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Using Precision Teaching Strategies to Alleviate Symptoms of Teacher Burnout

A DISSERTATION APPROVED FOR THE
DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

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DEDICATION

To all the devoted, hard-working teachers out there in the world. Your worth is beyond measure.

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ABSTRACT

Teachers in the United States experienced a dramatic increase in occupational burnout following changes in instruction brought about by the COVID-19 pandemic. Teacher burnout, however, is not a new phenomenon. Burnout is the main cause of teacher absenteeism and turnover; the United States spends approximately $7 billion per year on teacher attrition. In the 2020-2021 school year, teachers cited stress as the primary reason for leaving the profession. Specifically, increased work demands, parent communication, and lack of administrative support were contributing factors to their symptoms of burnout. This study employed two methodologies, a single-case changing criterion design and a behavior dynamics design to evaluate the effects a precision teaching and self-management intervention package had on symptoms of occupational burnout in four special education teachers. Participants used wrist counters to track daily positive and negative thoughts and feelings for 6 weeks. Baseline included self-monitoring; the intervention was a 1-minute timing and self-management treatment package. Data were charted on standard celeration charts and analyzed using traditional precision teaching metrics. Results were mixed, with three participants showing small improvements and one showing slightly worsening outcomes. Pre and post burnout scores on the Maslach Burnout Inventory (MBI) showed improvements for three participants in some domains of the MBI. The Areas of Worklife Survey (AWS) showed improvement for three participants in several domains of the AWS. The social validity survey and qualitative data indicated that, in general, participants felt the study had a positive impact on their lives. One participant reported continued use of the 1-minute timing seven weeks after completion of the study.

Keywords: teacher burnout, precision teaching, standard celeration chart, private events, inner behavior, self-management, behavior dynamics

CHAPTER 1: INTRODUCTION

In the 1970s, when occupational burnout became a source of social concern and attention in research, teaching was quickly identified as an at-risk profession due to high rates of the phenomenon. National surveys from 1978 and 1979 revealed that teachers suffered symptoms of burnout they directly related to their jobs, such as anxiety, fear, depression, migraines, ulcers, and hypertension; surveys from the same time showed 40% had intentions to quit, and over half reported that, if they had it to do all over again, they would not have chosen teaching as a profession (Cunningham, 1983). Multiple publications on the topic surfaced in peer reviewed journals in the 1980s (Farber, 1982; Gold, 1984; Truch, 1980), early aughts (e.g., Friedman, 2000), up to and post onset of the COVID-19 pandemic (Pressley, 2021; Skaalvik & Skaalvik, 2017). One early publication pondered whether teacher burnout was an authentic, genuine threat to the profession or just a "fad" due to recent hype (Cunningham, 1983, p. 38). Long before the term "burnout" was coined, however, an article from *The Journal of Education* dated February 12, 1920, titled "143,000 Teachers in One Year Quit an Underpaid Service", noted increased workload in addition to low pay had caused classroom teachers to be "starved out of the most useful work that men and women can do" (p. 175). Yet in over 40 years since seminal research in burnout was published, very little practical progress has been made to improve the same conditions that caused teacher shortages over one century ago (Farley & Chamberlain, 2021; Pressley, 2021; Skaalvik & Skaalvik, 2017).

The American education system has now been presented with a new opportunity to care for its teachers. Global and national disasters often cause disruptions in healthcare and education systems sizeable enough to unmask, with novel urgency, longstanding systemic problems (Iacoella et al., 2021; Stok et al., 2021). The political and social unrest following multiple recent

national events, including the unfolding of the global pandemic beginning March 2020, the murder of George Floyd in May 2020, and the school shooting in Uvalde, Texas in May 2022, have rightfully placed new pressure on educators to address systemic instructional and policy changes in schools. While some policies have historically resulted in increased stress for teachers, such as the No Child Left Behind Act (NCLB; Farley & Chamberlain, 2021), the current change has prioritized teacher and student social and emotional well-being. Some hopeful educators view this new appreciation of teacher wellness as a sign that heralds a long-needed transformation.

Post-Pandemic Funding and Policy Changes

A portion of funds provided to states under the American Rescue Plan Act (ARPA), passed by Congress in March 2021, was allocated for the purpose of improving mental health policies and resources (Johnson-Staub & Weerasinghe, 2021). Approximately $123 billion from the ARPA will channel to K-12 schools to safely reopen schools and "ensure states and districts address the learning loss and social and emotional needs of students disproportionately impacted by COVID-19, including students of color, Emergent Bilinguals, and students with disabilities" (American Rescue Plan Fact Sheet, 2021, p. 1). This will likely include addressing the social and emotional needs of teachers. In a policy brief developed for a series of publications devoted to pandemic recovery in education, the Collaborative for Academic, Social, and Emotional Learning (CASEL) made three recommendations for state and local policymakers to ensure recovery money is well spent:

1. *Promote social and emotional learning for students.* This includes culturally affirming, evidence based social and emotional learning (SEL) programs that are (a) sequenced, (b) use active forms of learning, (c) focus on skill development,

and (d) are explicit. Specific advice to policymakers includes incentivizing coordination across agencies and developing state SEL standards or guidelines.

2. *Support adult SEL competencies and capacity-building*. This includes creating a climate of support for school staff in which they feel valued and connected. Specific advice to policymakers and district leaders includes supporting well-being and self-care for educators, offering job-embedded professional learning opportunities in SEL, creating state-wide professional SEL learning communities, and investing in programs focused on adults' personal SEL skills.
3. *Align SEL efforts across schools, families, and communities.* This includes extending SEL into families and communities by efforts such as establishing community partnerships and wraparound supports that align SEL goals and mental health services. (CASEL, 2021)

Teacher Burnout in the Literature

Research on teacher burnout conducted before and during the pandemic supports CASEL's second recommendation. Pressley (2021) advised school administration to monitor teachers and provide ongoing instructional, technology, and emotional support throughout the school year. Cipriano and Brackett (2020) surveyed over 5,000 teachers less than one month after the World Health Organization (WHO) declared COVID-19 a global pandemic and warned of rising but familiar themes of stress and burnout. Recommendations included immediate emotional support for teachers from administrators—in teachers' own words, "honesty, respect, kindness, flexibility, and patience"—and the development of an "Emotional Intelligence Charter" to act as a written contract among faculty and staff of agreed-upon behaviors, values,

and emotional climates at work (Cipriano & Brackett, 2021, p. 5). In its essence, a charter of this kind is an expression of SEL policy and procedure at the local level.

With state and local policy changes on the horizon, district leaders will be faced with important decisions regarding best practices for supporting teacher SEL. This will undoubtedly include universal strategies for burnout prevention, identification, and referral for treatment. Contributing factors to occupational burnout, discussed at length in Chapter 2, include work environment and personal variables; however, Maslach and Leiter (2017) described the dearth of empirical research investigating effective interventions for preventing and treating burnout. Some promising interventions have been identified, such as cognitive behavioral therapy (CBT) and organizational strategies that include employee feedback and workplace coaching. Results must be taken with certain caveats, as multiple studies had poor methodology, small sample sizes, or no control group. Wellness models have been introduced focused on teacher social and emotional competence (SEC) as a mediating factor to student SEC (Jennings & Greenberg, 2009) and a mitigating factor for burnout (Brasfield et al., 2019). Other models have focused on change processes over time that incorporate steps of interventions built on one another (Maslach & Leiter, 2017).

Some research has shown that well-implemented SEL programs, when delivered exclusively to students by teachers, has positive effects on teacher behavior (Blewitt et al., 2020; Domitrovich et al., 2016; Jennings et al., 2017). From the limited amount of research, however, few firm conclusions can be made about what interventions are likely to promote teacher SEC and prevent or alleviate teacher burnout. Maslach and Leiter (2017) concluded, after an extensive review of the literature, that short-term, one-shot interventions are not likely to make significant differences, nor will interventions targeting only individual or situational factors exclusively.

Successful change will only take place if interventions have the following qualities: (a) a sense of urgency with descriptive goals defining a desired end state; (b) are targeted and strategic; (c) are collaborative, with employee participation throughout the intervention process; (d) are sustained or ongoing; and (e) evaluate or measure progress.

Problem Statement

Occupational burnout, a phenomenon traditionally cited as the primary cause of teacher shortages and attrition, increased exponentially following changes to instruction and increased job demands following the COVID-19 pandemic (Chang, 2009; Gold, 1984; Pressley, 2021). Teachers across the nation reported intense feelings of anxiety, emotional exhaustion, depression, and intentions to quit (Reich et al., 2020; Pressley, 2021). State and local policy changes are transpiring following funding provided by the American Rescue Plan Act (ARPA), making the identification of evidence-based interventions that target teacher behavior paramount. Approaches to treatment for burnout have largely focused on individual or situational factors in isolation, which produced insignificant and temporary improvement or inconclusive results. Research thus far supports a comprehensive approach to burnout that is strategic, involves active participation, measures progress, and targets both individual and environmental factors simultaneously.

Self-Management and Precision Teaching

Self-management and precision teaching, two evidence-based strategies commonly used in applied behavior analysis (ABA), can provide a comprehensive approach to burnout by incorporating interventions that require active participation, promote long-term behavior change, and provide ongoing measurement of progress. Self-management is defined as "the personal application of behavior change tactics that produces a desired improvement in behavior" (Cooper

et al., 2020, p. 683). Effective self-management interventions generally include some combination of self-monitoring, self-evaluation, charting or graphing progress, and self-delivered reinforcement. When individuals are carefully trained, a few self-management strategies can control a wide range of behavior. Precision teaching is "a system for precisely defining, measuring, recording, analyzing, and facilitating the subsequent decision making of behavior" (Kubina & Yurich, 2012, p.18). The standard celeration chart, which originated from Skinner's cumulative response recording, is always the primary measurement of behavior in precision teaching (Lindsley, 2010). Used together, self-management and precision teaching have the potential to reduce symptoms of burnout by teaching individuals to monitor their own behavior, track changes or improvements, and administer their own reinforcement. Research using precision teaching strategies to change thoughts and feelings has shown an additional advantage of helping participants identify what environmental variables occasion covert behavior (e.g., Kubina et al., 1994; Kostewicz et al., 2000).

Cognitive Behavioral Therapy and the One-Minute Timing

A characteristic of burnout is repetitive, negative, or intrusive thought patterns and work-related rumination. Worrying and thinking about work-related issues on personal time may prevent individuals from recovery processes that would normally alleviate burnout symptoms, such as sleep. Cognitive behavioral therapy has been used to treat occupational burnout by teaching employees to (a) become aware of negative thoughts and "irrational beliefs"; (b) challenge or counter negative thoughts; and (c) substitute the negative with positive or "rational" thoughts or beliefs (Querstret et al., 2015, p. 54). Behavior dynamics research on private (inner) behavior has used similar methods by teaching participants to (a) identify, list, and count response classes of positive and negative thoughts and feelings, (b) quantify the behavior change

on the standard celeration chart, and (c) employ a daily 1-minute timing of positive thoughts to influence the frequencies (Calkin, 1981; 1992; Calkin & Pennypacker, 2003; Kostewicz et al., 2000; Kubina et al., 1994; Patterson & McDowell, 2009).

Purpose of the Study

The purpose of this study is to expand the literature in precision teaching, special education, and applied behavior analysis by using precision teaching and self-management strategies to reduce symptoms of burnout in special education teachers. Most behavior analytic research seeks to demonstrate a functional relation between variables using single-case experimental design (Barlow et al., 2009; Cooper et al., 2020). Precision teaching research differs from single-case experimental design in that it uses an approach called *behavior dynamics*, which studies behavior change (Kubina, 2020; Kubina & Yurich, 2012). This study employs both methodologies to analyze behavior change across time and identify potential functional relations between behavior and intervention.

