during the role-play session to be eligible to assist with data collection.

Interobserver Agreement (IOA) data were calculated for 30% of total sessions, across different treatment procedures for all participants. A trained independent observer

independently scored data observed as “correct,” “incorrect,” or “pass.” Interval-by-interval Interobserver Agreement was calculated by comparing data collected by the researcher and the trained independent observer for each card reviewed by the participant. The number of agreements were divided by the number of agreements plus disagreements between the two observers, and multiplied by 100. As shown in Table 3, total IOA averages ranged from 94.1% - 100% across participants and across conditions.

Participant	Basic SAFMEDS Control (Range)	Sprints Supplemental Practice (Range)	Whole Deck Supplemental Practice (Range)
Participant #1 IOA	98.7% (92.3%-100%)	100.0% (100%)	99.3% (97.2%-100%)
Participant #2 IOA	99.9% (98.1%-100%)	99.2% (98.1%-100%)	99.5% (96.6%-100%)
Participant #3 IOA	100.0% (100%)	99.3% (94.3%-100%)	97.9% (90.7%-100%)
Participant #4 IOA	99.5% (96.3%-100%)	98.9% (95.7%-100%)	98.3% (93%-100%)
Participant #5 IOA	100.0% (100%)	100.0% (100%)	97.3% (94.4%-100%)
Participant #6 IOA	99.2% (95.5%-100%)	99.8% (98%-100%)	100.0% (100%)
Participant #7 IOA	99.3% (97.3%-100%)	98.8% (96.2%-100%)	97.5% (90.7%-100%)
Participant #8 IOA	99.4% (95.7%-100%)	100.0% (100%)	98.5% (93.3%-100%)
Participant #9 IOA	100.0% (100%)	100.0% (100%)	94.1% (94.1%)

*Note.* IOA mean and range data for each participant across each condition.

Treatment integrity was assessed for each condition through the use of a Researcher Procedural Fidelity Checklist (see Appendix F). This checklist was used to measure the extent to which the intervention was implemented as intended, and was also



used to train assisting researchers. Treatment integrity data were completed by the researcher or a secondary data collector, who was trained on data collection prior to the start of the study. Training in completing the procedural fidelity checklist included reviewing the SAFMEDS procedural fidelity checklist with the secondary data collector, modeling how to complete the checklist, providing specific examples for when steps would be marked as correct or incorrect, and role play data collection.

To support with training, those assisting with sessions completed the Researcher Procedural Fidelity Checklist while observing the primary researcher conduct SAFMEDS sessions. Additionally, the primary researcher completed this checklist on each secondary researcher, during supervised SAFMEDS sessions. Each assisting researcher needed to achieve a criterion of 100% fidelity to be eligible to conduct SAFMEDS sessions independently. Procedural fidelity data were collected for 30% of sessions for Participant 1 through 8. Opportunities to collect procedural fidelity data for Participant 9 did not occur prior to their withdrawal of the study. Data in Table 4 represents the percentage of steps correctly implemented by the investigator. Average procedural fidelity ranged from 99% - 100% across participants and across conditions.

Social validity was assessed through the use of a survey provided to all participants that completed the study following their final SAFMEDS session. A sample questionnaire can be seen in Appendix G. The questionnaire used a Likert rating scale to assess the participants' perception of the procedures used in the study. A section for additional comments or suggestions was also provided.

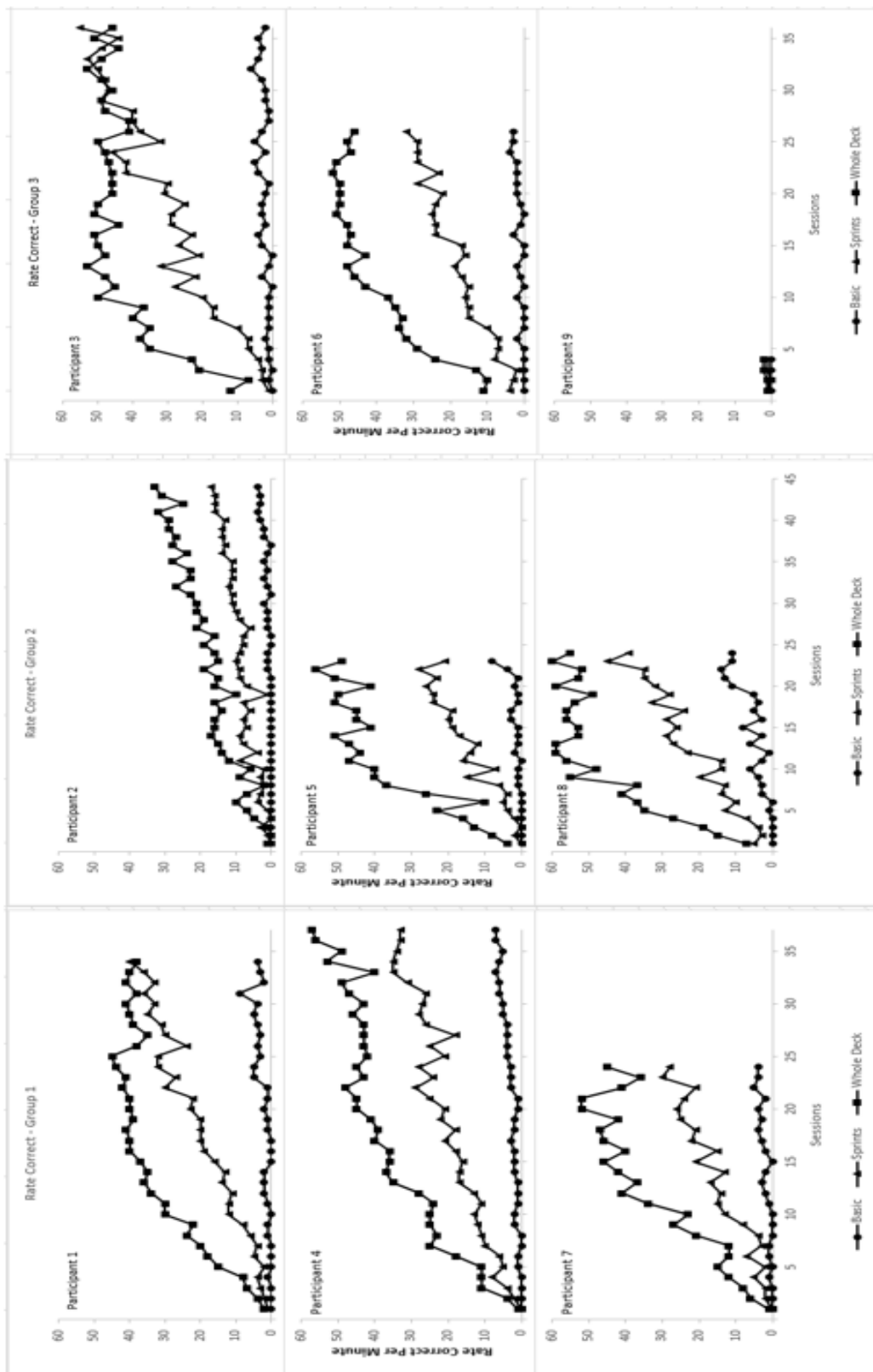
Table 4: <i>Treatment Integrity</i>			
Participant	Basic SAFMEDS Control (Range)	Sprints Supplemental Practice (Range)	Whole Deck Supplemental Practice (Range)
Treatment Integrity - Participant #1	100% (100%)	100% (100%)	100% (100%)
Treatment Integrity - Participant #2 IOA	100% (100%)	100% (100%)	100% (100%)
Treatment Integrity - Participant #3	99% (85.7%-100%)	100% (100%)	99% (85.7%-100%)
Treatment Integrity - Participant #4	100% (100%)	100% (100%)	100% (100%)
Treatment Integrity - Participant #5	100% (100%)	100% (100%)	100% (100%)
Treatment Integrity - Participant #6	100% (100%)	100% (100%)	100% (100%)
Treatment Integrity - Participant #7	100% (100%)	100% (100%)	100% (100%)
Treatment Integrity - Participant #8	100% (100%)	100% (100%)	100% (100%)
Treatment Integrity - Participant #9	N/A	N/A	N/A
<i>Note.</i> Treatment integrity mean and range data for each participant across each condition.			

### CHAPTER 3 RESULTS

Results were evaluated by examining the mean, maximum range, level, trend, and variability of the rate of correct responses per minute. Figure 1 displays rate correct per minute for participants one through nine, across all three conditions. All procedures demonstrated an increasing trend in correct responding, yet the procedure that produced the greatest change in level across most participants was the whole deck review supplemental practice procedure. Average and high scores per condition are displayed in Table 5. Nearly all participants had higher average correct responses and higher total correct responses (range maximum) in the whole deck review supplemental practice condition, when compared to their average correct responses in the basic control and sprints supplemental practice conditions; the exception being Participant 3 who had a higher range maximum in the sprints supplemental practice procedure (55 correct), than in the whole deck review supplemental practice procedure (53 correct).

Participant	Basic SAFMEDS		Sprints Supplemental Practice		Whole Deck Review Supplemental Practice	
	Mean	Range Max	Mean	Range Max	Mean	Range Max
Participant 1	2.0	9.0	19.3	40.0	39.9	45.0
Participant 2	0.8	4.0	8.3	17.0	17.2	33.0
Participant 3	2.2	6.0	29.5	55.0	42.8	53.0
Participant 4	2.8	7.0	19.5	35.0	35.3	57.0
Participant 5	1.3	8.0	13.4	28.0	36.3	56.0
Participant 6	1.2	5.0	17.7	32.0	39.5	52.0
Participant 7	1.8	5.0	14.1	30.0	30.8	52.0
Participant 8	4.8	14.0	21.8	45.0	45.6	60.0
Participant 9	0.0	0.0	0.75	1.0	1.5	2.0

*Note.* Mean and maximum range for correct responses for each participant across conditions.



*Figure 1. Rate of correct responses per minute across a basic SAFMEDS control condition, a sprints supplemental practice condition, and a whole deck review supplemental practice condition, across participants.*

Percentage of nonoverlapping data points (PND) was evaluated to determine the effectiveness of responding across conditions. PND evaluates the proportion of data that overlaps across conditions by calculating the number of data points in each treatment condition (sprints supplemental practice procedure and whole deck review supplemental practice procedure) that are above the highest data point in the “basic SAFMEDS” control condition. These data were divided by the total number of sessions per participant, and is displayed in Table 6. According to Scruggs and Mastropieri (1998), a PND score of 91% and above can be considered very effective, scores between 70% and 90% can be considered effective, scores between 50%-70% can be considered questionable, and scores below 50% are considered ineffective. Percentage of nonoverlapping data points between the basic SAFMEDS control condition and the sprints supplemental practice procedure was between 70% and 90% for all participants except Participant 8, in which a PND score of 58.3% was obtained. Percentage of nonoverlapping data points between the basic SAFMEDS control condition and the whole deck review supplemental practice procedure was above 91% all participants except Participant 1, in which a PND score of 88.2% was obtained and Participant 2, in which a PND score of 90.9% was obtained.

Data were also displayed on Standard Celeration Charts (Graff and Lindsley, 2002; Lindsley, 2005; Pennypacker et al. 2003). A Standard Celeration Chart (SCC) allows for a proportional visual representation of behavior change over time (Johnston and Pennypacker, 2009). This measure, known as celeration, allows for the assessment of learning over time by evaluating the rate of which behavior multiplies (Calkin, 2005).