CHAPTER 2: REVIEW OF THE LITERATURE

The global pandemic has exposed long standing ways in which the public education system in the United States has marginalized the emotional health of its classroom teachers. Following the World Health Organization's declaration on March 11, 2020, schools closed and academic instruction went virtual in a matter of days. Shortly after, states began strategizing ways of reopening schools safely while addressing a wide range of existing inequities and mental health issues that surfaced after school closures. Parents, for example, particularly those who cared for children with disabilities, were at increased risk for burnout and emotional distress (Coyne et al., 2020; Griffith, 2020). Instances of domestic violence increased in multiple states (Boserup et al., 2020; Usher et al., 2020). Thirty percent of families with school-aged children, primarily minorities or from schools with high poverty rates, did not have internet access or adequate digital devices for online instruction (Reich et al., 2020). Pediatric psychiatrists and counselors projected, with alarming accuracy, the harmful impact that stay-at-home orders would have on the academic, emotional, and developmental well-being of children and adolescents (Fegert et al., 2020; Golberstien et al., 2020; Loades et al., 2020). It is likely youth will remain at increased risk for anxiety, depression, and other problems for some time, potentially resulting in more academic setbacks and significant losses in quality-of-life markers (Petersen, 2021). The voices of teachers have painted a clear portrait of the current social and emotional climate in classrooms.

Education in the Era of a Global Pandemic

In an early qualitative investigation into pandemic-era teaching, Reich et al. (2020) revealed several key themes from interviews of 40 teachers across the U.S.:

1. Student motivation was a serious struggle during online instruction.

2. Teachers lost essential feelings of self-efficacy and professional identity as they were forced to provide instruction in unfamiliar ways.
3. Teachers were distressed by existing social inequities among students, which were worsened by the pandemic.

A national survey of over 5,000 teachers showed the most common emotions experienced are anxiety, worry, exhaustion, and sadness—emotions typically linked to poor motivation, poor classroom management, poor decision-making, and reduced engagement with students (Cipriano & Brackett, 2020; Gilmour et al., 2021; Jennings & Greenberg, 2009).

Workload, a significant pre-pandemic predictor of anxiety and depression among teachers (Ferguson et al. 2012), increased significantly during the pandemic with distance learning. Instruction in most states during the 2020-2021 school year alternated between in-person, hybrid, and online platforms, leaving teachers to navigate unfamiliar instructional territory while acting as "the first resource for parents using district instructional technology" (Pressley, 2021, p.1). Specifically, the five work demands currently contributing most to emotional exhaustion in teachers are parental expectations, work life balance, time management, lack of resources, and technology (Sokal et al., 2020). Thus, the unique professional expectations that surfaced simultaneously with online instruction exacerbated a prevailing problem associated with teacher burnout: lack of self-efficacy and feelings of incompetence.

Student behavior and classroom management, also significant predictors of work-related stress among teachers (Ferguson et al., 2012), have become a complicated labyrinth since the pandemic. Teachers have traditionally reported student behavior as a causative factor in burnout (Aloe et al., 2014; Chang, 2013; Herman et al., 2018; Whiteman et al., 1985). Past research has pointed to several reasons for this, such as subjective teacher perceptions, emotional reactivity

(Chang, 2013), lack of social and emotional competence (SEC; Jennings & Greenberg, 2009), and stressors related to student-teacher relationships that interfere with personal accomplishment (Aloe et al., 2014; Skaalvick & Skaalvick, 2017). Thus, the social and emotional climate in many schools was unstable prior to the pandemic. Changes in the education system after March 2020, however, have caused further deterioration expected to continue for years to come. Teacher burnout is a complex phenomenon and there are multiple contributing factors that must be addressed systemically to prevent or ameliorate its impact.

Occupational Burnout Model and Theoretical Framework

Most conceptualizations of burnout in the literature are based on the Maslach model, which defines burnout as a response to prolonged occupational stress consisting of three distinct dimensions: emotional exhaustion, depersonalization, and reduced personal accomplishment (Maslach et al., 1986; Skaalvick & Skaalvick, 2017). Emotional exhaustion, the most commonly reported and analyzed dimension of burnout, is characterized by extreme fatigue and lack of motivation. Depersonalization, or cynicism, is the result of attempts to distance oneself from distressing elements of one's job. Reduced personal accomplishment is associated with feelings of self-perceived inadequacy and inefficacy. Reduced personal accomplishment may not be directly related to the first two dimensions (Maslach & Leiter, 2008). Collectively, the three dimensions aptly characterize personal accounts of teachers' discouraging journey through K-12 instruction since March 2020, as school teacher Mary describes:

> I spent intentional time in the beginning of my career where I was learning to call it a day. I was learning to leave it at the door. I was learning to take space and reflect before adjusting and all of that is gone. (Reich et al., 2020, p.11)

Teacher Burnout and Attrition

Employees in certain helping professions, such as human services, healthcare, and education, are more likely to experience burnout (Emery & Vandenberg, 2010; Maslach, 1997). Unsurprisingly, burnout accounts for a significant portion of teacher absenteeism and attrition. The financial burden placed on school systems for recruiting, replacing, and training new teachers has grown exponentially; the United States spends approximately $7 billion per year on teacher attrition (Chambers Mack et al., 2019). Data has shown teacher burnout is a significant predictor of intention to quit (Madigan & Kim, 2021), making the prevention, identification, and treatment of burnout key to reversing teacher attrition.

Teachers cite stress as the most common reason for leaving the profession. In a survey conducted just one month into the 2020-2021 school year, over 300 K-12 teachers specified that stress about COVID-19, new work demands, parent communication, and lack of administrative support were key contributors to their symptoms of burnout (Pressley, 2021). Another large national survey of teachers who voluntarily left the profession since March 2020 cited general stress from the pandemic as the primary reason for leaving (Diliberti et al., 2021). Further, general morale among teachers has plummeted. In a large national survey (n=817) conducted by the EdWeek Research Center in November 2020, 75% of teachers reported that personal morale was lower than before the pandemic and 85% reported low morale among the teachers within their respective schools. A national survey conducted by the same organization in March 2020 showed a 22% drop in self-reported teacher morale in a span of just 8 months (Will, 2021).

The Multiple Costs of Burnout

Negative consequences of burnout are considerable. Maslach and Leiter (2017) list a continuum of work-related problems associated with the phenomenon. For example, workers

who experience burnout may engage in negative social interactions with coworkers that become contagious and self-perpetuating. Chronic absenteeism, low job commitment, and low job satisfaction may result in attrition or intent to quit. Workers experiencing burnout report numerous relational and family problems as a result of the "spillover" effect from work to home (Maslach & Leiter, 2017, p. 49). Poor job performance, another common outcome of burnout, has resulted in disastrous consequences for certain occupations. For example, there is a higher risk of patient mortality in medical settings where staff experience burnout. Police officers experiencing burnout are more likely to use violence against civilians. Similarly, teachers who experience burnout may lack empathy for students and use coercive, punitive classroom management strategies (Jennings & Greenberg, 2009).

In addition to risks at the workplace, burnout poses significant physical and psychological health risks to individuals. Specifically, emotional exhaustion is strongly associated with greater instances of work-related injuries, cold/flu, headaches, chronic fatigue, gastrointestinal disorders, hypertension, and sleep problems (Maslach & Leiter, 2017). Burnout is also a predictor of mental health problems such as extreme irritability, anxiety, and depression. It is positively correlated with an increased risk for type 2 diabetes and hospitalization for mental health and cardiovascular episodes. Due to these relations, when employees are burned out there is often a tendency to dismiss their experience as representative of mental illness, flaws within their character, or poor work habits. While there are some individual factors predictive of burnout in individuals, situational or environmental variables may play a more critical role. Burnout is presumed to be a distinct phenomenon separate from psychiatric diagnoses (Maslach & Leiter, 2017; Schaufeli et al., 2001).

Impact of Teacher Burnout on Students

The Burnout Cascade

A downward spiral is initiated in the classroom when teachers are burned out, astutely referred to as the "burnout cascade" by Jennings and Greenberg (2009, p. 492). Effects of the burnout cascade on student outcomes are substantial. Students in classrooms of distressed teachers experience higher rates of externalizing and internalizing problem behavior. This behavior is maintained by the adverse instructional impact of teacher burnout—inadequate implementation of instructional strategies, lack of positive behavior interventions and supports (PBIS), and impeded access to enriching, reinforcing classroom environments (Aloe et al., 2014; Herman et al., 2018; Jennings & Greenberg, 2009; Jennings et al., 2017; Madigan & Kim, 2021; Skaalvik & Skaalvik, 2017). Reciprocally, poor student outcomes exacerbate feelings of inadequacy in teachers as they struggle to preserve a sense of self-efficacy. This cyclical pattern of burnout, poor coping and instruction, and grim student outcomes further wears down teacher morale and contributes to increasing levels of burnout.

Teacher-Student Relationships

Teacher-student relationships are perhaps the most influential relationships in children's lives apart from family members. These relationships deteriorate when teachers are emotionally exhausted. Student misbehavior, especially when perceived subjectively by an overly stressed teacher, can erode the teacher-student relationship and the teacher may devalue that relationship as a result (Aldrup et al., 2018; Aloe et al., 2014). Because teacher-student relationships are reciprocal, teachers of students who engage in high levels of externalizing behaviors in early adolescence may report perceived relationship difficulties with those students as much as two years later (Pakarinen et al., 2018). Consequently, exceedingly stressed teachers who lack

sufficient training may use more punitive, reactive behavior management procedures and develop a callous attitude toward their students.

Conversely, teachers who experience strong, positive relationships with students report increased overall well-being, emotional health, and job satisfaction (Aldrup et al., 2018; Aloe et al., 2014). Supportive teacher-student relationships that exhibit open communication, warmth, and trust can improve student academic performance, social-emotional development, behavioral outcomes, and mitigate peer victimization and bullying (Sulkowski & Simmons, 2017). To build positive relationships with students, however, teachers must have the intrapersonal skills to effectively manage their own stress levels and sufficient self-awareness to understand the roles their own emotional health and well-being play in student outcomes. They must promote prosocial values and have the capacity to create a nurturing, supportive learning environment. Emotionally healthy and effective teachers must possess social and emotional competence.

Teacher Well-Being and Social and Emotional Competence

Teachers with high levels of social and emotional competence (SEC) are better teachers and less vulnerable to burnout. They are able to manage their own emotions and behavior, use their strengths to motivate students, build healthy relationships, and choose self-care practices that enhance well-being (Blewitt et al., 2020; Durlak, 2015; Jennings & Greenberg, 2009). SEC is the intended outcome of SEL. The CASEL defines social and emotional learning as "the process through which all young people and adults acquire and apply the knowledge, skills, and attitudes to develop healthy identities, manage emotions and achieve personal and collective goals, feel and show empathy for others, establish and maintain supportive relationships, and make responsible and caring decisions" (CASEL, 2021). The CASEL SEL model comprises five core behavioral competencies: self-awareness, self-management, social awareness, relationship

skills, and responsible decision-making. As with students, the five core SEL competencies are essential for teachers to develop the interpersonal and intrapersonal skills needed for work, healthy relationships, and valued lifestyle choices. Subskills of the SEL competencies include stress management, identifying emotions, self-efficacy, self-confidence, and personal reflection.

Prosocial Classroom Model

SEL has demonstrated numerous benefits to students and can improve teacher outcomes related to burnout and classroom management (Domitrovich et al., 2016; Jennings et al., 2017). Because teacher SEC is closely linked to student academic and behavioral outcomes, Jennings and Greenberg (2009) introduced a prosocial classroom model in which teacher SEC is the central, organizing framework mediating student SEC. This model makes several evidence-based assumptions important to burnout prevention. First and perhaps most importantly, teachers with high SEC build strong relationships with students and demonstrate effective classroom management. They can recognize student emotions and respond to problem behavior with empathy, using evidence-based interventions rather than punitive methods. In this way the prosocial classroom model is preventative. In addition, teachers with higher SEC deliver quality SEL instruction and model desired social and emotional behavior.

Teacher SEL and SEC in the Literature

Research in teacher SEL is limited; however, multiple studies have produced growing support for teacher-focused interventions that foster teacher SEC within the prosocial classroom framework. For example, Jennings et al. (2017) examined the effects of the Cultivating Awareness and Resilience in Education (CARE) program for teachers in emotion regulation, teaching efficacy, mindfulness, psychological distress, and physical distress. Teachers showed within one school year increases in emotion regulation and mindfulness, and lower levels of time

urgency and psychological distress. Other effects included significant improvements in sleep as well as increases in teacher sensitivity and positive climate during classroom observations.