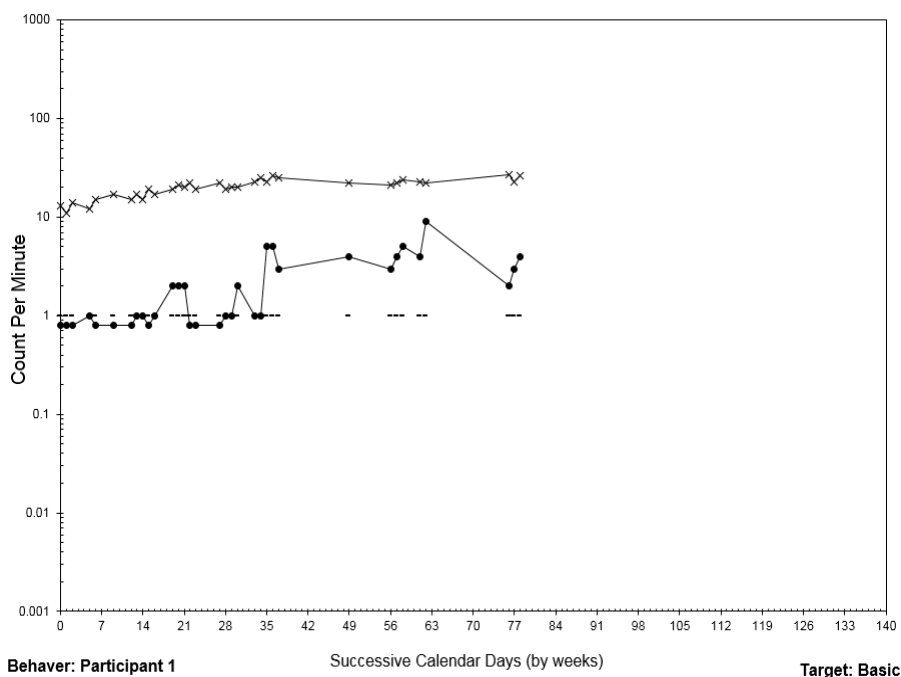
Participant	PND Basic: Sprints	PND Basic: Whole Deck	PND Sprints: Whole Deck
Participant 1	73.5%	88.2%	20.6%
Participant 2	72.7%	90.9%	47.7%
Participant 3	88.9%	100.0%	0.0%
Participant 4	86.5%	94.6%	70.6%
Participant 5	78.3%	91.3%	69.6%
Participant 6	88.5%	100.0%	76.9%
Participant 7	70.8%	95.8%	58.3%
Participant 8	58.3%	95.8%	66.7%
Participant 9	75.0%	100.0%	50.0%

*Note.* Percentage of Non-overlapping Data for each participant across conditions.

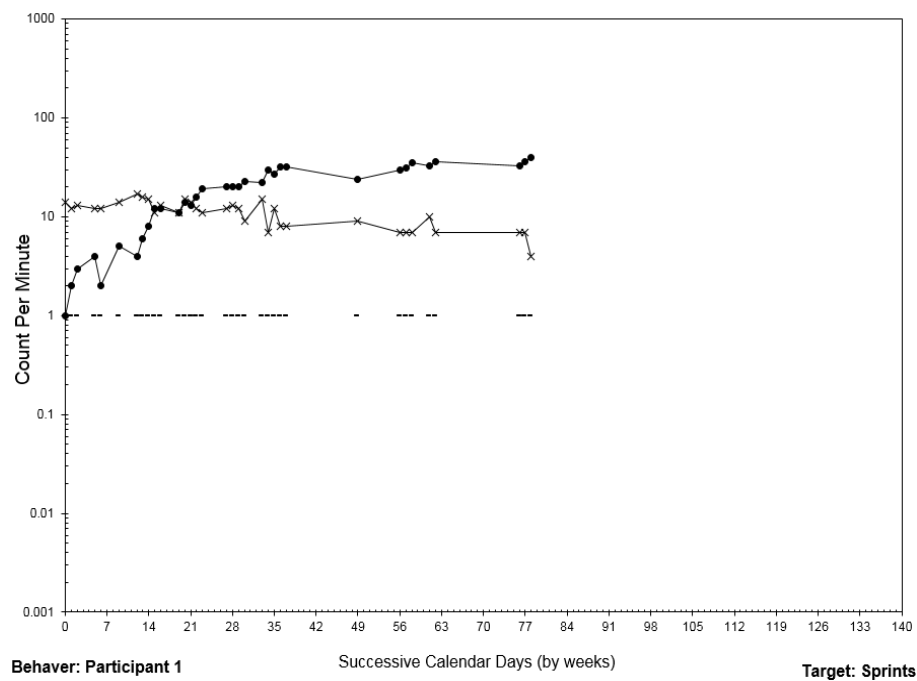
When the frequency of correct responses accelerates and the frequency of incorrect responses decelerates, the two celerations meet in a cross over pattern. This is known as “crossover jaws,” and is a visual representation of learning (Lindsley, 1977).

Figures 2 through 9 display three Standard Celeration Charts (one for the control condition, one for the sprints supplemental practice condition, and one for the whole deck review supplemental practice condition) for Participant 1 through 8. Results for Participant 9 were not charted, as they withdrew from the study after 4 days of sessions. The solid black dots on the charts represent the frequency of correct responses during each 1-minute timing. The X’s represent incorrect response frequencies per timing. Quantitative values for celeration were evaluated by assessing the slope of the first ten scores for each condition. This was done to measure the initial magnitude of change (celeration) in responding with each procedure. Celeration values were calculated using the Finder tool in Appendix H (White, 2012). Data are displayed in Table 7.

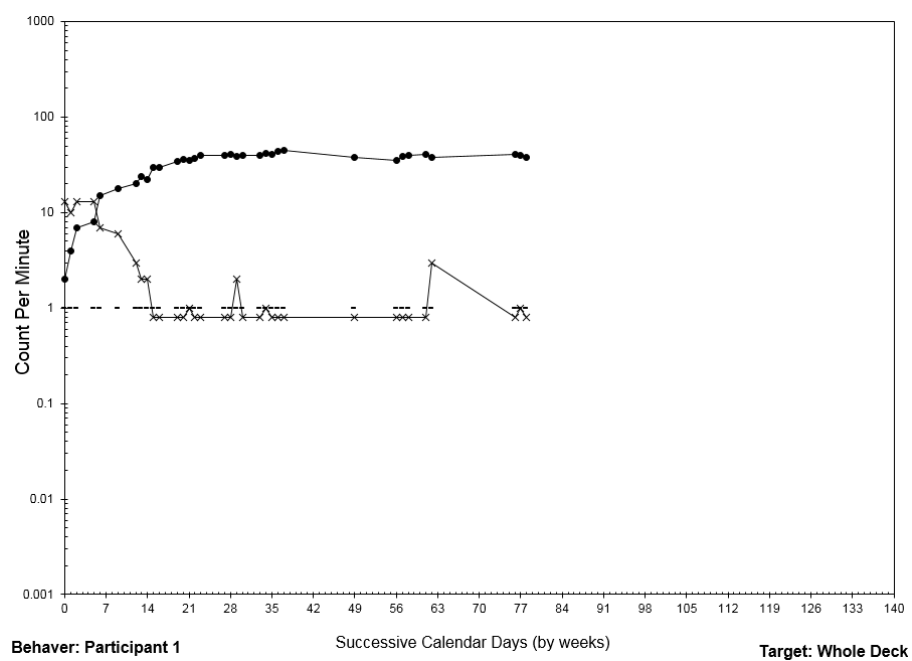
A visual analysis of all standard celeration charts revealed that all participants demonstrated slight increases in level with the basic SAFMEDS control condition, but Participant 8 was the only participant whose data demonstrated a slight crossover with the basic SAFMEDS procedure. This trend began at session 20 of the control condition. Data for the sprints supplemental practice procedure revealed jaws crossover patterns for Participant 1, Participant 3 and Participant 8. This pattern occurred with greater separation of correct and incorrect responses on day 15 for Participant 1, on day 8 for Participant 3 and 8. Participants 4, 5, 6, and 7 did have cross over in acceleration and deceleration of correct and incorrect responses, yet the separation of their celerations were not as clear. Participant 2 did have accelerating correct responses with the sprints was not significant and no crossover was noted.



*Figure 2.* Standard Celeration Chart of rate of correct responses per minute and incorrect responses per minute across the basic SAFMEDS control condition for Participant 1.



*Figure 3.* Standard Celeration Chart of rate of correct responses per minute and incorrect responses per minute across the sprints supplemental practice condition for Participant 1.



*Figure 4.* Standard Celeration Chart of rate of correct and incorrect responses per minute across the whole deck review supplemental practice condition for Participant 1.



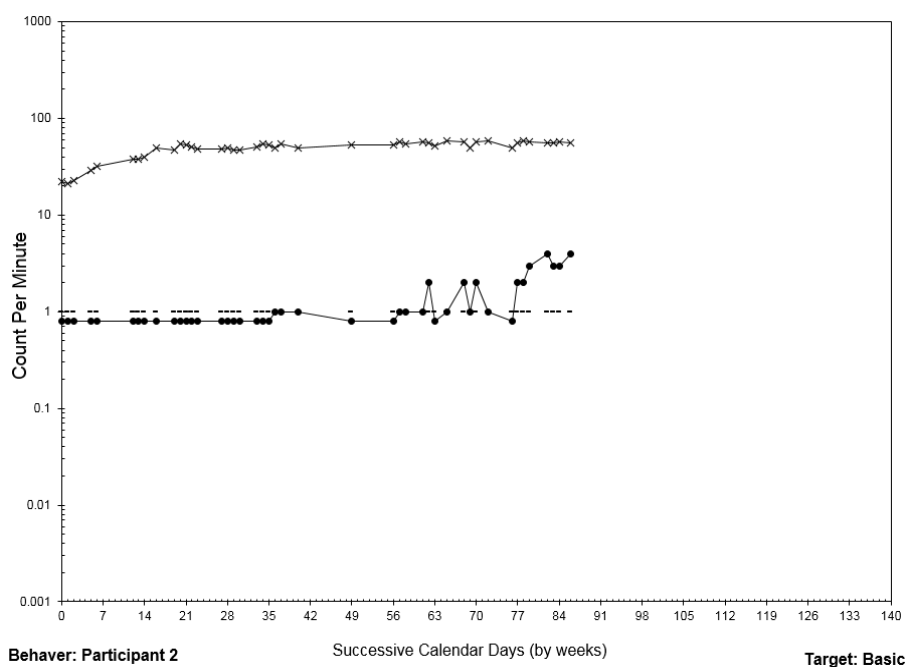


Figure 5. Standard Celeration Chart of rate of correct responses per minute and incorrect responses per minute across the basic SAFMEDS control condition for Participant 2.

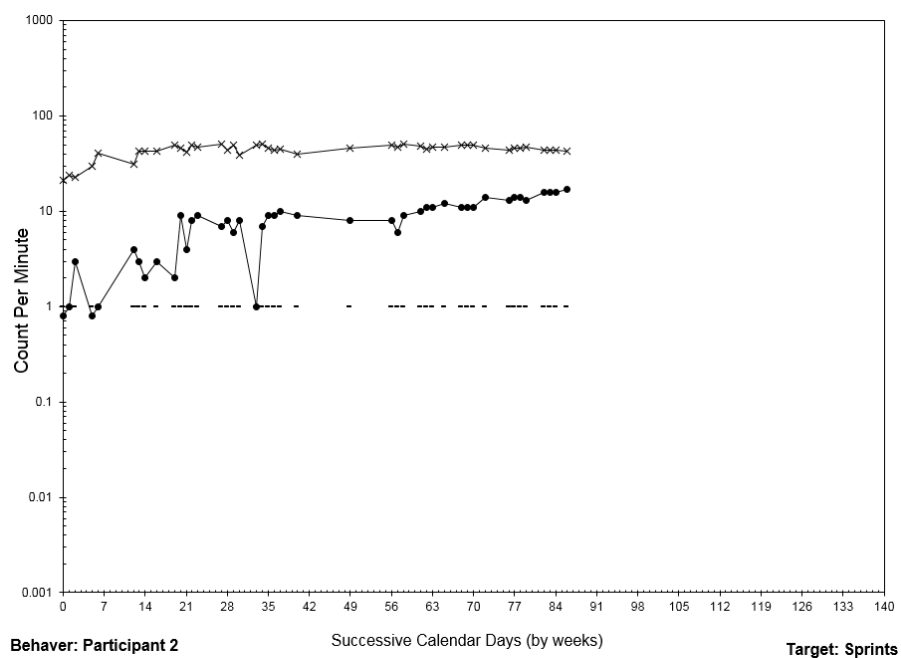


Figure 6. Standard Celeration Chart of rate of correct responses per minute and incorrect responses per minute across the sprints supplemental practice condition for Participant 2.