Similarly, one randomized controlled trial investigated the impact of the PAX Good Behavior Game and Promoting Alternative Thinking Strategies (PATHS) programs on K-5 teachers when using the interventions in class with their students. Measures included teacher efficacy, teacher burnout, teacher SEL, and perceptions of school climate. Results indicated increased levels of self-efficacy for behavior management and SEL (Domitrovich et al., 2016). It is important to note improvements were seen only in the condition in which both programs were used, and only in the personal accomplishment dimension of the Maslach burnout model. A systematic literature review conducted by Blewitt et al. (2020) on the impact of universal SEL programs on early childhood teachers showed an increase in responsive caregiving, improved teaching practices, and use of positive classroom management strategies, particularly with the following programs: Preschool PATHS, the Incredible Years Curriculum, Tools of the Mind, INSIGHTS, and RECC. While these findings are promising in terms of general burnout prevention, they are not widely available to teachers and they do not target teacher behavior directly.

Interventions for Burnout Prevention and Treatment

Despite an abundance of publications on the topic of occupational burnout each year, Leiter and Maslach (2018) note a dearth in quality research evaluating actual burnout interventions. This is due in part to "constraints" within the field that make applied research less valuable and publishable in prestigious journals than basic research (Leiter & Maslach, 2018, p. 39). In addition, empirical investigations of burnout interventions have typically had numerous methodological problems, such as small samples sizes and no control or comparison group.

Nevertheless, one important theme that has emerged from the literature is a divergence between interventions focused on factors related to the individual and those focused on factors related to the workplace or organization. Leiter and Maslach (2018) stress both the person and organization have a role to play in burnout prevention and treatment.

Interventions Targeting Workplace Factors

Workplace interventions have produced more consistent results than interventions that focus on individual factors exclusively (Leiter & Maslach, 2018). Workplace coaching; programs targeting work-life quality and address inequity in the workplace; and skills development workshops have all demonstrated reductions in one or more dimension of burnout. Organizational interventions that employed action research, in which a group of managers and employees were given a problem-solving exercise to address problems within the workplace, resulted in reductions in exhaustion and cynicism.

To be effective, organizational interventions require a cultural shift from placing blame on the individual for being burned out to accepting a more team-centered approach. To date, focus on the individual experience of burnout reflects our national cultural tendencies to view people as responsible for their own success or failure at work, including their responses to work-related stress (Leiter & Maslach, 2018). This is not likely to change in the U.S. public school system. Further, person-centered approaches are cheaper than organizational interventions and do not require continual employee feedback from all levels of the organization.

Interventions Targeting Individual Factors

Mindfulness

Mindfulness is defined by prominent Western practitioner Kabat-Zinn (2003) as "the awareness that emerges through paying attention on purpose, in the present moment, and

nonjudgmentally to the unfolding of experience moment by moment" (p. 145). Research in mindfulness training for burnout prevention has yielded promising results, but with certain caveats related to methodological weaknesses (Jaworska-Burzyńska et al., 2016; Leiter & Maslach, 2018). For example, Leiter and Maslach (2018) identified one study showing a reduction in burnout symptoms in healthcare workers with the use of an 8-week mindfulness program; however, the study had no control group. Conversely, Roeser et al. (2013) conducted two randomized, waitlist-control field trials on 113 elementary and secondary teachers and found mindfulness training for 8 weeks (11 sessions) increased measures of mindfulness, focused attention, working memory capacity, occupational self-compassion, and lower levels of stress and burnout. Other studies have shown similar results (Cohen-Katz et al., 2005). Methods in traditional and contemporary cognitive behavioral therapies generally include some form of mindfulness. Examples include cognitive distancing, perspective taking, and present moment awareness.

Traditional Cognitive Behavioral Therapy

Beck (1970) defined traditional cognitive behavioral therapy (CBT) broadly as "any technique whose major mode of action is the modification of faulty patterns of thinking", including techniques that indirectly modify cognitive patterns (p. 777). CBT utilizes interventions to help individuals notice patterns of disordered thinking, or *cognitive distortions*, and dispute or alter their frequency or content to improve emotional states (Beck, 1970; Clark, 2013). Strategies used in traditional CBT include distancing oneself from one's thoughts, reframing or perspective taking, correcting cognitive deficiencies or errors, and systematic desensitization.

Though not commonly referred to as mindfulness in the original CBT literature, the processes of distancing and reframing closely resemble mindfulness training as it is used in other psychotherapeutic applications and behavior therapy. Collectively, CBT techniques are referred to as *cognitive restructuring*. CBT is frequently cited in the literature as a promising practice for burnout prevention and reduction, but with many of the same caveats mentioned previously (e.g., Jaworska-Burzyńska et al., 2016; Larsson et al., 2016; Leiter & Maslach, 2018)

Third Wave CBT. Roughly 20 years ago a new approach to traditional CBT emerged, termed "third wave", which challenged certain aspects of cognitive restructuring (Hayes & Hofmann, 2017). Third wave therapeutic approaches concentrate efforts on helping individuals change their relationship to their thoughts and feelings rather than the content or frequency of them. Examples of such therapies are dialectical behavior therapy (DBT), functional analytic therapy (FAP), integrative behavioral couples therapy (IBCT), mindfulness-based cognitive behavior therapy (MBCT), and acceptance and commitment therapy (ACT). Third wave cognitive behavior therapies share several common approaches that focus on mindfulness, personal values, dialectics, and acceptance. Collectively, all have demonstrated sound theoretical frameworks and "amassed a substantial and compelling evidence base" (Dimidjian et al., 2016, p. 901).

ACT has been used to address burnout in parents (Coyne et al., 2020), teachers (Jeffcoat & Hayes, 2012), and behavior analysts (Fiebig et al., 2020). One randomized controlled trial, which used a popular ACT self-help workbook with 240 K-12 teachers, showed preventative effects for anxiety and depression and improvement in overall mental health markers already within clinical ranges (Jeffcoat & Hayes, 2012). Inexpensive preventative interventions teachers

can use independently on their own time can provide school districts a feasible way to address teacher burnout.

Private Events in Applied Behavior Analysis (ABA)

Components of cognitive behavioral therapies are used in behavior analysis but remain controversial due to conflicting interpretations about the role private events should play in the scope of practice of board certified behavior analysts (BCBAs). Private events, or covert behaviors that occur within an individual (feeling, emotions, urges, perceiving, thinking, pain) were essential to the theoretical framework of B. F. Skinner's radical behaviorism. Consideration of them as "scientifically legitimate" phenomena predominately differentiated Skinner's model from that of methodological behaviorism (Calkin, 2009; Hayes & Brownstein, 1986, p. 184; Skinner, 1945; 1974); moreover, exclusion of them could potentially lead to an inadequate or undeveloped analysis of behavior (Fryling & Hayes, 2015; Kangas & Maguire, 2016). The debate is becoming increasingly trivial given the ample evidence base of these interventions and the behavior analytic approach many of them assume. Furthermore, it is counter-intuitive to the purpose of ABA to withhold evidence-based behavior analytic technologies that could improve socially significant behaviors.

It is universally understood the overarching goal of behavior analysis is to mitigate human suffering and the impact individual behavior has on major world problems. Behavior analysts have an obligation to devote their skills to that end. This sentiment is fundamental to all three branches of behavior analysis: behaviorism, which is the philosophy of behavior; the experimental analysis of behavior (EAB), which is the research behind the philosophy; and applied behavior analysis (ABA), which puts research to practice by developing technologies with the sole purpose of improving lives. Thus, conceptually and pragmatically, the *applied*

component of ABA denotes its mission to facilitate behavior change based on technologies, informed by research, to ease human suffering and advance humanity. We have those technologies.

Skinner has said much regarding the potential for behavior science to improve all areas of society (1974; 1976; 1987); these were dreams he considered unrealized even by the time he wrote the preface for the 1976 *Walden Two* reprint. Seven decades after its first publication, Skinner's behavioral utopian vision has been reduced to a very narrow focus on "simple demonstrations of well-known phenomena" (Dixon et al., 2018, p. 241). But the world is replete with problems; emotional suffering and burnout being among the most widespread and destructive. If we are to improve the world, which Skinner intended, changes will have to be made in our approach to the analysis of *all* socially significant behavior, public and private. Research evaluating new and existing technologies for use in applied settings, particularly in the underdeveloped area of private events, is necessary to move the field forward. One such technology exists in precision teaching, a measurement and decision-making system strongly rooted in behavior analysis and Skinner's early work in the laboratory. Although it is primarily used in learning environments, researchers and teachers have used precision teaching methods for over 50 years to analyze and change inner behavior (Calkin, 2002).

Precision Teaching

Precision teaching was developed in 1965 by Ogden R. Lindsley, a distinguished graduate student of B. F. Skinner's, for use in self-contained special education classrooms during his professorship in special education at the University of Kansas. From the beginning precision teaching embodied radical behaviorism in three ways: (a) use of the standard celeration chart during classroom instruction to record the frequency of responses and celeration of learning; (b)

measurement and charting of private events (termed "inner behavior" by precision teachers); and (c) use of plain English rather than technical jargon when communicating (Potts et al., 1993). The development of the standard celeration chart was inspired by Skinner's cumulative records that recorded real-time changes in frequency and slope, allowing researchers and practitioners a precise way to define, measure, and analyze small changes in behavior. Lindsley (1991) considered precision teaching a unique legacy and extension of Skinner's work, as it is the only instructional system developed using his cumulative recording and monitoring method.

Guiding Principles of Precision Teaching

There is no instructional technique or curriculum associated with precision teaching; rather, it is a decision-making system with a set of guiding principles and clearly defined process for monitoring instruction. The four guiding principles of precision teaching are derived from Skinner's experimental analysis of behavior (Kubina & Yurich, 2012; Potts et al., 1993):

The Learner Knows Best

This principle originated from Skinner's statement "the rat knows best" regarding his work with lab rats. Organisms are subject to environmental contingencies; any deviation from expected patterns of responding are the result of uncontrolled variables within the environment. This principle holds important implications for precision teachers and researchers: pay attention to the data and discover the variables responsible for unexpected or unwanted behavior. Do not blame the learner or participant if an intervention is not working.

Focus on Observable Behavior

Direct observation is the only way to quantify, understand, or affect change in behavior. It is important to note participants or students can be trained to observe and count their own inner

behavior in a way that is considered direct observation and measurement (Cooper et al., 2020; Lindsley, 2010).

Use Frequency as a Universal Measure of Behavior

Frequency is a precise, direct measurement that counts instances of behavior over a specific period of time. Frequency counts demonstrate minute, accurate changes in performance. Lindsley summed up the practicality of this tenet: "Everything you can see, hear, touch, feel, or think can be counted, and the period over which you counted can be timed. If you can sense it, you can count it" (Kubina & Yurich, 2012, p. 24).

Display Data on the Standard Celeration Chart

The standard celeration chart has several advantages to other charts commonly used in behavior analysis. For example, it uses a standard scale to show changes in behavior, allowing users to analyze the frequency and growth of learning across time. Because it is standard, "to read one standard celeration chart is to have the ability to read any of them" (Calkin, 2005, p. 213).

Steps of Precision Teaching

The precision teaching process comprises four simple steps: pinpoint, record, change, and try again (Kubina & Yurich, 2012). Pinpointing involves identifying and defining a target behavior already within the learner's repertoire. The recording step includes recording its daily frequency on the standard celeration chart and monitoring for slight changes in acceleration or deceleration. The change step is a systematic instructional decision-making process based on changes observed in the standard celeration chart. This step includes rearranging environmental as well as instructional variables. Try again, the final step of the precision teaching process, involves additional daily monitoring and instructional changes in response to daily performance

frequencies, which emphasizes continual recursive problem solving in order to "never give up on the learner" (Kubina & Yurich, 2012, p. 304).

The evidence base of precision teaching is substantial. In 1967 Lindsley formed the Behavior Bank to collect and disseminate data from standard celeration charts on a wide range of academic, clinical, personal, and inner human behavior. In addition, articles in numerous peer reviewed journals over decades have substantiated the claim that precision teaching meets criteria for being research and evidence-based (Kubina, 2021). With the inclusion of additional standard celeration charts from precision teachers, practitioners, and researchers, by the year 2000, 1.2 million charts documented data supporting the use of precision teaching (Calkin, 2002; Kubina, 2021). Of those, 1,600 charted inner behavior (Calkin, 2002).

Precision Teaching and Inner Behavior

As mentioned previously, a common practice in traditional CBT is to train individuals to monitor the occurrence and frequency of unwanted thoughts and replace or refute them with positive thoughts to improve feelings. Behavior analysts have used precision teaching methods to influence inner behavior in similar ways. For example, Patterson and McDowell (2009) used a combination of precision teaching strategies to promote self-management of inner behavior of nine participants with depression. Results included an increase in positive thoughts and decreased negative thoughts, with an overall decrease in depression symptoms pre- and post-intervention as measured by the Beck Depression Inventory II.

Kostewitcz et al. (2000) conducted a study in which the first author used a wrist counter and celeration chart to track the frequency of his aggressive thoughts and feelings for 6 weeks, then introduced a daily intervention of 1-minute then six 10-second counts of non-aggressive thoughts for 14 weeks. Results showed a drastic reduction (zero to near zero) in aggressive

thoughts and feelings compared to baseline, as well as improved mood, including feelings of relaxation, that maintained post-treatment. In addition, he reported self-monitoring and self-recording allowed him to notice the environmental events that evoked his aggressive feelings, something he had found very difficult to do before the experiment. Similarly, Aninao et al. (2015) used standard celeration charts to identify and analyze the contextual factors associated with problem behavior of three children with disabilities, allowing researchers to better predict antecedent setting events and choose more effective interventions for target behaviors.

Cooper (1991) changed destructive thoughts and feelings related to his family that he worried might ruin his 25-year marriage. Using a wrist counter, Cooper counted and charted daily destructive and loving feelings on the standard celeration chart for one month. After one month with no improvement in inner behavior, he began the daily 1-minute timing procedure. Destructive thoughts and feelings immediately jumped down in frequency and loving thoughts and feelings correspondingly jumped up in frequency. After just nine 1-minute timing sessions, a 4-month follow-up showed positive results had maintained.

Many studies using a combination of self-management and precision teaching have produced similar data, such as reductions in the negative thoughts and feelings of senior citizens (Kubina et al., 1994), and reductions in the selfish thoughts and anger of children as young as three (Duncan, 1971). Using behavior analytic methods in this way, research participants who have been trained to observe their own private events are "measuring the behavior of interest directly" rather than indirectly (Cooper et al., 2020, p. 104). Abigail Calkin, former graduate student of Lindsley and pioneer in clinical and empirical investigations of private events, has counted, charted, and used the 1-minute timing intervention to influence inner behavior related to marriage, self-esteem, and missed opportunities to have feelings (1981; 1992; Calkin &

Pennypacker, 2003). To date, Calkin has amassed 1,060 standard celeration charts on inner behavior representing 514 subjects from research projects dating back to 1971.

Justification and Contribution to the Literature

There is a dearth in the literature regarding empirically supported interventions to prevent and ameliorate occupational burnout. Many individual and situational factors contribute to teacher burnout, such as school climate, self-efficacy, organizational justice, emotional intelligence, and social and emotional competence (Capone et al., 2019; Jennings & Greenberg, 2009; Mérida-López & Extremera, 2017; Skaalvik & Skaalvik, 2011). Anxiety, emotional exhaustion, and depression are strongly correlated with burnout, and researchers have found depression and burnout share "similar work-related antecedents" (Capone et al., 2019, p. 4; Schonfeld & Bianchi, 2016). Data suggests, however, that burnout is a unique phenomenon, separate from the clinical models of depression or anxiety represented in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5; Schaufeli et al., 2001). Thus, many teachers who experience burnout may suffer for extended periods of time without receiving treatment or even knowing they need help. In addition, those teachers may have skill deficits in emotion regulation, self-management, or self-awareness. Because teacher burnout impedes student motivation and achievement, if we are to keep healthy, quality teachers in the field they need to be taught skills to help maintain social and emotional health. Social and emotional competence includes having the ability to identify and change work-related variables that occasion symptoms of burnout.

Pervasive and distressing repetitive thoughts, which often accompany symptoms of depression and anxiety (Ruiz et al., 2020), contribute to occupational burnout. Excessive rumination and negative self-talk often become habit and transpire undetected in busy work

environments. Awareness of these private events and the conditions that occasion them is a critical first step toward behavior change. As noted previously, one empirically supported therapy for depression, anxiety, and burnout is CBT. Traditional CBT posits (a) moods are influenced by negative thinking; (b) negative thinking can be systematically measured and changed; and (c) changes in thinking will influence emotions and behavior (Hayes, 2004; Patterson & McDowell, 2009). Contemporary CBT models based in contextual behavioral science, such as acceptance and commitment therapy, challenge this approach and utilize interventions that train individuals to notice and tolerate unwanted thoughts rather than trying to count or change the content of them. Both approaches have accrued substantial empirical support for their use, and research comparing the efficacy of the two has produced mixed results (Jiménez, 2012; Öst, 2014). This study uses methods congruent with traditional CBT to target both personal and situational factors that contribute to teacher burnout.

This research will make contributions to the fields of special education, precision teaching, and behavior analysis by replicating several components of previous studies to inform and stimulate further research in private events. It also aims to identify empirically-based approaches special education teachers can use to self-manage burnout symptoms and identify potential antecedent stressors within their work environments. In this way teachers can take control of at least some contributing factors associated with occupational burnout.

CHAPTER 3: METHODOLOGY

The purpose of this study is to: (a) to measure the effect that precision teaching and self-management strategies have on the inner behavior (thoughts and feelings) of classroom special education teachers; (b) examine the effect the interventions have on participant identification of contextual and environmental variables that occasion inner behavior; and (c) to examine subsequent changes in symptoms of teacher burnout as measured by pre and post-tests of the Maslach Burnout Toolkit for Educators. Previous investigations in teacher burnout have demonstrated stress, anxiety, and depression are significant and negative predictors of job satisfaction, while occupational factors such as student misbehavior and increased workload are significant predictors of depression and anxiety (Ferguson et al., 2012). Ignored, this circular pattern can create a "burnout cascade" in which teachers exhibit emotional exhaustion, cynicism, and callousness toward students (Jennings & Greenberg, 2009, p. 492; Skaalvik & Skaalvik, 2017). Special education teachers, particularly those who work with students with significant behavioral needs, are at greater risk for burnout (Gilmour et al., 2021; Hopman et al., 2018). Considering the challenges in education exacerbated by the pandemic, identification of interventions that mitigate the adverse effects of burnout in teachers is of paramount importance.

Calkin (2009) presented the following eight conclusions about inner behavior from over 50 years of research:

1. Thoughts, feelings, and urges can be counted and charted.
2. Inner behaviors show consistent frequency ranges of 0 to 100 per day; sometimes they occur above 100 per day.

3. Inner and outer behaviors have similar celerations (acceleration and deceleration), frequency magnitudes, and variability. Inner behavior changes by a multiply factor and implementation of the 1-minute timing intervention.
4. The variability, or bounce, above and below the celeration line is symmetrical and comparable to outer behavior.
5. A 1-minute timing of positive thoughts increases positive thoughts and feelings all day, but generally does not influence the frequency of daily negative thoughts and feelings; however, some studies have shown that it decreases daily negative thoughts and feelings.
6. The frequency and celeration variance "might co-vary (vary together), counter-vary (vary in opposite directions), or vary independently (one may stay the same while the other one goes up or down)" (Calkin, 2009, p.71).
7. A x10 or x20 difference between positives and negatives must occur, with positives being higher, to affect change in inner behaviors such as self-esteem, suicide ideation, and depression.
8. Taken together, data from standard celeration charts over time support the statement that "inner behavior is of the same structure and shows the same patterns as outer behavior" (Calkin, 2009, p. 73).

These conclusions have direct implications for the present investigation. First, relatively simple precision teaching and self-management strategies have the potential to produce meaningful changes in inner behaviors associated with emotional competence and occupational burnout in teachers. These interventions have been repeatedly replicated in studies yet are rarely used by practitioners. Second, collective empirical data from precision teaching research has

established that inner behavior is accessible and appropriate for analysis and not different than outer behavior "by any structure or nature", substantiating Skinner's primary intent behind radical behaviorism (Calkin, 2002; 2009; Kubina et al., 1994; Skinner, 1965, p. 257). This line of research is relatively unknown in mainstream ABA, despite brief mention of it in the most commonly used textbook in graduate ABA programs (Cooper et al., 2020, p.104).

Research Questions

1. To what extent will the following precision teaching—self-management intervention package change targeted negative thoughts and feelings in special education teachers? Will it change the frequency of positive thoughts and feelings during a 1-minute daily frequency timing of positive thoughts and feelings?
    a. Daily self-monitoring and self-recording of the frequency of positive thoughts and feelings.
    b. Daily self-monitoring and self-recording of the frequency of negative thoughts and feelings.
    c. One-minute daily timings of positive thoughts and feelings.
    d. Use of the standard celeration chart to track and analyze behavior changes.
2. What effect will the interventions have on participant identification of contextual and environmental variables that occasion unwanted thoughts and feelings?
3. Will a decrease of negative thoughts and feelings and/or an increase of positive thoughts and feelings improve scores related to the Maslach Burnout Inventory (MBI)?

Method

Experimental Design

This study employed two designs: a single-case, changing criterion design and behavior dynamics design using precision teaching metrics and the standard celeration chart (Kubina, 2021). Cooper at al. (2020) and McDougall (2005) suggest the following guidelines regarding the length of phases, magnitude of criterion changes, and number of criterion changes in changing criterion designs: (a) each phase length should vary and continue long enough to achieve stable responding; rather than establishing a predetermined number of sessions per phase, the data should guide decisions; (b) the size or magnitude of criterion changes should vary and be large enough to be detectable, yet small enough to be attainable; and (c) the number of criterion changes should be at least three and determined based on the length of phases and magnitude of criterion changes.

Sample

Following IRB approval, purposive sampling was used to recruit public school teachers who self-reported mild to moderate feelings of occupational burnout (e.g., emotional exhaustion, feelings of inadequacy, anxiety, sadness about teaching). Due to the extended time between pre-tests and start of the study, all participants confirmed they were not in high or crisis level distress during their second training. Participants met the additional criteria: (a) not in their first year of teaching, (b) national K-12 public special education teacher, (c) willing to complete initial training sessions and carry out daily data collection tasks, including regular correspondence with the researcher, over a 6-week period, and (d) consent to participate in the study. Due to the demanding nature of daily data collection tasks, participants were screened with a willingness

questionnaire consisting of 5 items rated on a slider 10-point Likert scale. Participants rated from 1 to 10 how willing they would be to carry out the daily tasks of the study.

Participants

Of the 10 participants who initially consented to participate, five completed training. One dropped out of the study after seven days of data collection. Four special education teachers participated in the study for the full 6 weeks. See Table 1 for participant demographic information.

Table 1

Participant Demographic Information

Demographics	Alexis	Amy	Christine	Leslie
Race/ Ethnicity	White	White	White	White
Age	43	30	44	47
Degree	Masters	Masters	Masters	Bachelors
Path to Certification	Alternative-Bachelors	Traditional	Traditional	Traditional
Teaching Placement	Alternate Curriculum-Life Skills	Inclusion/Self-Contained Science	Self-Contained	Self-Contained/Resource Room
Years of Teaching	19	7	21	13
Current Grades	9-12	9-12	9-12	PK-8

Alexis. Alexis is a 43-year-old high school special education teacher with 19 years of teaching experience. She is alternatively certified. She teaches grades 9-12 in an alternate

curriculum and life skills setting. Alexis's Maslach Burnout Inventory (MBI) pre-test scores reflected a moderate level of emotional exhaustion, low level of depersonalization, and moderate level of personal accomplishment. Alexis reported a moderate level of burnout during her Zoom training.

Amy. Amy is 30-year-old high school special education teacher who received traditional teacher certification 7 years ago. She teaches grades 9-12 in an inclusion setting and self-contained science classes. Amy's MBI pre-test scores reflected a high level of emotional exhaustion, moderate level of depersonalization, and low level of personal accomplishment. Amy reported moderate levels of burnout during her Zoom training.