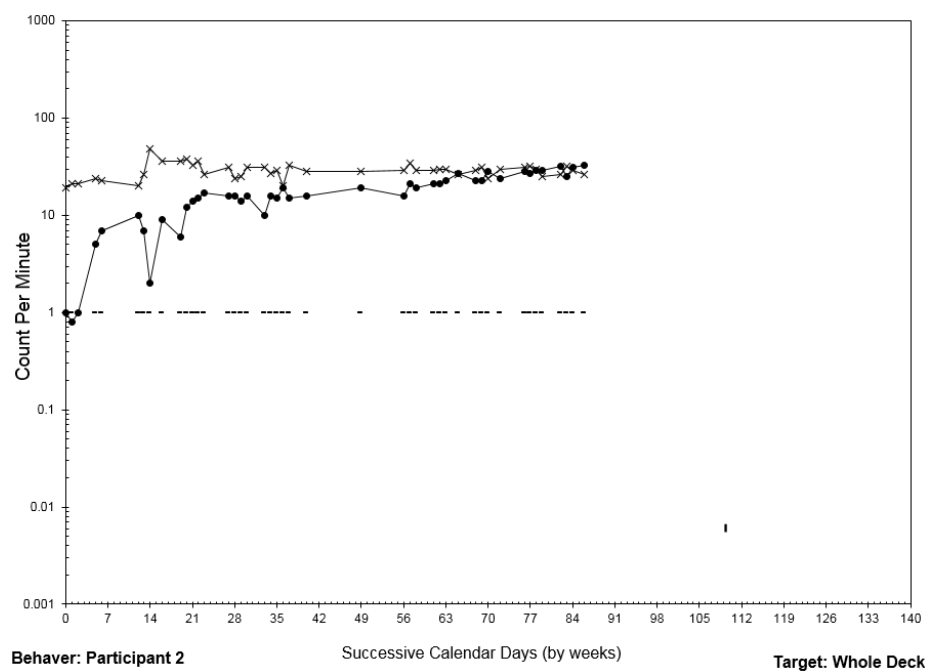


Figure 7. Standard Celeration Chart of rate of correct and incorrect responses per minute across the whole deck review supplemental practice condition for Participant 2.

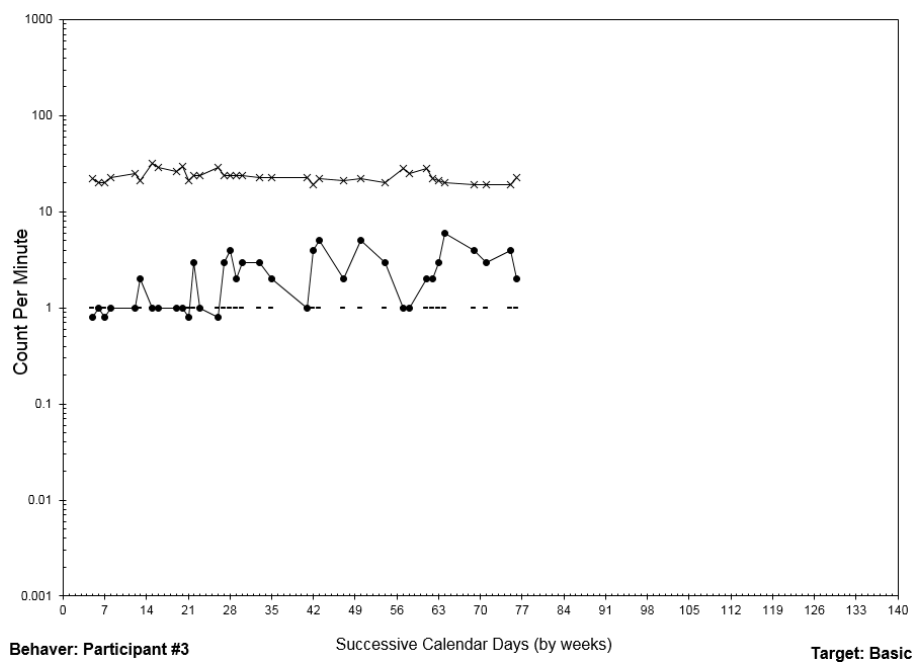


Figure 8. Standard Celeration Chart of rate of correct responses per minute and incorrect responses per minute across the basic SAFMEDS control condition for Participant 3.

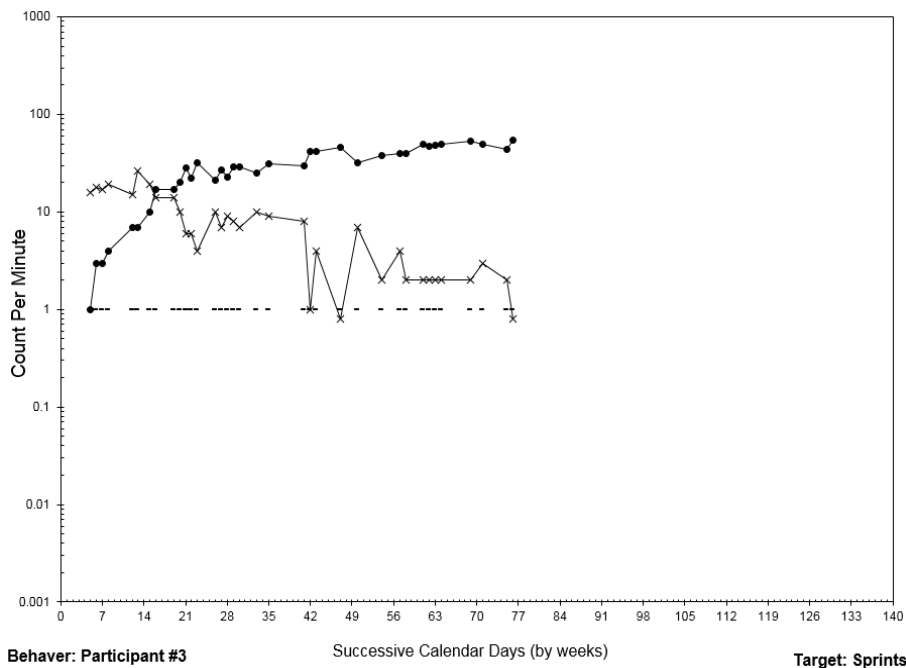


Figure 9. Standard Celeration Chart of rate of correct responses per minute and incorrect responses per minute across the sprints supplemental practice condition for Participant 3.

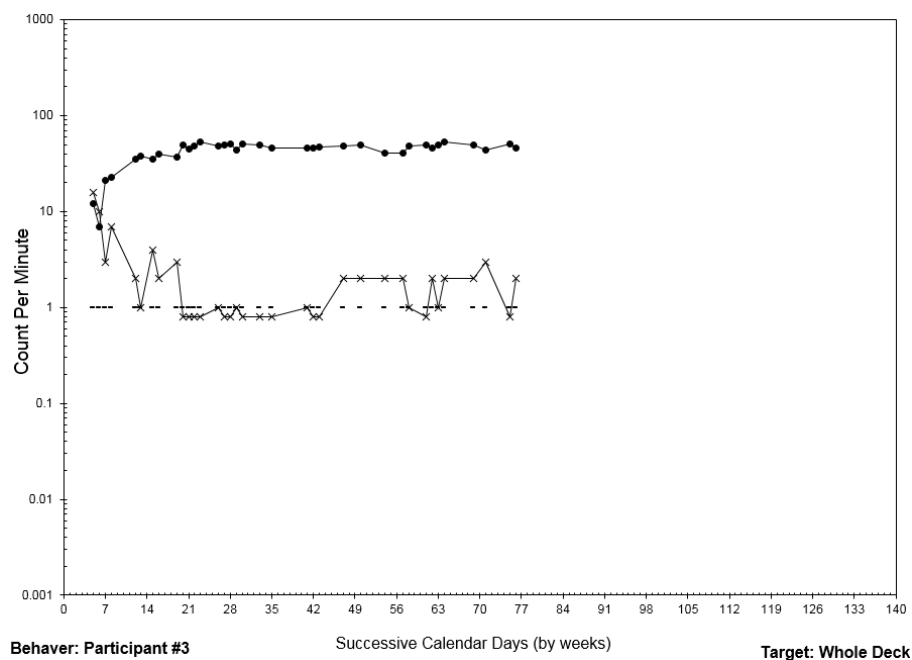
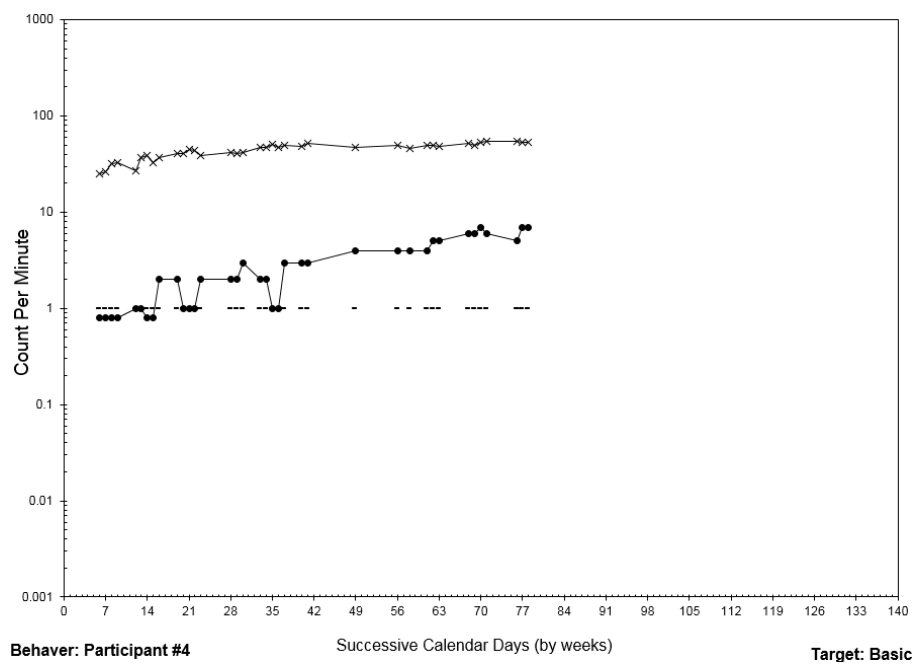
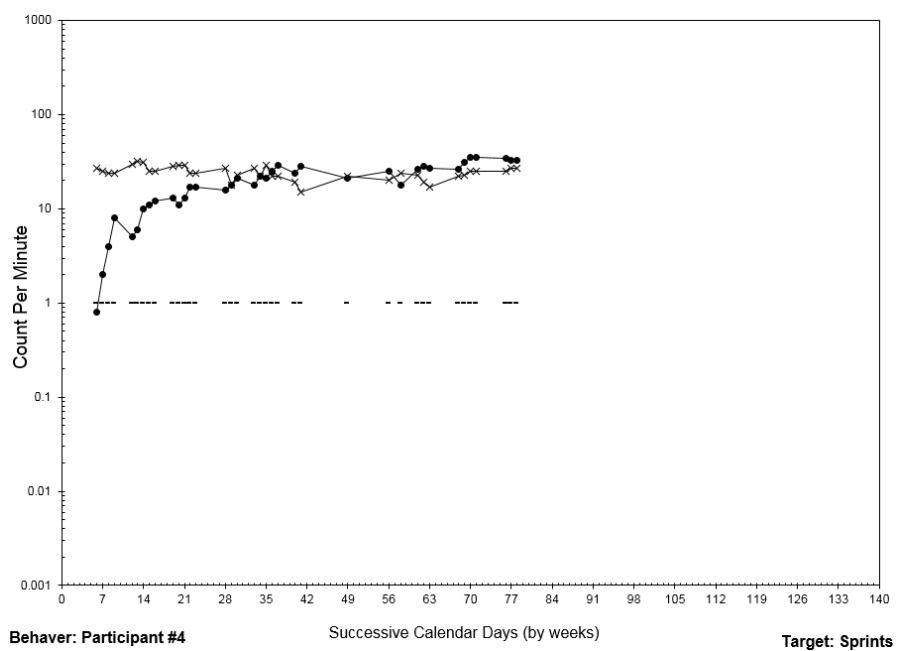


Figure 10. Standard Celeration Chart of rate of correct and incorrect responses per minute across the whole deck review supplemental practice condition for Participant 3.



*Figure 11.* Standard Celeration Chart of rate of correct and incorrect responses per minute across the basic SAFMEDS control condition for Participant 4.



*Figure 12.* Standard Celeration Chart of rate of correct and incorrect responses per minute across the sprints supplemental practice condition for Participant 4.

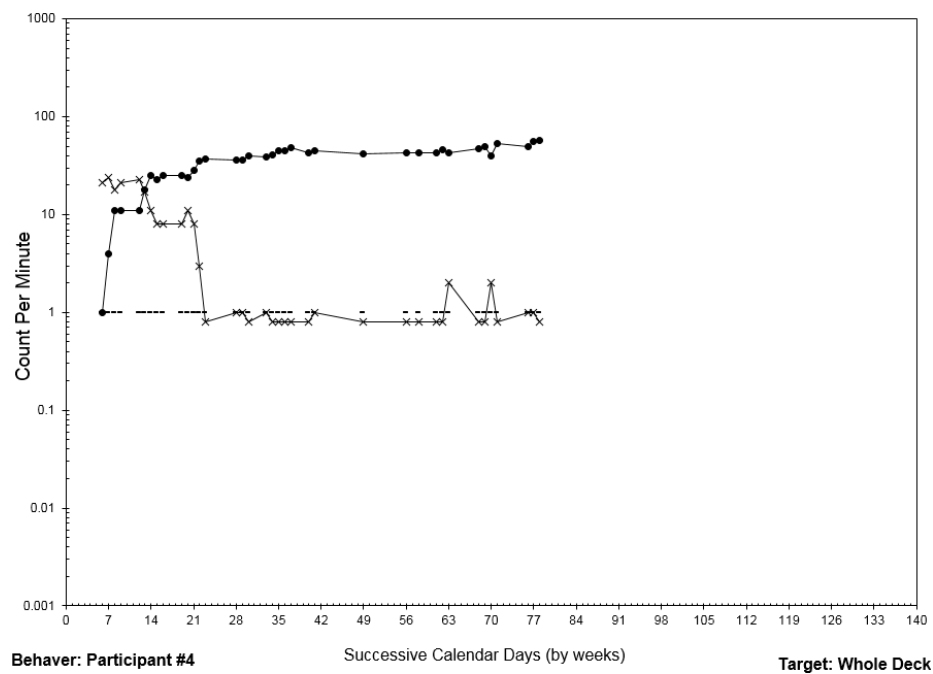


Figure 13. Standard Celeration Chart of rate of correct and incorrect responses per minute across the whole deck review supplemental practice condition for Participant 4.

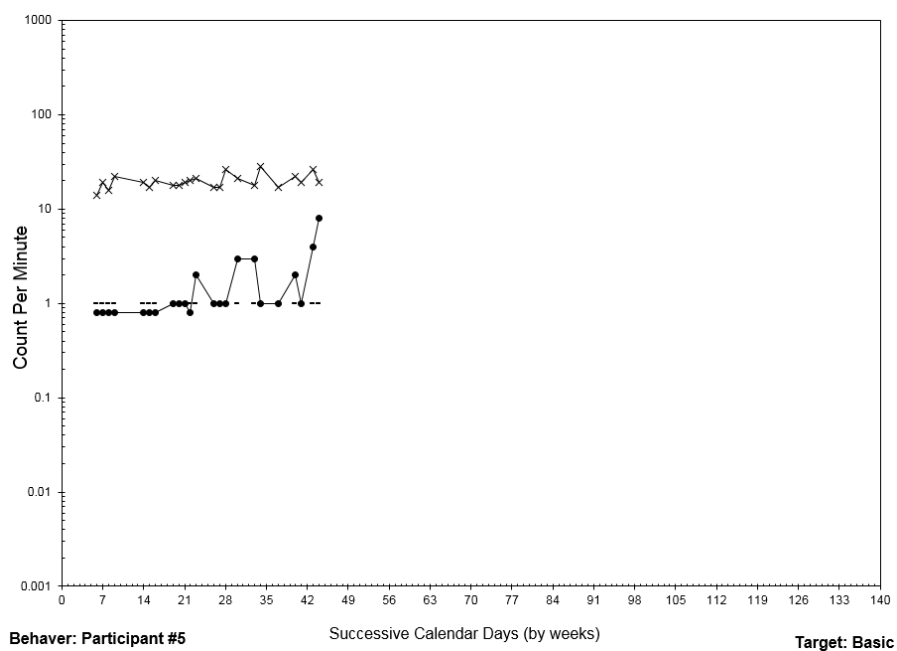
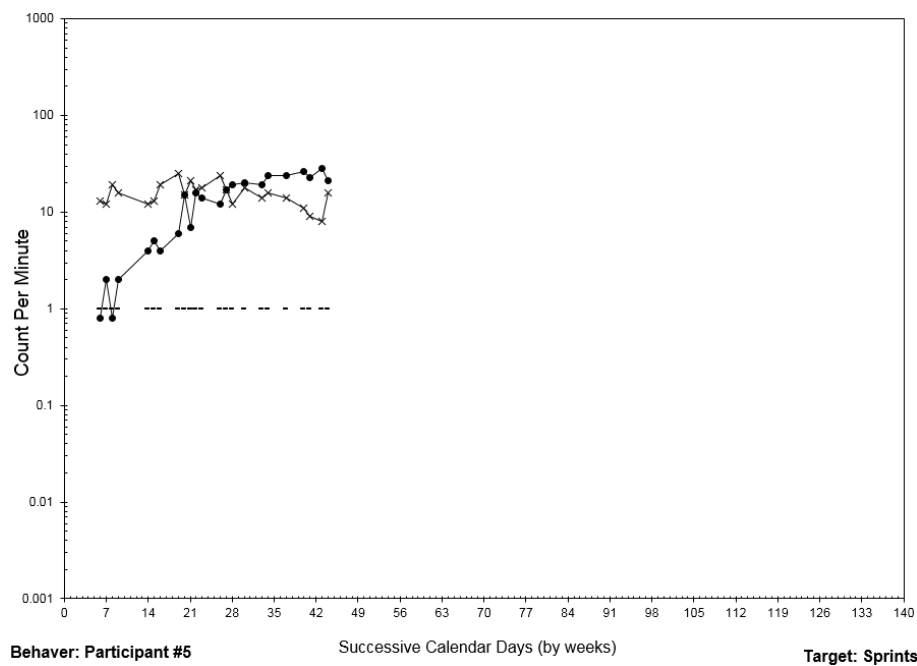
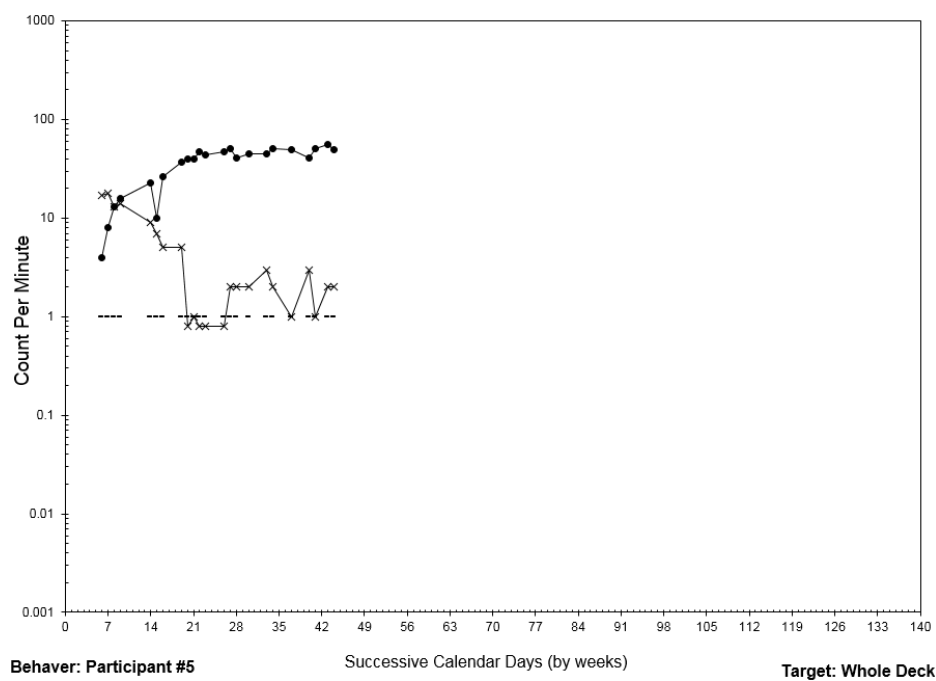


Figure 14. Standard Celeration Chart of rate of correct and incorrect responses per minute across the basic SAFMEDS control condition for Participant 5.



*Figure 15.* Standard Celeration Chart of rate of correct and incorrect responses per minute across the sprints supplemental practice condition for Participant 5.



*Figure 16.* Standard Celeration Chart of rate of correct and incorrect responses per minute across the whole deck review supplemental practice condition for Participant 5.

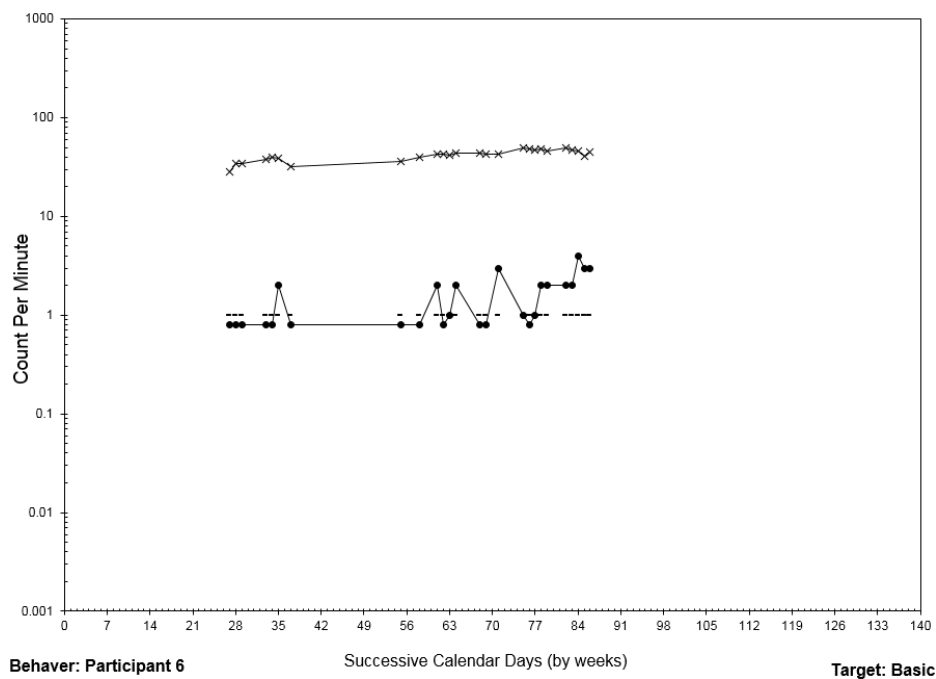


Figure 17. Standard Celeration Chart of rate of correct and incorrect responses per minute across the basic SAFMEDS control condition for Participant 6.