Christine. Christine is a 44-year-old high school special education teacher who is traditionally certified with 21 years of teaching experience. She currently teaches grades 9-12 in a self-contained setting. Christine's MBI pre-test scores reflected a high level of emotional exhaustion, low level of depersonalization, and moderate level of personal accomplishment. She reported mild to moderate levels of burnout during her Zoom training.

Leslie. Leslie is a 47-year-old special education teacher who received traditional teacher certification. She has 13 years of teaching experience. She is currently teaching grades PK-8 in a self-contained resource room. Leslie's MBI pre-test scores reflected a moderate level of emotional exhaustion, moderate level of depersonalization, and high level of personal accomplishment. Leslie reported mild to moderate levels of burnout during her Zoom training.

Setting

Correspondence, data collection, and initial trainings were conducted through email, online, and via zoom. Participants carried out daily counting and charting in the natural environment during their usual daily activities.

Treatment Integrity and Inter Observer Agreement (IOA)

One significant limitation of this and other studies like it is the lack of IOA data. Because the dependent variable is inner behavior, there can be no IOA. Acknowledging this, Kostewicz et al. (2000) and Kubina (2020) believe that direct and systematic replication of these procedures over time, conducted by different researchers, and confirming the same outcome can help determine believability. Until we have better instruments to observe and measure inner behavior, researchers can apply experimental replication logic.

Dependent Variables

The target behaviors of this study were daily positive and negative thoughts and feelings measured by frequency, which are response classes unique to the individual. Frequency, or count, is the measure of an observed, discrete occurrence of behavior. Lindsley noted that "everything you can see, hear, touch, feel, or think can be counted, and the period over which you counted can be timed" (Lindsley, 2010, p. 8). Rate is the occurrence of behavior over time. Skinner often said to his graduate students that "rate is a universal datum", meaning all behaviors have a frequency and can therefore be compared using this measure (Lindsley, 2010, p. 8). Examples of the target behavior were determined, classified, and listed based on what participants perceived as positive and negative thoughts or feelings specific to them. As such, this study took the approach of Kubina et al. (1994) and Calkin (1981) in defining target behaviors: "We defined a negative feeling as an individually perceived emotional state of dissonant or otherwise uncomfortable emotional tone…A negative thought was an idea or similar consideration that was self-observed as negative" (Kubina et al., 1994, p. 29).

> I defined a positive feeling about myself as feeling good about who I was or something I had done…I had a positive feeling when I had a positive emotion, a sense of warmth, a twinge, or when there was a sense of expansion…negative feelings about myself included feelings of inadequacy and insecurity. (Calkin, 1981, p. 9)

Participants were encouraged to spend more time on their list of positives than their list of negatives. Positive thoughts and feelings were identified and defined as positive attributes participants believe about themselves, positive attributes or qualities other people have told them about themselves (regardless of whether they believe them), or opposites from their list of negatives (e.g., Patterson & McDowell, 2009). This included accomplishments, activities, and imagery that occasioned positive inner behavior. Participants were instructed to include thoughts and feelings specifically about work and teaching, but not to exclude inner behavior related to other aspects of their personal lives. Examples of positives included “I am a good teacher”, “competent”, “youthful”, “attractive”, “I am smart”, “I’m a good mom”, and “healthy and fit”. Examples of negatives included “I’m a terrible teacher”, “I’m incompetent”, “people think I’m crazy”, “stupid”, and “I hate work”. Nonexamples of positives and negatives included inner behavior associated with general observations or considerations not related to themselves or work, such as appreciating nature during a walk; feeling upset about an objectively distressing world event; or reflecting about politics.

Once response classes were discussed, the target behaviors of all participants were defined and listed on a piece of paper. Participants were instructed to fold the piece of paper in half lengthwise with the positives on one side and negatives on the opposite side. They were encouraged to review their list of positives as much as they desired throughout the day.

Independent Variables

Daily One-Minute Timing Procedure. After the baseline phase, a 1-minute counting period was implemented by all participants to record the count of positive thoughts and feelings for one minute each day. This intervention began as an academic fluency exercise in the 1960s, was subsequently implemented in 1977 to influence inner behavior, and is still frequently used in precision teaching (Calkin, 2009; Kubina et al., 1994; Kubina & Yurich, 2012).

Self-Management. A well-documented, empirically supported benefit of self-management is its ability to change behavior not directly accessible to or observable by others, such as urges to smoke, feelings of self-doubt, feelings and thoughts related to low self-esteem; feelings of depression; and destructive or aggressive thoughts and feelings (Calkin, 1981; 1992; Calkin & Pennypacker, 2003; 2019; 2021; Calkin & Pennypacker, 2003; Cooper, 1991; Cooper et al., 2020; Kostewicz et al., 2000; Kubina et al., 1994). All participants self-monitored when they counted their own behavior. Self-monitoring is the most widely applied self-management strategy in research and clinical settings, effective due in part to reactivity, or the effects of assessment and measurement on behavior (Cooper et al., 2020). Reactivity is an uncontrolled variable that is generally undesirable by researchers but desirable when used in self-management.

Self-management procedures in the current investigation included antecedent-based self-management procedures, such as the use of response prompts or manipulation of motivating operations (MOs), as well as self-administered consequences such as reinforcement.

Measures

Pre and Post Measures. The Maslach Burnout Toolkit for Educators was administered pre- and post-intervention to measure burnout. The toolkit comprises two assessments, the

Maslach Burnout Inventory (MBI), and the Areas of Worklife Survey (AWS). The MBI has demonstrated adequate reliability and validity and is the most common assessment tool used to measure burnout (Byrne, 1994). Maslach et al. (1996) report internal consistency was estimated by Cronbach's coefficient alpha, and reliability coefficients for subscales of the MBI were .90 for the emotional exhaustion, .79 for the depersonalization, and .71 for personal accomplishment. Test-retest reliability coefficients for the subscales were .82 for emotional exhaustion, .60 for depersonalization, and .80 for personal accomplishment, with all coefficients in the significant range (beyond .001). Convergent and discriminant validity were also demonstrated (Maslach et al., 1996).

The AWS assesses factors within the work environment to identify the level to which there is a match between an individual and their job. The AWS has demonstrated reliability and validity for samples in the United States and four additional countries (Brom et al., 2015; Leiter & Maslach, 2004).

Frequency Counting. Participants were provided three separate counting devices in three different colors to count daily positives, daily negatives, and the positives count from the 1-minute timing. Two were finger or wrist counters and one could be worn around the neck. Participants counted the frequency of daily negatives, daily positives, and the 1-minute timing and reported daily counts to the researcher by typing into a document uploaded on a shared Google drive. The researcher then charted daily progress on each participant's standard celeration chart for analysis within the behavior dynamics design. Participants were provided a simple line graph on a word document and encouraged to graph their own progress independently. Personal graphs were not monitored by the researcher.

For the changing criterion design portion of the study, participants were given the choice to focus on either positive or negative inner behavior for criterion changes, referred to as "goals" by the researcher. Antecedent and reinforcement contingencies included in the self-management part of the intervention package were developed and planned by the participants and researcher during initial training, but not explicitly monitored during the study other than occasional prompts by the researcher to "reward" themselves for showing progress.

Social Validity

Social validity refers to the social significance and acceptability of treatment goals, procedures, and treatment outcomes (Baer et al., 1968; Cooper et al., 2020; Luiselli, 2017), and is perhaps the most important consideration in applied behavioral science. A combination of semi-structured interviews and an adapted rating scale based on Patterson & McDowell (2009, p. 291) were used to assess social validity with stakeholders.

Baseline

Pre-assessments were taken with participants' consent prior to baseline. Participants began baseline after two training sessions. Baseline for all participants began simultaneously and continued for 12-15 days. During baseline, participants counted daily positives and negatives and entered counts on the data sheet in the shared Google drive.

Training and Treatment Protocol

Initial Training Sessions

Participants who met criteria and consented to be in the study attended two training sessions—one asynchronously on video and one synchronously on zoom—in which the researcher explained the purpose and goals of the study, explained daily data collection and self-management procedures, and answered questions. During that time participants were asked to

write down what they classified as negative and positive thoughts and feelings. Next, target behaviors were defined and listed based on each participant. Definitions of target behaviors were thoroughly discussed, with examples and nonexamples. All participants were trained by the researcher how to use their clicker counters to count thoughts and feelings and transfer counts onto the daily data sheet. The data sheet included a column in which participants were encouraged to enter notes meaningful to their counts, such as situations they noticed occasioned inner behavior. See Appendix A for a template of the data sheet. Participants were given a choice of using either a think-say or think-write learning channel set for the 1-minute timing. Learning channel sets are linked sensory "ins", which describe the sensory organ used to acquire information, and "outs", the behavior used in responding (Kubina & Yurich, 2012, p. 77). Counting time floors were established based on participants' sleeping patterns. Finally, the second synchronous zoom training included a few questions to confirm that the emotional states of participants were stable enough so the study would not pose an unnecessary risk to them or add too much additional stress to their lives.

After baseline and prior to intervention, the first criterion for the changing criterion design was established based on the median baseline count of the target behavior (positives or negatives) the participants chose to focus endeavors. The first criterion for all participants was 7% of their baseline median.

Intervention

Participants implemented the daily 1-minute timing procedure of positive thoughts and feelings following baseline, continuing to do total daily counts of negative and positive thoughts and feelings for the entirety of the study. Participants who did not respond to the 1-minute timing procedure were directed to try a different learning channel (e.g., Patterson & McDowell, 2009)

or try an alternate timing procedure, such as six distributed 10-second counting times spread throughout the day (e.g., Kostewicz et al., 2000), two 30-second distributed daily counting times, or one 1-minute timing in the morning and another 1-minute timing in the afternoon or evening. Participants were instructed to begin their predetermined self-management strategies when the 1-minute timing phase began.

An important guiding principle of precision teaching is "the learner knows best", which posits that unexpected changes in data are the result of uncontrolled variables and not the learner. Typically, instructional decisions are driven by data and made in real time when the learner does not respond in a predictable way (Kubina & Yurich, 2012). Thus, multiple strategies may be used in addition to the 1-minute timing which would initiate phase changes. The traditional precision teaching approach was constrained due to the changing criterion design, which requires steady state responding before phase changes are implemented. This issue is discussed at length in Chapter 5.

Data Analysis

Data analysis followed traditional precision teaching metrics (e.g., Kubina & Yurich, 2012; Kubina, 2020; Pennypacker et al., 2003). Standard celeration charts were analyzed to evaluate differences between baseline and intervention phases. The following established patterns of inner behavior found in previous studies guided analysis in the current study (Calkin, 2009): (a) frequency range, (b) growth across time (acceleration or deceleration), (c) variability around the celeration line (bounce), (d) if a x10 or x20 difference between daily positives and negatives occurred for maintenance. AimStar Pro, a standard celeration application for iOS, was used to chart and analyze data. AimStar Pro calculates celeration lines using the Theil's Incomplete linear regression method. Celeration and bounce values were calculated by AimStar

Pro. All other behavior dynamics metrics, such as frequency multipliers, celeration multipliers, accuracy improvement measures, and accuracy ratios were calculated by the researcher. Mean changes from the pre- and post-tests on the Maslach Burnout Toolkit for Educators, both assessments, were evaluated.

Frequency Range

Frequency represents performance and is the basic unit of behavioral measurement in precision teaching. Frequency is calculated by dividing the count of occurrences of behavior by the counting time or floor. Frequency accurately reflects behavior as it occurs in time and has several advantages to other measures in that it is representative, understandable, sensitive, standard, absolute, and universal (Kubina & Yurich, 2012). This study will compare frequency ranges of participants and compare to previous research conducted by multiple precision teaching researchers over the past five decades, which have shown that frequencies of inner behaviors consistently range from 0 to 100 per day and only occasionally exceed 100 per day (Calkin, 2009).