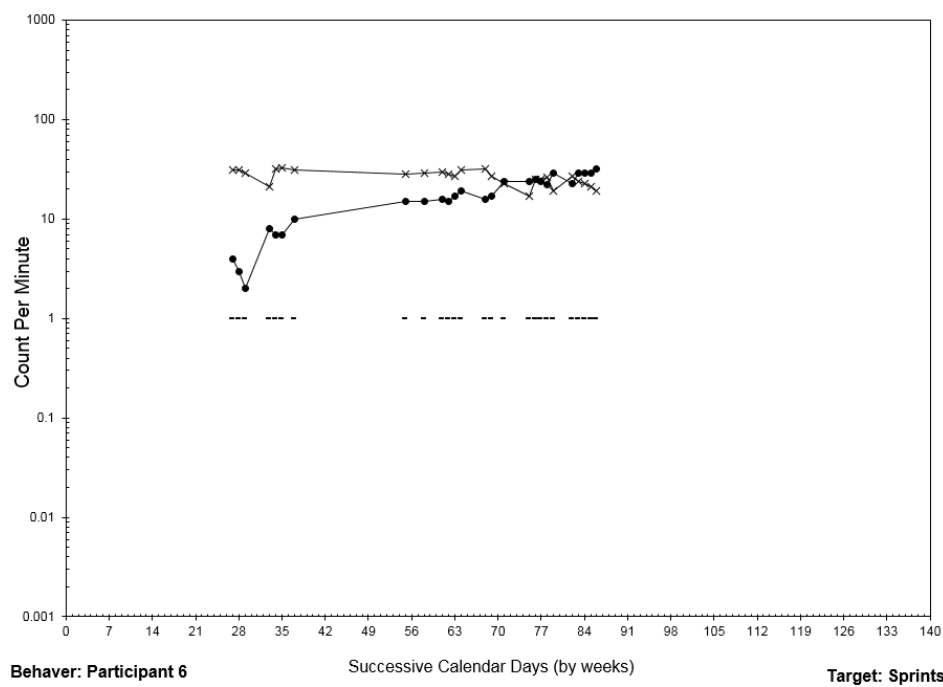


Figure 18. Standard Celeration Chart of rate of correct and incorrect responses per minute across the sprints supplemental practice condition for Participant 6.

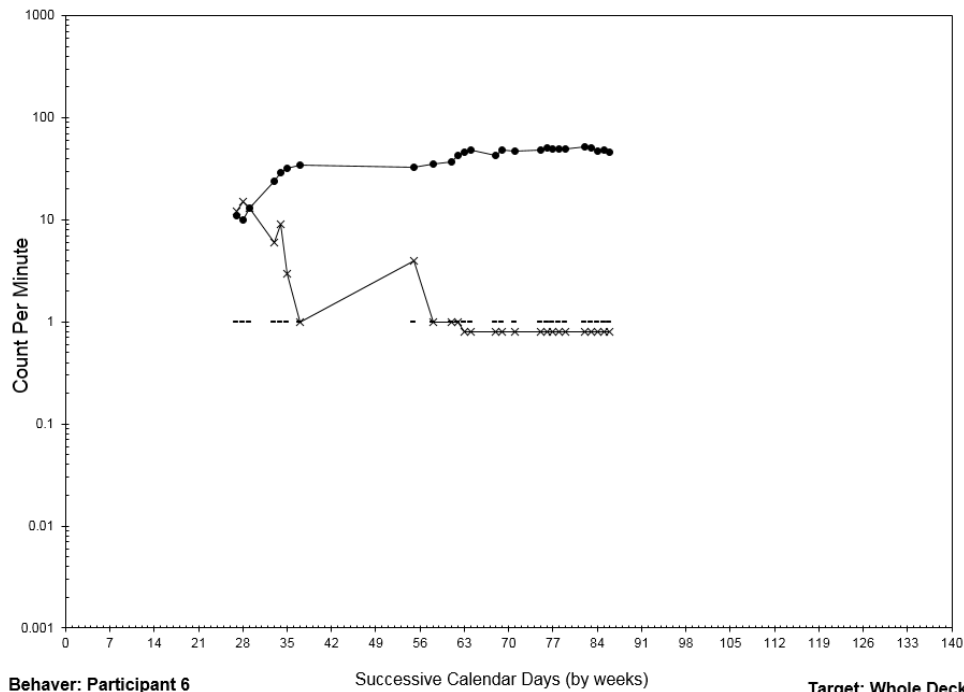


Figure 19. Standard Celeration Chart of rate of correct and incorrect responses per minute across the whole deck review supplemental practice condition for Participant 6.

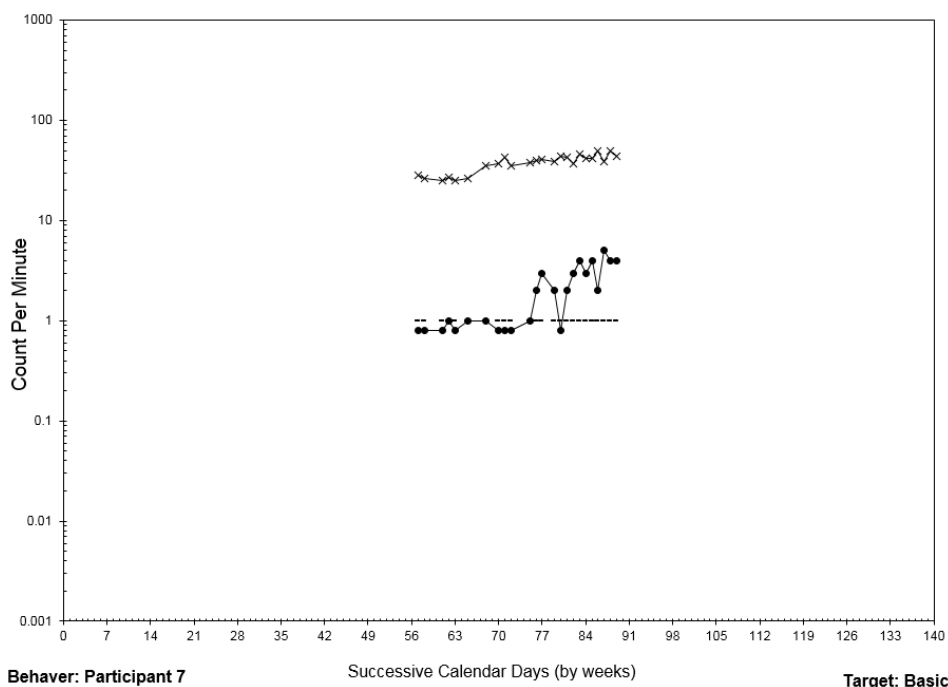
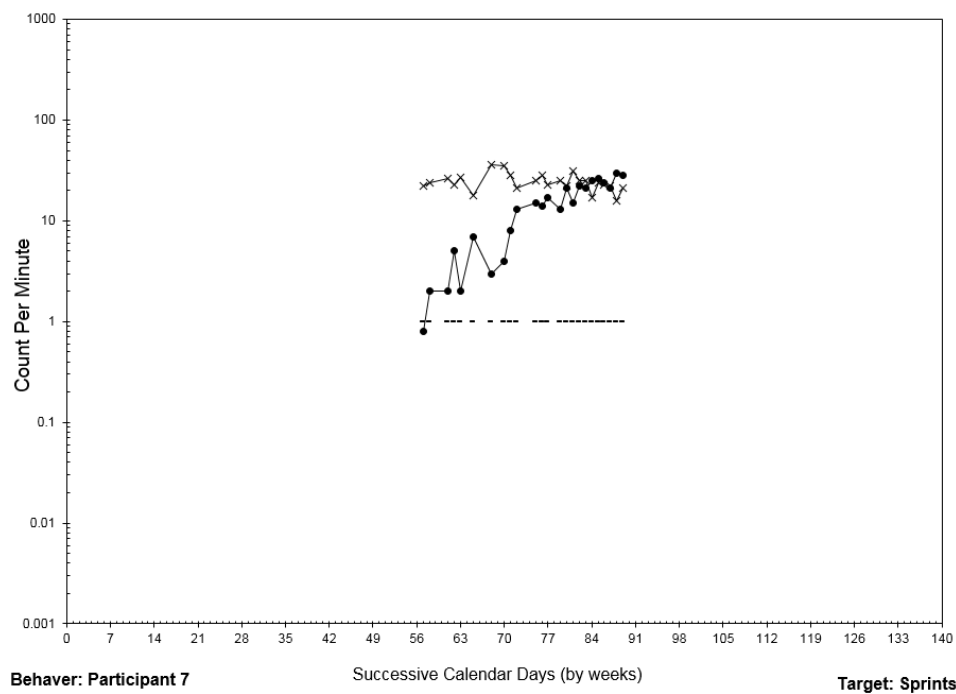
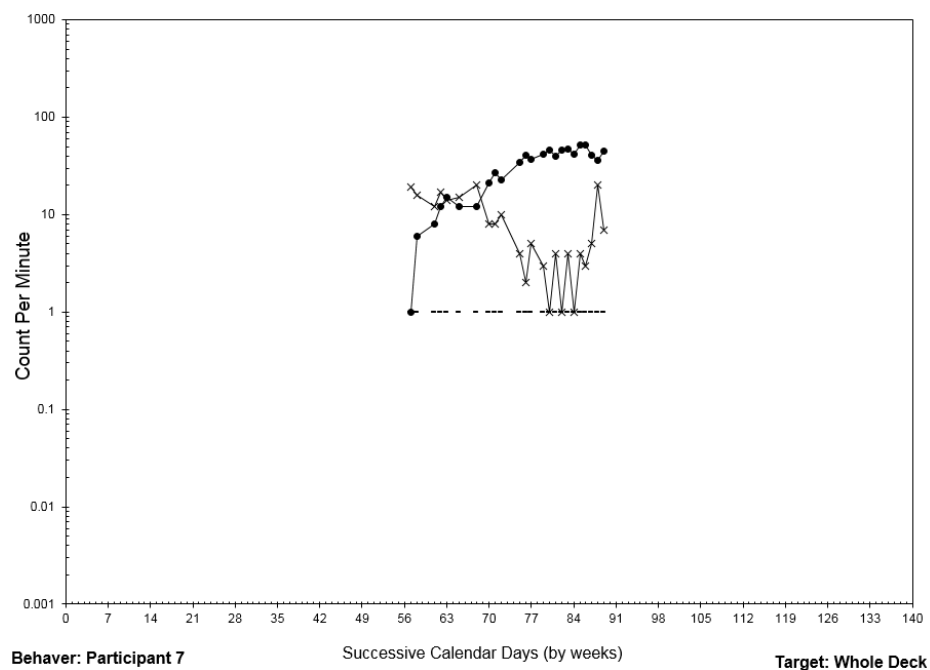


Figure 20. Standard Celeration Chart of rate of correct and incorrect responses per minute across the basic SAFEMDS control condition for Participant 7.

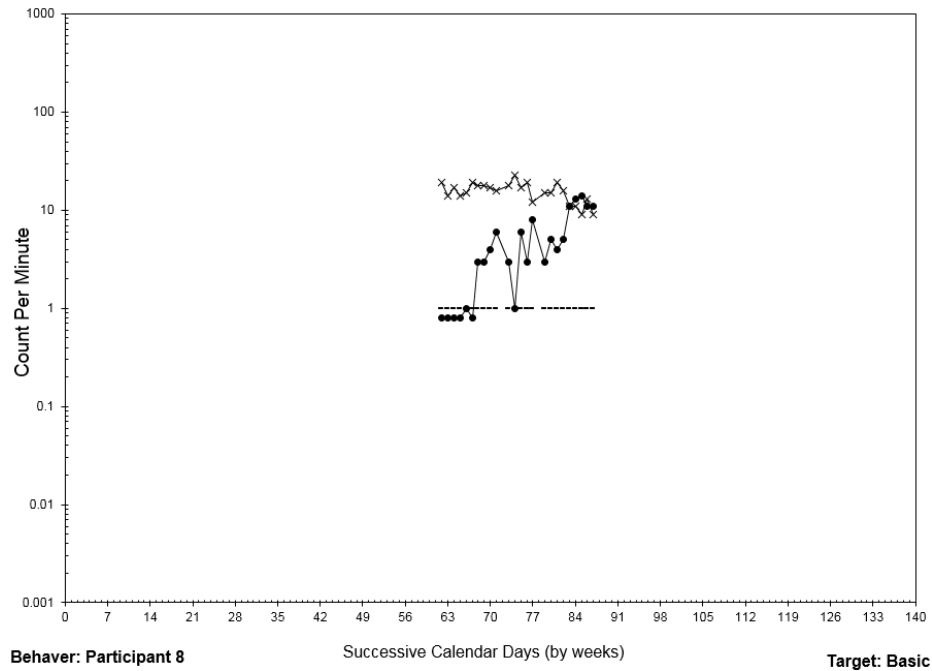




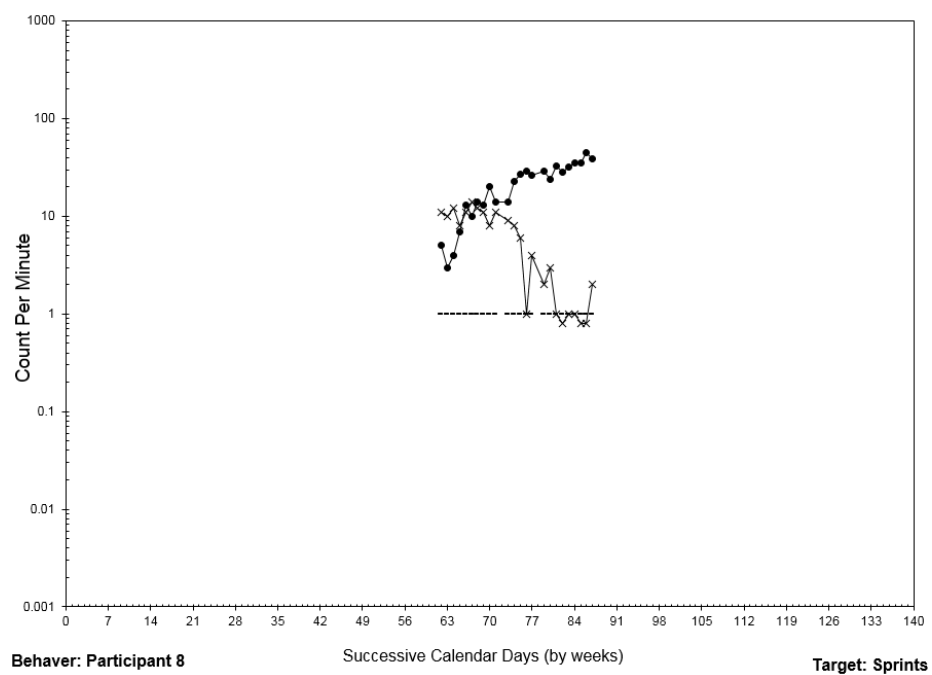
*Figure 21.* Standard Celeration Chart of rate of correct and incorrect responses per minute across the sprints supplemental practice condition for Participant 7.



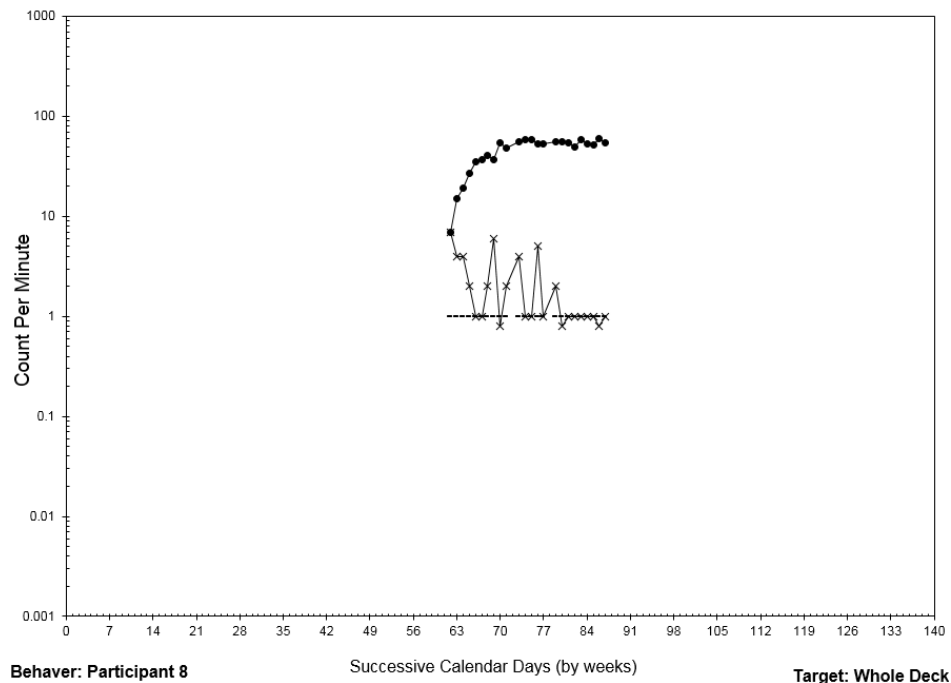
*Figure 22.* Standard Celeration Chart of rate of correct and incorrect responses per minute across the whole deck review supplemental practice condition for Participant 7.



*Figure 23.* Standard Celeration Chart of rate of correct and incorrect responses per minute across the basic SAFMEDS control condition for Participant 8.



*Figure 24.* Standard Celeration Chart of rate of correct and incorrect responses per minute across the sprints supplemental practice condition for Participant 8.



*Figure 25.* Standard Celeration Chart of rate of correct and incorrect responses per minute across the whole deck review supplemental practice condition for Participant 8.

Data for the whole deck review supplemental practice procedure demonstrated the most immediate change in celeration. Jaws crossover patterns for accelerating correct responses and decelerating incorrect responses were quickly noted for Participant 1 (day 5), Participant 3 (day 3), Participant 4 (day 7), Participant 5 (day 5), Participant 6 (day 4), Participant 7 (day 8), and Participant 8 (day 2). Crossover in the whole deck review supplemental practice condition was also achieved for Participant 2, yet the rate of their accelerating and decelerating responses was not as drastic as with other participants.

Celeration values for the slope of correct responses in the first ten days further demonstrated the magnitude of effects for each condition. Celeration data for the basic conditions were smaller than values in the sprints supplemental condition for all

participants except for Participant 9; they had no change in celeration in the basic condition and the sprints condition.

	Basic SAFMEDS	Sprints Practice	Whole Deck Practice
Participant 1	X 1.0 [10 days]	X 2.05 [10 days]	X 2.15 [10 days]
Participant 2	X 1.0 [10 days]	X 1.9 [10 days]	X 3.2 [10 days]
Participant 3	X 1.0 [10 days]	X 3.3 [10 days]	X 1.7 [10 days]
Participant 4	X 2.5 [10 days]	X 2.7 [10 days]	X 2.3 [10 days]
Participant 5	X 1.1 [10 days]	X 1.6 [10 days]	X 2.15 [10 days]
Participant 6	X 1.1 [10 days]	X 1.45 [10 days]	X 1.3 [10 days]
Participant 7	X 1.15 [10 days]	X 2.7 [10 days]	X 2.15 [10 days]
Participant 8	X 3.7 [10 days]	X 5.0 [10 days]	X 2.9 [10 days]
Participant 9	X 1.00 [4 days]	X 1.00 [4 days]	X 2.2 [4 days]

*Note.* Celeration values for each participant across each condition.

Basic celeration values were also smaller than values in the whole deck supplemental condition for all except for Participant 8. Participant 8 had a celeration of X 3.7 for the basic condition, which was greater than the X 2.9 celeration of the whole deck condition; a smaller slope may have been due to Participant 8 obtaining higher initial scores in the whole deck condition (day 1 = 7 correct; day 2 = 15 correct), than in the basic condition (day 1 = 0 correct; day 2 = 0 correct). Overall, celeration values in the whole deck supplemental condition were highest, with the exception of Participants 3, 4, 6, and 8, whom had larger initial celerations with the sprints practice procedure.

Celeration differences between the sprints condition and the whole deck condition were not very significant for Participants 4 (sprints =  $X$  2.7; whole deck = 2.3) and 6 (sprints =  $X$  1.45; whole deck = 1.3); but differences were significant for Participants 3 (sprints =  $X$  3.3; whole deck = 1.7) and 8 (sprints =  $X$  5.0; whole deck = 2.9). This, once again, may be accredited to Participants 3 and 8 obtaining higher initial scores in the whole deck condition, leading to more gradual slopes. Generally, all participants in the whole deck procedure obtained higher frequencies of correct responses when compared to the other two SAFMEDS conditions.

### **Social Validity**

Seven of the 9 participants completed social validity questionnaires upon finishing the study. All participants completing the questionnaire felt that the following statement was either clear or very clear: 1) How clear was your understanding of the SAFMEDS procedure. Five participants selected “liked it” or “extremely liked it” for the following statement: 2) How much did you like using the SAFMEDS procedure; Two participants selected “neutral” or “disliked it” for item number 2 on the questionnaire. All participants answered “acceptable” or “very acceptable” and “somewhat willing” or “very willing” to the following questions: 3) How acceptable did you find the SAFMEDS procedure to be; 4) How willing would you be to use the SAFMEDS procedure in the future. When asked “How effective do you feel the SAFMEDS procedure would be in learning additional content (Question 5),” two participants selected “very effective,” one participant selected “neutral,” three participants selected “ineffective,” and one participant selected “very ineffective.” When asked “How effective did you find the

Whole Deck Review Supplemental SAFMEDS procedure to be (Question 6),” six participants selected “very effective” and one participant selected “effective.” When asked “How effective did you find the Sprints Supplemental SAFMEDS procedure to be (Question 7),” three participants selected “very effective” and four participant selected “effective.”

Additional comments provided on the social validity questionnaire were generally favorable. One participant stated that they planned to use the SAFMEDS procedure to help them learn another language and another commented on the recognition of a Chinese symbol in the natural environment. Another participant described differences in symbol acquisition with the various procedure used. They stated that some of their responding was based off of contextual cues (which deck/procedure they were using at the moment), particularly with the SAFMEDS cards in the basic and sprints supplemental conditions. Additionally, this participant stated their desire to assess their current rates of responding with the responding of one large, combined deck of 180 cards.

## CHAPTER 4 DISCUSSION

The acronym SAFMEDS describes specific procedures for use, suggesting a standard acquisition application; However, there is little literature to suggest standardization (Quigley et al., 2017). Instead, the SAFMEDS literature provides vague definitions of procedures used or includes supplementary procedures such as additional timings or practice, which are not specifically defined in the procedures originally outlined by its creators (Quigley et al., 2017). The aim of this study was to evaluate participant responding when using a variation of the basic SAFMEDS procedure (Lindsley, 1996a; Eshelman, 2000a, b; Graf & Auman, 2005; Quigley, et al. 2017) and compare results to responding when using the sprints supplemental practice procedure and the whole deck review practice procedure. The frequencies of correct responses were evaluated across conditions, as well as the rate in which results accelerated. While the number of correct responses increased with each condition across all participants, the rate in which they increased differed greatly.