Single Phase Analysis

Single phase analyses were conducted using: (a) celeration, (b) bounce, (c) outliers, and (d) the accuracy improvement measure (AIM) to analyze performance and learning within a phase. Celeration quantifies the change in frequency of behavior over time and represents learning in precision teaching (Kubina & Yurich, 2012; Pennypacker et al., 2003). Upward and downward slopes on the standard celeration chart indicate acceleration and deceleration and are communicated with a x or ÷ symbol, allowing teachers to quickly identify learning magnitude and growth or decay. Inner behavior has shown in previous studies to change by a multiply

factor and 1-minute timing intervention (Calkin, 2009). This study compared celeration findings to previous studies on inner behavior.

Bounce is a measure of the variability inherent in behavior and is displayed on the standard celeration chart as data points scattered loosely or tightly about the celeration line (Kubina & Yurich, 2012; Pennypacker et al., 2003). Bounce, or degree of variability in the data, can communicate whether learning is occurring efficiently or inefficiently. Less bounce on the standard celeration chart is associated with better, more efficient learning and greater bounce is associated with unsatisfactory learning. Bounce distances on the standard celeration chart, bounce values, and the significance of bounce values have been published by Kubina and Yurich (2012) and Pennypacker et al. (2003) to aid precision researchers and teachers in their analyses of variability.

Multiple Phase Analysis

Multiple phase analyses were conducted using: (a) frequency multipliers, (b) celeration multipliers, (c) bounce comparisons, and (d) AIM comparisons to analyze performance and learning across two or more phases. Because precision teaching involves instructional decision making across time, multiple changes in interventions and teaching methods often occur; therefore, it is necessary for precision teachers and researchers to examine data between phases. Frequency and celeration multipliers offer a way to do this. The frequency multiplier is the distance between two frequencies and is used to compare two separate performances (jump; Kubina & Yurich, 2012; Pennypacker et al., 2003). Similarly, the celeration multiplier allows for the comparison of one phase of learning to another phase (turn; Kubina & Yurich, 2012; Pennypacker et al., 2003).

CHAPTER 4: RESULTS

The research questions of this study considered the effects of a precision teaching and self-management treatment package on the inner behavior of special educators with various self-identified symptoms of occupational burnout. This study employed two methodologies—a single-case changing criterion design and a behavior dynamics design. As such, results are interpreted and discussed in separate sections within each methodology for clarity. Due to small *n*, pre and post-tests of the Maslach Burnout Inventory for Educators (MBI) and the Areas of Worklife Survey (AWS) are discussed descriptively. Results from the social validity questionnaire are presented in Table 2 with further discussion in Chapter 5. See Appendix C for single and multiple phase analyses tables for each participant.

1. **To what extent will the following precision teaching- self-management intervention package change targeted negative thoughts and feelings in special education teachers? Will it change the frequency of positive thoughts and feelings during a 1-minute daily frequency timing of positive thoughts and feelings?**
    a. **Daily self-monitoring and self-recording of the frequency of positive thoughts and feelings.**
    b. **Daily self-monitoring and self-recording of the frequency of negative thoughts and feelings.**
    c. **One-minute daily timings of positive thoughts and feelings.**
    d. **Use of the standard celeration chart to track and analyze behavior changes.**

Precision Teaching and Standard Celeration Chart Results

All standard celeration charts were analyzed using the following traditional precision teaching methods: (a) single phase analysis, which examines celeration, bounce, outliers, and the

accuracy improvement measure (AIM) to analyze performance and learning within a phase, and (b) multiple phase analysis, which utilizes frequency multipliers, celeration multipliers, bounce comparisons, and AIM comparisons to analyze performance and learning across two or more phases (e.g., Kubina & Yurich, 2012; Pennypacker et al., 2003). All formulas, growth classifications for celeration values, and significance parameters for bounce, AIM, celeration multipliers, and jump/turn analyses were taken from recommended guidelines provided by Kubina and Yurich (2012) and Pennypacker et al. (2003). See Appendix B. A brief description of all measures and terms used in the analysis is provided for those unfamiliar with precision teaching (Kubina & Yurich, 2012):

- *Celeration* measures learning within a phase and is assigned values with x, ÷, or x1.0 to indicate whether the frequency of the target behavior is accelerating (x), decelerating (÷), or not changing (x1.0; appears as a straight horizontal line on the chart). On the standard celeration chart, celeration is "the slope of a line describing a set of behavior frequencies arrayed in real time" (Pennypacker et al., 2003, p. 8). Celeration is charted on the standard celeration chart as a solid line.
- *Bounce* quantifies variability within a phase and indicates the extent to which interventions control behavior. Bounce envelopes are depicted on the standard celeration chart as dashed lines above and below celeration lines.
- *Outliers* are individual performance values that are exceptionally high or exceptionally low. Outliers help identify variables or conditions that directly influence behavior. Lowliers refer to exceptionally bad performances and highliers refer to exceptionally good performances. Precision teachers welcome and carefully examine outliers.

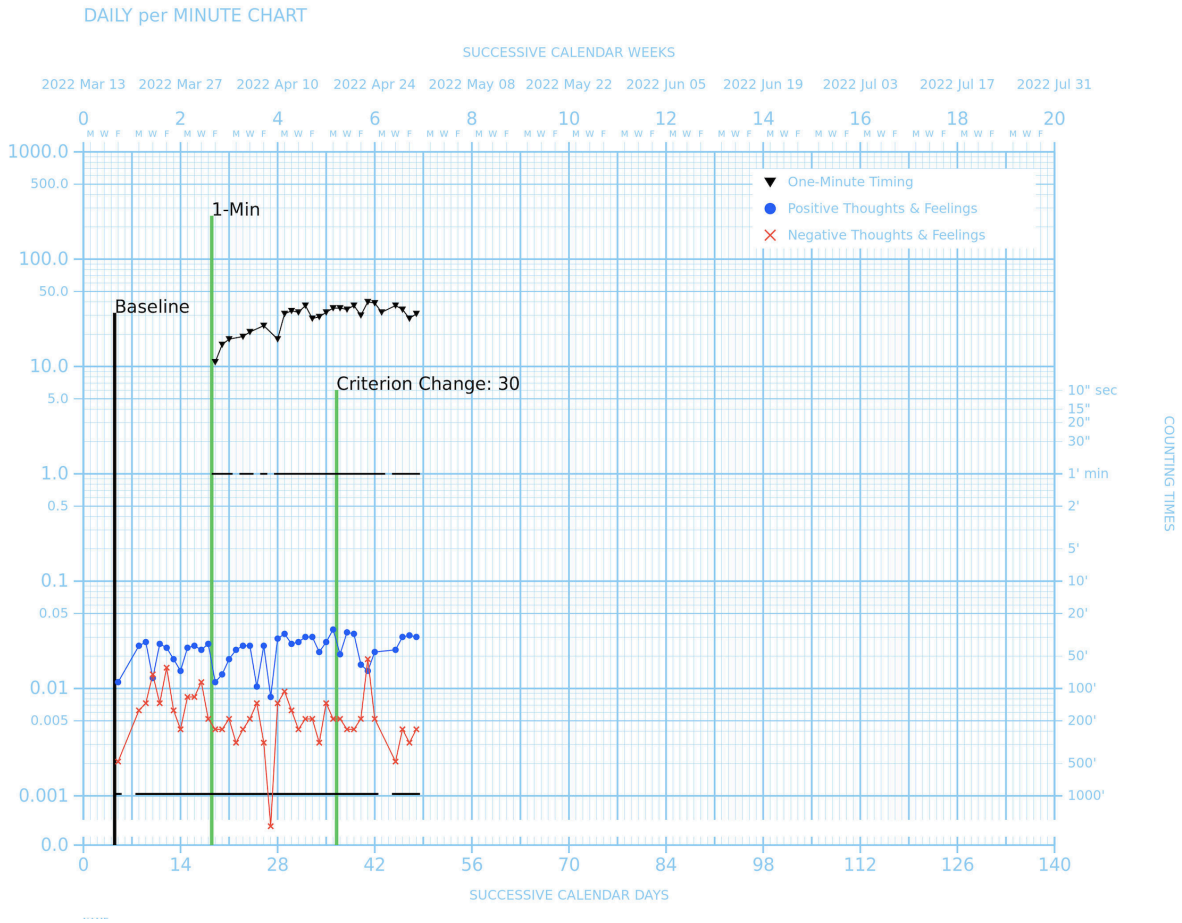
- The *accuracy improvement measure (AIM)* measures accuracy, or the quality of learning over time. The AIM takes concurrent celeration data from positives (corrects) and negatives (incorrects) and combines them into a ratio.
- *Frequency multipliers*, or "jumps", compare two performances (data points) from one phase to the next to quantify how quickly a behavior changes as the result of an intervention. Frequency multipliers are measured by change in the first data point in a comparison celeration (comparison phase) compared to the last data point in the reference celeration (reference phase). A jump up indicates an intervention had an immediate accelerative effect on performance. A jump down indicates an intervention had an immediate decelerative impact on performance. No jump indicates no immediate impact.
- *Celeration multipliers*, or "turns", indicate if behavior accelerated or decelerated compared to the previous phase. Turns are measured by comparing change in celeration values between phases. A turn up indicates an intervention had an accelerative impact on learning rate. A turn down indicates an intervention had a decelerative impact on learning rate. No turn indicates no impact on learning rate.

Effects of the Intervention Package

Effects of the precision teaching-self-management intervention package on targeted inner behavior varied across all four participants, with three participants showing slight improvement in inner behavior and one showing slightly unfavorable changes in inner behavior. Behavioral changes within each phase and across phases are discussed for each participant with accompanying figures and tables. See Figures 1, 7, 11, and 15 for each participant's complete standard celeration charts and referenced tables for data sets pertaining to each analysis.

Figure 1

Alexis's Standard Celeration Chart



Alexis. Overall, Alexis showed a slight acceleration in positives (acceleration target) and deceleration in negatives (deceleration target) across 30-day implementation of the 1-minute timing and self-management intervention package. Single phase analyses showed the most significant growth celeration values for positives occurred during the first 18 days following baseline (phase 1); however, the final phase showed a robust decrease in negatives with AIM values indicating a substantial increase in accuracy.

Single Phase Analysis. Single phase analyses were conducted on data from baseline, phase 1, phase 2, and the entire 30-day duration of the 1-minute timing (evaluated as one phase).

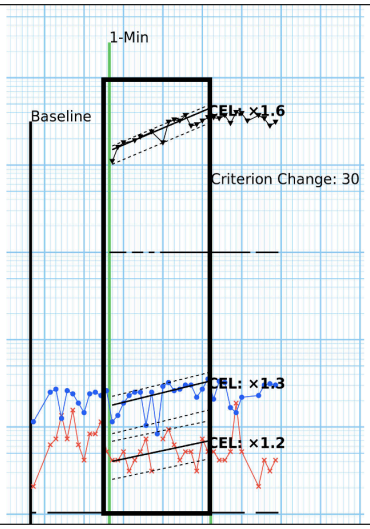
Implementation of the 1-minute timing over a 30-day span, when examined as one phase, showed only a slight acceleration in positives and deceleration in negatives. Celeration values for both positive and negative target behaviors (x1.1 and ÷1.1, respectively) are insignificant or "unacceptable" by traditional precision teaching standards (Kubina & Yurich, 2012, p. 193). The acceleration target showed less variability than the deceleration target; bounce in negatives was moderately variable. The daily1-minute timing data showed smooth and consistent bounce across the entire study.

Baseline data exhibited no celeration in positives and a slight, insignificant deceleration in negatives. Bounce was smooth and consistent for the acceleration target and moderately variable for the deceleration target. Outliers (lowliers) occurred in the data during baseline for the acceleration target on days 1 and 6; one outlier (highlier) occurred for the deceleration target on day 1. Notes entered on the data sheet by the participant for day 1 explained she had been on vacation and left her counters at home. She had used an application on her cell phone to count, resulting in low numbers for both positives and negatives on that day.