Overall, the basic SAFMEDS procedure, as defined above, did not produce the same rate of correct responses as the other two supplemental practice SAFMEDS procedures. The change in level, trend, mean, and celeration for the whole deck and sprints supplemental procedures, when compared to participant performance during the basic SAFMEDS procedure, demonstrated greater improvement in correct responding across all participants. The counterbalancing of Chinese decks across treatments and participants suggests that treatment effects are the result of the independent variables, rather than learning the content. Given the lack of progress participants made with the

without additional practice in this study and in Quigley (2014), it appears that the relation of SAFMEDS and fluency may not be accurate. Instead, it appears that accurate and fluent behavior is achieved through additional learning opportunities outside of the 1-minute timing. In the present study, this occurred in the form of two supplemental practice procedures.

Rate of correct responding was greater with additional practice added to the SAFMEDS procedure; specifically, correct responding was generally greater in the whole deck review supplemental practice procedure than in the sprints supplemental practice procedure, as was evident by larger changes in levels and overall larger celeration values. Additionally, steeper increasing trends demonstrated quicker acquisition of content in the whole deck review condition than with the sprints supplemental practice condition. These effects signify the impact that 10 minutes of review can have on knowledge acquisition. This information could benefit practitioners using SAFMEDS for various knowledge assessments, by outlining one strategy that could be most effective for general use, as well as providing more information on additional strategies that could be effective for other learners. It is suggested that further procedural guidelines be refined or added to SAFMEDS, to better define what works for learners. Technologically outlining the SAFMEDS procedure will continue to improve its application across various learners and settings.

Additionally, this study attempted to control for the effects of practice and reinforcement. Doughty, Chase and O'Shields (2004) provided a detailed critique of fluency-based instruction and its lack of experimental control with regards to rates of reinforcement and practice effects. SAFMEDS, a type of fluency-based instruction,



experiences the same criticisms. Participants using this procedure will naturally experience reinforcement and feedback when manipulating the SAFMEDS cards; however, additional measures can be taken to control for additional confounds. To control for practice effects, each participant experienced three practice conditions – the no practice control condition, the sprints practice control condition, and the whole deck review practice condition. No additional access to the Chinese SAFMEDS was provided to prevent additionally studying outside of the sessions. In an effort to control for rates of reinforcement, the present study used a variation of the proposed basic SAFMEDS procedure outlined by Lindsley (1996a), Eshelman (2000a, b), Graf & Auman (2005) and Quigley (2017). Specifically, participants did not count the cards in each pile when their time expired, nor did they chart their own performance. Furthermore, no additional feedback was provided to participants during and after each session. This allowed the researcher to evaluate the effects of practice on the procedure itself, without any other external confounds. While these changes allowed for better experimental control, they also provided some limitations.

First, Participant 9 withdrew from the study after four days of sessions. After each SAFMEDS session completed, they repeatedly commented on their performance; often stating that they performed terribly and that the content was difficult. While the researcher did not make any changes to the experimental procedures used, it is assumed that Participant 9 would have greatly benefited from some type of reinforcement (i.e.-praise/feedback after sessions, graphic feedback through charting) throughout sessions. Furthermore, anecdotally, all participants commented on the lack of feedback during and after sessions. A second limitation pertains to the experimental design used. While an

alternating treatments design with a control condition was able to clearly demonstrate different responding between conditions, results could have been further strengthened with the inclusion of a baseline across all phases, or the application of a best treatment phase.

Lastly, a variation of the basic SAFMEDS procedure (Quigley, et al. 2017) was used. The intent was to use this variation for better experimental control, yet it is also possible that deviating from the proposed “basic” procedure continues to add to the discrepancies in the SAFMEDS literature. Future research focusing on the replication of a standard procedure will provide more firm conclusions regarding SAFMEDS and its contribution to fluency development, specifically REAPS. Further research focusing on the comparison of basic and supplemental procedures, as well as replications with different materials and populations are also warranted. Additionally, there is continued need for SAFMEDS research to focus on controlling the effects of external variables- specifically the effects of practice and rates of reinforcement.

To conclude, the basic SAFMEDS procedure appeared to be most ineffective in increasing rates of correct responding in participants learning Chinese characters, when compared to two supplemental practice procedures. Rates of responding were greater in conditions that provided additional learning opportunities. While the sprints supplemental practice procedure did produce high frequencies in correct responses, conditions in which participants used the whole deck review supplemental practice procedure had the steepest increasing trends, signifying quicker rates of acquisition.

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## APPENDIX A PARTICIPANT QUESTIONNAIRE

### Participant Questionnaire

1. Highest level of education completed (circle one):

- |                                 |                                |
|---------------------------------|--------------------------------|
| High school                     | Post High School Certification |
| Associates Degree (in progress) | Associates Degree              |
| Bachelor Degree (in progress)   | Bachelor Degree                |
| Master's Degree (in progress)   | Master's Degree                |
| Doctoral Degree (in progress)   | Doctoral Degree                |

2. Do you speak any other languages other than English?      YES      NO

If YES: Which Language(s)? \_\_\_\_\_

3. Have you ever received any formal training in another language?      YES      NO

If YES: Please describe how much and what type of training:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

4. Have you ever used SAFMEDS before?      YES      NO

If YES: Please describe:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

5. Please list your scheduled work days and hours below:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## APPENDIX B PRE-TEST

### Pre-Test

Instructor: \_\_\_\_\_ Name: \_\_\_\_\_  
 Results: \_\_\_\_\_ Date: \_\_\_\_\_

*Instructions: Circle the correct English translation for the symbol above.*

1. What is the translation for 姜     
  - a. Corn
  - b. Wall
  - c. Plastic
  - d. Boy
  - e. Ginger
  - f. Teeth
2. What is the translation for 我     
  - a. Noise
  - b. Lock
  - c. Rule
  - d. Yellow
  - e. You
  - f. Me
3. What is the translation for 象     
  - a. Cheese
  - b. Napkin
  - c. Shoe
  - d. Elephant
  - e. Foot
  - f. Bay
4. What is the translation for 兔     
  - a. Kitchen
  - b. Chat
  - c. Rabbit
  - d. Phone
  - e. Spin
  - f. Hog
5. What is the translation for 红     
  - a. Flat
  - b. Red
  - c. Knife
  - d. Message
  - e. Spoon
  - f. Green
6. What is the translation for 长     
  - a. Coffee
  - b. Knot
  - c. Long
  - d. Short
  - e. Drink
  - f. Pin
7. What is the translation for 猴     
  - a. Sweet
  - b. Hair
  - c. Monkey
  - d. Blue
  - e. Bottle
  - f. Note
8. What is the translation for 能     
  - a. Light
  - b. Bag
  - c. Basement
  - d. Dragon
  - e. Jade
  - f. Stop

9. What is the translation for 梦

- a. Dark
- b. Black
- c. Flower
- d. Girl
- e. Book
- f. Dreams

10. What is the translation for 玄

- a. Hat
- b. Duck
- c. House
- d. Ghost
- e. Mysterious
- f. Glasses

11. What is the translation for 于

- a. Name
- b. To
- c. Soap
- d. Tissue
- e. Church
- f. Bird

12. What is the translation for 岛

- a. Push
- b. Teacher
- c. Radio
- d. Island
- e. Island
- f. Country

13. What is the translation for 看

- a. Positive
- b. Fire
- c. Look
- d. Friday
- e. Tree
- f. King

14. What is the translation for 站

- a. Picture
- b. Stand
- c. Tuesday
- d. Bay
- e. Cat
- f. Toe

15. What is the translation for 芥

- a. Box
- b. Mustard
- c. Love
- d. Pen
- e. Frog
- f. Word

16. What is the translation for 醒

- a. Wake
- b. Brush
- c. Thursday
- d. Mustard
- e. Car
- f. Bird

17. What is the translation for 下

- a. Shirt
- b. Glass
- c. Number
- d. Treasure
- e. Sword
- f. Down

18. What is the translation for 茶

- a. Tea
- b. Pass
- c. Sun
- d. Long
- e. Deer
- f. Stand

19. What is the translation for 大

- a. Gold
- b. Big
- c. Pants
- d. Heat
- e. Listen
- f. Smoke

20. What is the translation for 周

- a. Job
- b. Fan
- c. Dish
- d. Snail
- e. Week
- f. Wish

21. What is the translation for 降

- a. Stars
- b. Save
- c. Drop
- d. Wood
- e. Computer
- f. Toy

22. What is the translation for 冷

- a. Leaf
- b. Cold
- c. Fall
- d. Monday
- e. Bottle
- f. Song

23. What is the translation for 果

- a. Student
- b. Fruit
- c. Paint
- d. Mouse
- e. Chew
- f. Doctor

24. What is the translation for 喝

- a. Worm
- b. Rabbit
- c. Cone
- d. Diamond
- e. Egg
- f. Life

25. What is the translation for 民

- a. Doom
- b. Street
- c. People
- d. Wednesday
- e. Fork
- f. Pumpkin



**APPENDIX C  
WORD LIST**

SAFMEDS Deck 1					
Number	English Word	Chinese Translation	Number	English Word	Chinese Translation
1	three	三	35	me	我
2	five	五	36	alcohol	醇
3	nine	九	37	star	星
4	leg	腿	38	nail	钉
5	head	頭	39	camp	营
6	eye	眼	40	low	低
7	teeth	牙	41	dry	干
8	chicken	雞	42	dreams	梦
9	pig	豬	43	wake	醒
10	goose	鵝	44	fill	填
11	dog	狗	45	sonic	音
12	monkey	猴	46	drop	降
13	snake	蛇	47	mysterious	玄
14	sheep	羊	48	black	黑
15	snow	雪	49	column	列
16	lake	湖	50	to	于
17	mountain	山	51	dew	露
18	week	周	52	frost	霜
19	day	天	53	number	数
20	cry	哭	54	dish	菜
21	zero	零	55	ginger	姜
22	stomach	胃	56	feather	羽
23	stand	站	57	white	白
24	light	光	58	only	才
25	house	屋	59	long	長
26	bag	袋	60	positive	正
27	god	神			
28	love	爱			
29	word	字			
30	close	关			
31	desk	台			
32	table	表			
33	bell	钟			
34	bite	咬			

SAFMEDS Deck 2					
Number	English Word	Chinese Translation	Number	English Word	Chinese Translation
1	four	四	36	new	新
2	seven	七	37	old	旧
3	ten	十	38	night	晚
4	feet	腳	39	ball	球
5	ear	耳	40	roll	滾
6	mouth	口	41	write	写
7	fish	魚	42	bridge	桥
8	competing	競	43	high	高
9	cat	貓	44	on	上
10	rat	鼠	45	tired	累
11	south	南	46	sleepy	困
12	east	東	47	empty	空
13	west	西	48	look	看
14	fire	火	49	gold	金
15	rain	雨	50	out	出
16	river	河	51	huge	巨
17	sea	海	52	fruit	果
18	flower	花	53	treasure	宝
19	tree	樹	54	weight	重
20	stone	石	55	mustard	芥
21	cold	冷	56	name	名
22	cloud	雲	57	country	国
23	hot	熱	58	people	民
24	year	年	59	king	王
25	go	走	60	evil	惡
26	good	好			
27	bad	坏			
28	far	远			
29	yes	是			
30	drink	喝			
31	back	背			
32	sit	坐			
33	shoe	鞋			
34	knife	刀			
35	red	紅			

SAFMEDS Deck 3					
Number	English Word	Chinese Translation	Number	English Word	Chinese Translation
1	one	一	35	plant	厂
2	six	六	36	book	书
3	eight	八	37	money	钱
4	hand	手	38	both	都
5	arm	臂	39	eat	吃
6	cow	牛	40	you	您
7	horse	馬	41	egg	蛋
8	elephant	象	42	folder	夹
9	left	左	43	run	跑
10	north	北	44	profit	盈
11	ice	冰	45	off	离
12	grass	草	46	cooked	熟
13	island	島	47	uncooked	生
14	leaf	葉	48	wet	湿
15	water	水	49	sound	声
16	come	来	50	down	下
17	mad	狂	51	earth	土
18	man	人	52	ground	地
19	big	大	53	jade	玉
20	little	小	54	church	堂
21	hard	硬	55	bird	鸟
22	near	近	56	push	推
23	hi	嗨	57	have	有
24	tea	茶	58	duck	鴨
25	bed	床	59	female	女
26	bowl	碗	60	stand	立
27	key	键			
28	spoon	勺			
29	boat	船			
30	paper	紙			
31	bamboo	竹			
32	beauty	美			
33	wall	壁			
34	play	玩			

## APPENDIX D TRAINING DATASHEET

### SAFMEDS Participant Procedural Fidelity (Training Deck)

Participant Pseudonym: \_\_\_\_\_

Date: \_\_\_\_\_

Researcher: \_\_\_\_\_

To determine competency with SAFMEDS procedure, enter % successful for each step below. Use chart on the right to determine % successful for steps 4 and 6. Passing criteria for entire procedure = 90%.

1. Participants holds the complete deck	
2. Participant shuffles cards	
3. Participant Starts timer for 1-minute	
4. Participant "sees" the front of the card and <u>vocally</u> "says" a presumed response for all cards turned	
5. Participant turns card to check answer correctness	
6. Participant sorts all cards turned into appropriate pile (correct, incorrect, pass)	
7. Participant stopped the timer after reviewing the final card	
8. Participant counts responses for each pile, after 1-minute timing	
Totals >	/800
% Successful >	

SAFMEDS Card #	Vocally says presumed response	Sort into correct pile?
1	Y N	Y N
2	Y N	Y N
3	Y N	Y N
4	Y N	Y N
5	Y N	Y N
6	Y N	Y N
7	Y N	Y N
8	Y N	Y N
9	Y N	Y N
10	Y N	Y N
11	Y N	Y N
12	Y N	Y N
13	Y N	Y N
14	Y N	Y N
15	Y N	Y N
16	Y N	Y N
17	Y N	Y N
18	Y N	Y N
19	Y N	Y N
20	Y N	Y N
21	Y N	Y N
22	Y N	Y N
23	Y N	Y N
24	Y N	Y N
25	Y N	Y N
Total Y's: % Successful	/Total	/Total

Passing Criteria for entire procedure = 90%

Passing Criteria for Vocal Responses and Sorting = 80%

### APPENDIX E DECK/TREATMENT SESSION SEQUENCE EXAMPLE

Deck Treatment/Session Sequence Template						
Template 1	Template 2	Template 3	Template 4	Template 5	Template 6	
1) Tx 1 CHINESE 1	1) Tx 1 CHINESE 1	1) Tx 2 CHINESE 2	1) Tx 2 CHINESE 2	1) Tx 3 CHINESE 3	1) Tx 3 CHINESE 3	
2) Tx 2 CHINESE 2	2) Tx 3 CHINESE 3	2) Tx 3 CHINESE 3	2) Tx 1 CHINESE 1	2) Tx 1 CHINESE 1	2) Tx 2 CHINESE 2	
3) Tx 3 CHINESE 3	3) Tx 2 CHINESE 2	3) Tx 1 CHINESE 1	3) Tx 3 CHINESE 3	3) Tx 2 CHINESE 2	3) Tx 1 CHINESE 1	
Day 1						
Day 2						
1) Tx 3 CHINESE 3	1) Tx 3 CHINESE 3	1) Tx 2 CHINESE 2	1) Tx 1 CHINESE 1	1) Tx 2 CHINESE 2	1) Tx 1 CHINESE 1	Day 6
2) Tx 1 CHINESE 1	2) Tx 2 CHINESE 2	2) Tx 1 CHINESE 1	2) Tx 3 CHINESE 3	2) Tx 3 CHINESE 3	2) Tx 2 CHINESE 2	
3) Tx 2 CHINESE 2	3) Tx 1 CHINESE 1	3) Tx 3 CHINESE 3	3) Tx 2 CHINESE 2	3) Tx 1 CHINESE 1	3) Tx 3 CHINESE 3	
Day 7						
Day 8						
1) Tx 1 CHINESE 1	1) Tx 2 CHINESE 2	1) Tx 1 CHINESE 1	1) Tx 3 CHINESE 3	1) Tx 2 CHINESE 2	1) Tx 3 CHINESE 3	
2) Tx 2 CHINESE 2	2) Tx 1 CHINESE 1	2) Tx 3 CHINESE 3	2) Tx 2 CHINESE 2	2) Tx 3 CHINESE 3	2) Tx 1 CHINESE 1	
3) Tx 3 CHINESE 3	3) Tx 3 CHINESE 3	3) Tx 2 CHINESE 2	3) Tx 1 CHINESE 1	3) Tx 1 CHINESE 1	3) Tx 2 CHINESE 2	
Day 13						
Day 14						
1) Tx 3 CHINESE 3	1) Tx 3 CHINESE 3	1) Tx 2 CHINESE 2	1) Tx 1 CHINESE 1	1) Tx 2 CHINESE 2	1) Tx 1 CHINESE 1	Day 18
2) Tx 2 CHINESE 2	2) Tx 1 CHINESE 1	2) Tx 1 CHINESE 1	2) Tx 2 CHINESE 2	2) Tx 3 CHINESE 3	2) Tx 3 CHINESE 3	
3) Tx 1 CHINESE 1	3) Tx 2 CHINESE 2	3) Tx 3 CHINESE 3	3) Tx 3 CHINESE 3	3) Tx 1 CHINESE 1	3) Tx 2 CHINESE 2	
Day 19						
Day 20						
1) Tx 3 CHINESE 3	1) Tx 1 CHINESE 1	1) Tx 2 CHINESE 2	1) Tx 3 CHINESE 3	1) Tx 1 CHINESE 1	1) Tx 2 CHINESE 2	Day 24
2) Tx 1 CHINESE 1	2) Tx 2 CHINESE 2	2) Tx 3 CHINESE 3	2) Tx 2 CHINESE 2	2) Tx 3 CHINESE 3	2) Tx 1 CHINESE 1	
3) Tx 2 CHINESE 2	3) Tx 3 CHINESE 3	3) Tx 1 CHINESE 1	3) Tx 1 CHINESE 1	3) Tx 2 CHINESE 2	3) Tx 3 CHINESE 3	
Tx 1 = Basic SAFMEDS						
Tx 2 = Sprints Procedure						
Tx 3 = Whole Deck Procedure						
* Deck Treatment/Session order will be randomly						

## APPENDIX F PROCEDURAL FIDELITY DATASHEET

### SAFMEDS Researcher Procedural Fidelity

Observer: \_\_\_\_\_ Date: \_\_\_\_\_

Researcher: \_\_\_\_\_

Participant Pseudonym: \_\_\_\_\_ Session: \_\_\_\_\_

#### Baseline

Session Prep	
1. Was the participant given the materials for the session (whole SAFMEDS deck, timer)?	+/-
2. Did the researcher provide the participant with appropriate instructions for baseline (basic SAFMEDS procedure)?	+/-
3. Was deck shuffled prior to test timing (can be researcher prompted)?	+/-
During/After Session	
4. Researcher refrained from providing feedback/praise during 1-minute timing?	+/-
5. Researcher refrained from providing feedback/praise after 1-minute timing?	+/-
6. Researcher totaled data (correct, incorrect, and passes) and entered into data spreadsheet, after daily sessions with each participant?	+/-
Total +'s >	/6
% Successful >	

## SAFMEDS Researcher Procedural Fidelity

Observer: \_\_\_\_\_ Date: \_\_\_\_\_

Researcher: \_\_\_\_\_

Participant Pseudonym: \_\_\_\_\_ Session: \_\_\_\_\_

## Whole Deck Review Supplemental Procedure

Session Prep	
1. Was the participant given the materials for the session (whole SAFMEDS deck, timer)?	+/-
2. Did the researcher provide the participant with appropriate instructions for the supplemental procedure?	+/-
3. Was the whole deck review less than 10-minutes in duration (can be researcher prompted)?	+/-
4. Did the researcher take duration data for length of practice?	+/-
5. Was deck shuffled prior to test timing (can be researcher prompted)?	+/-
During/After Session	
6. Researcher refrained from providing feedback/praise during 1-minute timing?	+/-
7. Researcher refrained from providing feedback/praise after 1-minute timing?	+/-
8. Researcher totaled data (correct, incorrect, and passes) and entered into data spreadsheet, after daily sessions with each participant?	+/-
Total +'s >	/8
% Successful >	

## SAFMEDS Researcher Procedural Fidelity

Observer: \_\_\_\_\_ Date: \_\_\_\_\_

Researcher: \_\_\_\_\_

Participant Pseudonym: \_\_\_\_\_ Session: \_\_\_\_\_

## Sprints Supplemental Procedure

Session Prep	
1. Was the participant given the materials for the session (whole SAFMEDS deck, timer)?	+/-
2. Did the researcher provide the participant with appropriate instructions for the supplemental procedure (i.e.- 3 practice 1-min timings)?	+/-
3. Was deck shuffled prior to each practice timing (can be researcher prompted)?	+/-
4. Was each practice timing 1-minute in duration?	+/-
5. Was deck shuffled prior to test timing (can be researcher prompted)?	+/-
During/After Session	
6. Researcher refrained from providing feedback/praise during 1-minute timing?	+/-
7. Researcher refrained from providing feedback/praise after 1-minute timing?	+/-
8. Researcher totaled data (correct, incorrect, and passes) and entered into data spreadsheet, after daily sessions with each participant?	+/-
Total +'s >	/8
% Successful >	



## APPENDIX G SOCIAL VALIDITY QUESTIONNAIRE

### SAFMEDS Survey

*Please read the following statement and select the appropriate level in which you agree or disagree:*

1. How clear was your understanding of the SAFMEDS procedure?

Very Unclear      Unclear      Neutral      Clear      Very Clear

2. How much did you like using the SAFMEDS procedure?

Extremely Disliked      Disliked it      Neutral      Liked it      Extremely Liked

3. How acceptable did you find the SAFMEDS procedure to be?

Very Unacceptable      Unacceptable      Neutral      Acceptable      Very acceptable

4. How willing would you be to use the SAFMEDS procedure in the future?

Very Unwilling      Unwilling      Neutral      Somewhat Willing      Very Willing

5. How effective do you feel the basic SAFMEDS procedure would be in learning additional novel content?

Very ineffective      Ineffective      Neutral      Effective      Very Effective

6. How effective did you find the Whole Deck Review Supplemental SAFMEDS procedure to be?

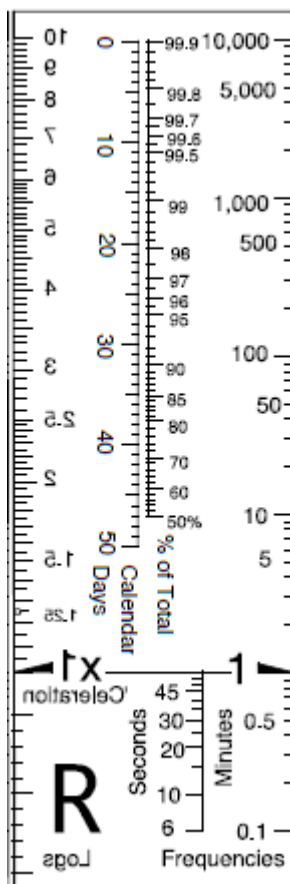
Very ineffective      Ineffective      Neutral      Effective      Very Effective

7. How effective did you find the Sprints Supplemental SAFMEDS procedure to be?

Very ineffective      Ineffective      Neutral      Effective      Very Effective

8. Additional Comments and Suggestions:

## APPENDIX H FINDER TOOL



<https://education.uw.edu/sites/default/files/areas/edspe/white/readings/finderbook.pdf>