Figure 2

Alexis's Single Phase Analysis: Phase 1

Single Phase Analysis: Phase 1
Phase Length- 18 Days



Measures	*Participant Data*
Frequency Range	(a) Acceleration Target (Positives): 8- 34 (b) Deceleration Target (Negatives): 0- 9 (c) 1-Min Timing: 11- 35
Celeration	(a) Acceleration Target (Positives): x1.3 (b) Deceleration Target (Negatives): x1.2 (c) 1-Min Timing: x1.6
Bounce	(a) Acceleration Target (Positives): x2.7 (b) Deceleration Target (Negatives): x2.7 (c) 1-Min Timing: x1.6
Outliers	(a) Acceleration Target (Positives): One lowlier, Day 23 (8) (b) Deceleration Target: Two highliers, Day 23 (0) and Day 30 (3) (c) 1-Min Timing: None
AIM	÷1.1 [18 days]

As shown in Figure 2, an acceptable growth celeration in positives but unfavorable concurrent acceleration in negatives occurred during phase 1. One-minute timing data presented robust growth celeration. Bounce values for both acceleration and deceleration targets during phase 1 showed very little variability. Outliers on day 23 (low count for both targets) were the result of a medical emergency with the participant's mother-in-law. A training booster was given on day 23, which could explain the favorable jump in positives from eight on day 23 to 28 on day 24. The AIM value for phase 1 was ÷1.1 over 18 days, indicating worsening outcomes due to the concurrent acceleration in negatives.

Phase 2 demonstrated a robust deceleration of negatives and a slight, insignificant acceleration of positives. The 1-minute timing showed a slight unfavorable deceleration. Bounce in both target behaviors showed smooth and consistent variability. One extreme deceleration lowlier (jump in negatives) occurred on day 37, which coincided with a family mental health emergency and ultimately led to the participant dropping out of the study three days early.

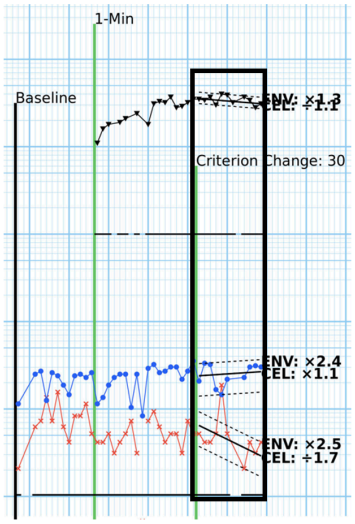
Alexis's AIM value for the final phase of the study was x1.9, indicating substantial accuracy improvement. See Figure 3.

Figure 3

Alexis's Single Phase Analysis: Phase 2

Single Phase Analysis: Phase 2

Phase Length- 12 Days



Measures	***Participant Data***
Frequency Range	(a) Acceleration Target (Positives): 14- 32 (b) Deceleration Target (Negatives): 2- 18 (c) 1-Min Timing: 28- 40
Celeration	(a) Acceleration Target (Positives): x1.1 (b) Deceleration Target (Negatives): ÷1.7 (c) 1-Min Timing: ÷1.1
Bounce	(a) Acceleration Target (Positives): x2.4 (b) Deceleration Target (Negatives): x2.5 (c) 1-Min Timing: x1.3
Outliers	(a) Acceleration Target (Positives): None (b) Deceleration Target: Lowlier on Day 37 (c) 1-Min Timing: None
AIM	x1.9 [12 days]

Multiple Phase Analysis. Multiple phase analyses were conducted on data from (a) baseline to phase 1 (introduction of the intervention and corresponding to the first criterion in the changing criterion design); (b) phase 1 to phase 2 (corresponding to the second criterion jump); and (c) baseline to the complete 30-day 1-minute timing phase.

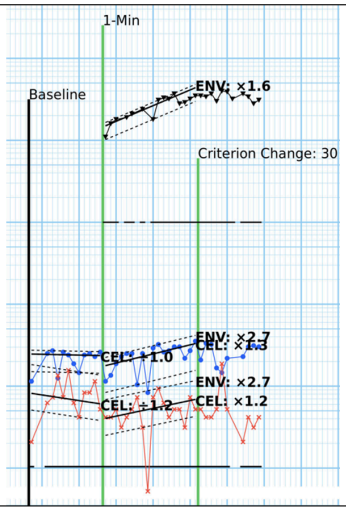
From baseline to phase 1, frequency and celeration multipliers showed a jump down, turn up in daily positives. This indicates an immediate drop in frequency, or decelerative, impact of the intervention on positives with an overall accelerative impact on learning rate. Frequency and celeration multipliers also revealed an unfavorable jump down, turn up in daily negatives between phases. This indicates an immediate drop in frequency in negatives following the intervention and an overall unfavorable accelerative impact on the learning rate during phase 1.

Acceleration target data from baseline to implementation of the 1-minute timing showed a slight increase in variability, but still within the smooth and consistent bounce rating. Deceleration target data from baseline to implementation of the 1-minute timing showed moderately variable bounce that smoothed and became more consistent during phase 1. The 1-minute timing showed robust growth celeration. AIM values indicated worsening accuracy. See Figure 4 for multiple phase analysis between baseline and phase 1.

Figure 4

Alexis's Multiple Phase Analysis: Baseline to Phase 1

Multiple Phase Analysis: Baseline to Phase 1



Measures	***Participant Data***
Frequency Multipliers (Jumps)	(a) Acceleration Target (Positives) Baseline to 1-min: ÷2.3 (b) Deceleration Target (Negatives) Baseline to 1-min: ÷1.3
Celeration Multipliers (Turns)	(a) Acceleration Target (Positives) Baseline to 1-min: x1.3 (b) Deceleration Target (Negatives) Baseline to 1-min: x1.4
Bounce Changes	(a) Acceleration Target (Positives) Baseline to 1-min: x1.8 to x2.7 (b) Deceleration Target Baseline to 1-min: x3.6 to x2.7
AIM	○ Baseline: x1.2 [14 days] ○ Phase 1: ÷1.1 [18 days]

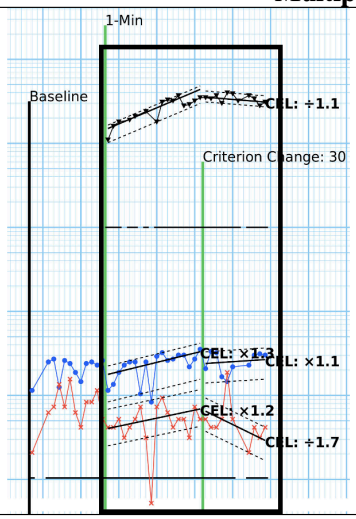
Frequency and celeration multipliers showed a jump down, turn up in daily positives and turn down in daily negatives between phase 1 and phase 2. The jump/turn analysis for negatives indicated no immediate change in frequency between phases with an overall decelerative impact in the rate of negatives. Acceleration and deceleration target data between phases showed very little change in bounce (both targets remained within the smooth and consistent bounce rating).

AIM values were impressive from phase 1 to phase 2. The concurrent acceleration in positives and negatives that was present during phase 1 changed drastically, with a robust deceleration in negatives. See Figure 5 for multiple phase analysis between phase 1 and phase 2.

Figure 5

Alexis's Multiple Phase Analysis: Phase 1 to Phase 2

Multiple Phase Analysis: Criterion Phase 1 to Phase 2



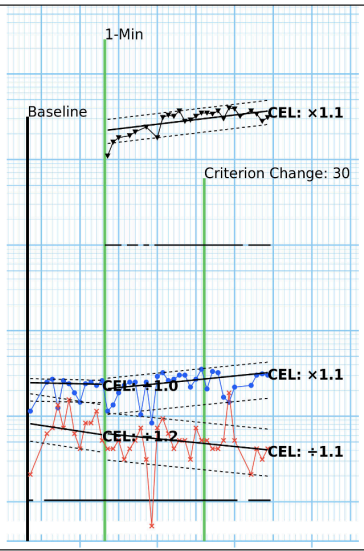
Measures	***Participant Data***
Frequency Multipliers (Jumps)	(a) Acceleration Target (Positives) Phase 1 to Phase 2: ÷1.7 (b) Deceleration Target (Negatives) Phase 1 to Phase 2: x1 (no change)
Celeration Multipliers (Turns)	(a) Acceleration Target (Positives) Phase 1 to Phase 2: ÷1.2 (b) Deceleration Target (Negatives) Phase 1 to Phase 2: ÷2.0
Bounce Changes	(a) Acceleration Target (Positives) Phase 1 to Phase 2: x2.7 to x2.4 (b) Deceleration Target Phase 1 to Phase 2: x2.7 to x2.5
AIM	○ Phase 1: ÷1.1 [18 days] ○ Phase 2: x1.9 [12 days]

Analysis between baseline and Alexis's complete 30-day intervention phase are presented in Figure 6. Frequency and celeration multipliers showed a very slight jump down, turn up in daily positives and a jump down in negatives with no turn (no impact in learning rate). Acceleration and deceleration target data between phases showed very little change in bounce. Variability in positives remained within the smooth and consistent bounce rating and variability in negatives remained in the moderately variable bounce rating across phases. AIM values from baseline to complete 30-day intervention phase indicated small accuracy improvement.

Figure 6

Alexis's Multiple Phase Analysis: Baseline to 1-Min

Multiple Phase Analysis: Baseline to 1-Min.

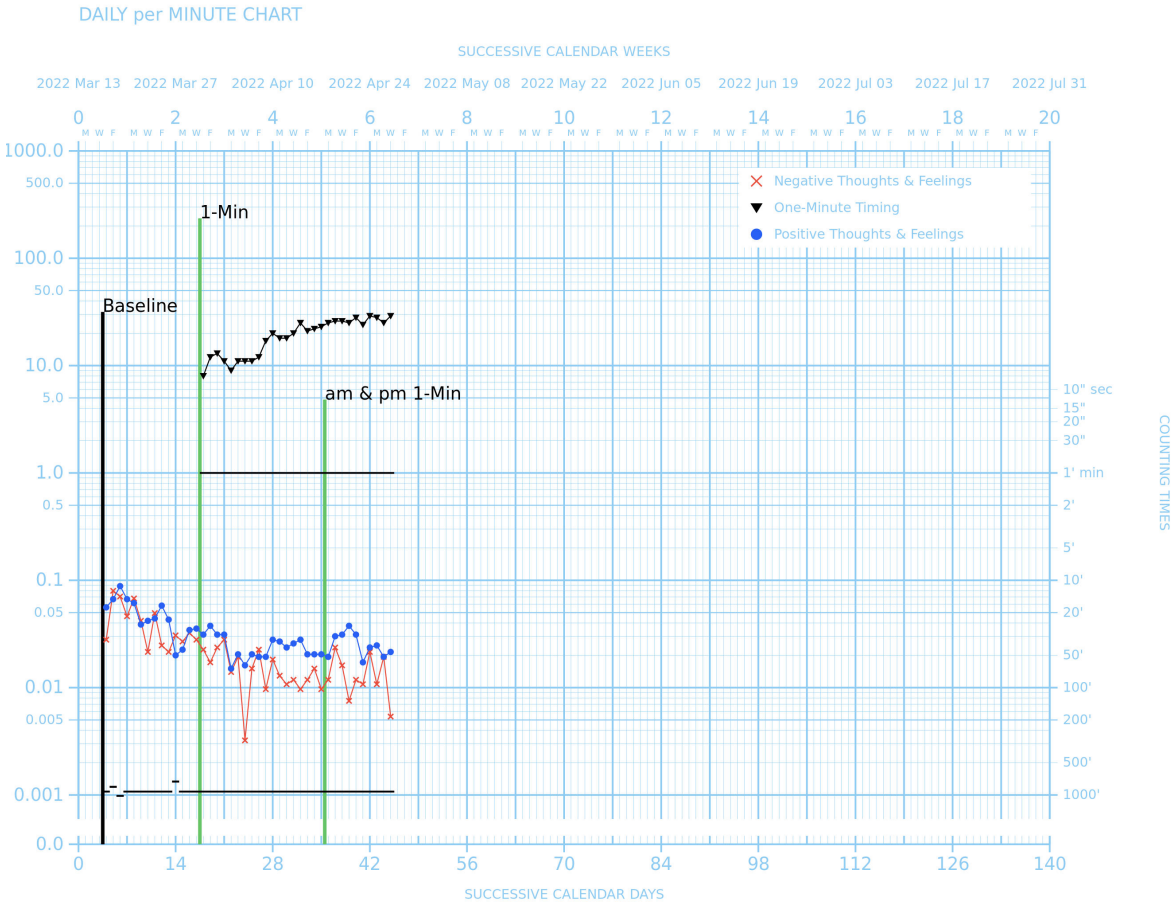


Measures	*Participant Data*
Frequency Multipliers (Jumps)	(a) Acceleration Target (Positives) Phase 1 to Phase 2: ÷2.0 (b) Deceleration Target (Negatives) Phase 1 to Phase 2: ÷2.8
Celeration Multipliers (Turns)	(a) Acceleration Target (Positives) Phase 1 to Phase 2: x1.1 (b) Deceleration Target (Negatives) Phase 1 to Phase 2: ÷1.1
Bounce Changes	(a) Acceleration Target (Positives) Phase 1 to Phase 2: x1.8 to x2.6 (b) Deceleration Target Phase 1 to Phase 2: x3.6 to x3.5
AIM	○ Baseline: x1.2 [14 days] ○ 1-Min: x1.2 [30 days]

Amy. Amy's standard celeration chart within and across all phases showed, in general, decelerating values or no celeration for positives and negatives during the complete 28 days of intervention. Interestingly, the 1-minute timing data showed a robust growth celeration of x1.4 during that time. AIM values within each phase showed deteriorating accuracy; the AIM value calculated in single phase analysis of the entire 28-day duration of the 1-minute timing was x1.0, indicating no change in accuracy. Significant contextual variables occurred during Amy's participation in the current study, explained in detail in Chapter 5. See Figure 7 for Amy's complete standard celeration chart.

Figure 7

Amy's Standard Celeration Chart



Single Phase Analysis. Single phase analyses were conducted on data from baseline, phase 1, phase 2, and the entire 28-day duration of the 1-minute timing (evaluated as one phase). During baseline, Amy's positives and negatives decelerated concurrently; the celeration value for negatives was robust at ÷1.5. Positives decelerated significantly as well at ÷1.3. Bounce values showed moderate variability and the AIM value indicated deteriorating accuracy.

Phase 1 presented no celeration of positives and a robust deceleration of negatives (÷1.6). The 1-minute timing showed robust growth celeration. Bounce for daily positives, daily negatives, and the 1-minute timing was smooth and consistent. The deceleration target highlier

on day 21 coincided with a vacation at the beach and admission that she was "not focused on doing my count but would have been mostly positive". The AIM value for phase 1 showed a continued deterioration in accuracy. A training booster was given on day 24.

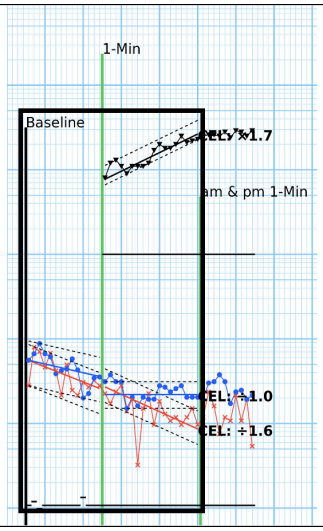
Phase 2 showed an unfavorable deceleration in positives and insignificant deceleration in negatives. There was very little variability in positives and the 1-minute timing; the deceleration target had moderate bounce. The AIM value for phase 2 showed no improvement in accuracy.

Multiple Phase Analysis. Multiple phase analyses were conducted on data from (a) baseline to phase 1 (introduction of the intervention and corresponding to the first criterion in the changing criterion design); and (b) phase 1 to phase 2 (switch to two daily 1-minute timings—one completed in the morning and another in the afternoon or evening).

From baseline to phase 1, frequency and celeration multipliers show a jump down, turn up in daily positives. Frequency and celeration multipliers show no jump, no turn in daily negatives. Bounce in both the acceleration and deceleration targets was moderately variable but smoothed during phase 1. AIM values showed increasing deterioration in accuracy. See Figure 8 for multiple phase analysis from baseline to phase 1.

Figure 8

Amy's Multiple Phase Analysis: Baseline to Phase 1

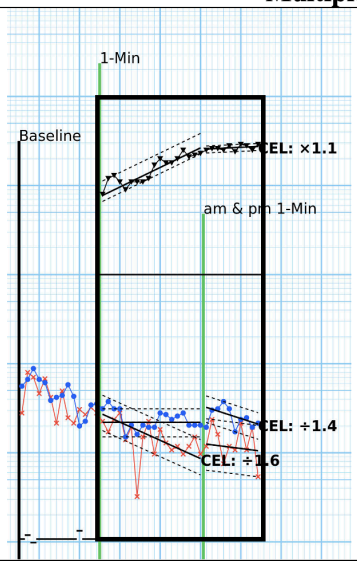
Multiple Phase Analysis: Baseline to Phase 1		
	***Measures***	***Participant Data***
	Frequency Multipliers (Jumps)	(a) Acceleration Target (Positives) Baseline to 1-min: ÷1.1 (b) Deceleration Target (Negatives) Baseline to 1-min: ÷1.2
	Celeration Multipliers (Turns)	(a) Acceleration Target (Positives) Baseline to 1-min: ÷1.3 (b) Deceleration Target (Negatives) Baseline to 1-min: ÷1.1
	Bounce Changes	(a) Acceleration Target (Positives) Baseline to 1-min: x3.4 to x1.7 (b) Deceleration Target Baseline to 1-min: x3.1 to x2.1
	AIM	○ Baseline: ÷1.2 [14 days] ○ Phase 1: ÷1.6 [18 days]

Multiple phase analysis conducted from phase 1 to phase 2 showed AIM values improved only slightly between the two phases (÷1.6 and ÷1.3 respectively), indicating weakened accuracy. Frequency and celeration multipliers show a jump up, turn down in daily positives between phase 1 and phase 2; frequency and celeration multipliers show a jump up, turn up in daily negatives. Bounce in positives stayed smooth and consistent between phases; bounce in negatives went from smooth to moderately variable. See Figure 9 for multiple phase analysis from phase 1 to phase 2.

Figure 9

Amy's Multiple Phase Analysis: Phase 1 to Phase 2

Multiple Phase Analysis: Phase 1 to Phase 2



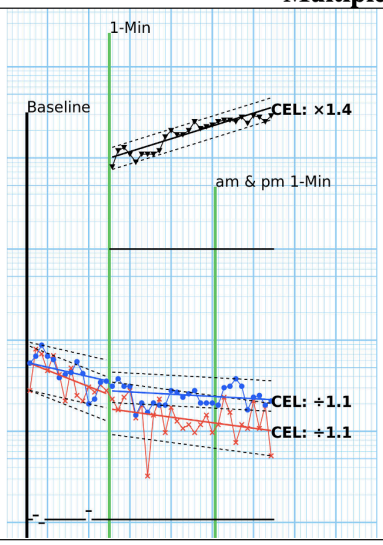
Measures	***Participant Data***
Frequency Multipliers (Jumps)	(a) Acceleration Target (Positives) Phase 1 to Phase 2: ÷1.5 (b) Deceleration Target (Negatives) Phase 1 to Phase 2: ÷2.3
Celeration Multipliers (Turns)	(a) Acceleration Target (Positives) Phase 1 to Phase 2: ÷1.4 (b) Deceleration Target (Negatives) Phase 1 to Phase 2: ÷1.5
Bounce Changes	(a) Acceleration Target (Positives) Phase 1 to Phase 2: x1.7 to x2.0 (b) Deceleration Target Phase 1 to Phase 2: x2.1 to x3.8
AIM	○ Phase 1: ÷1.6 [18 days] ○ Phase 2: ÷1.3 [10 days]

Finally, Figure 10 illustrates multiple phase analysis between baseline and Amy's complete 28-day intervention phase. Frequency and celeration multipliers show a jump down, slight turn up in daily positives between baseline and the complete 28-day intervention phase. Frequency and celeration multipliers show a jump down, very slight turn up in daily negatives. Bounce in positives went from moderately variable to smooth and consistent. Bounce in negatives became more variable during the intervention but remained in moderately variable bounce parameters across the two phases. AIM values from both phases improved from slightly deteriorating accuracy to x1.0 (no change).

Figure 10

Amy's Multiple Phase Analysis: Baseline to 1-Min

Multiple Phase Analysis: Baseline to 1-Min.

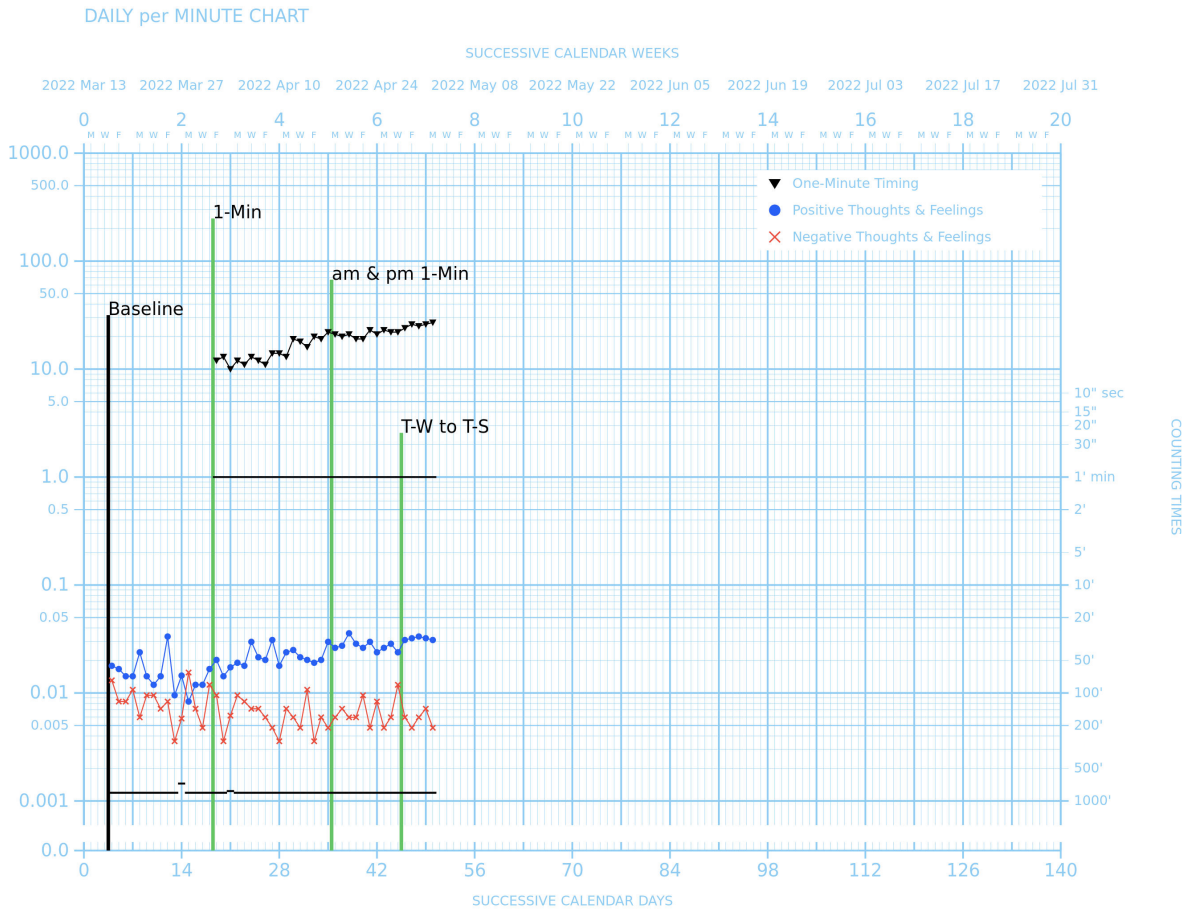


Measures	***Participant Data***
Frequency Multipliers (Jumps)	(a) Acceleration Target (Positives) Baseline to 1-min: ÷1.1 (b) Deceleration Target (Negatives) Baseline to 1-min: ÷1.2
Celeration Multipliers (Turns)	(a) Acceleration Target (Positives) Baseline to 1-min: ÷1.2 (b) Deceleration Target (Negatives) Baseline to 1-min: ÷1.4
Bounce Changes	(a) Acceleration Target (Positives) Baseline to 1-min: x3.4 to x2.2 (b) Deceleration Target Baseline to 1-min: x3.1 to x3.8
AIM	○ Baseline: ÷1.2 [14 days] ○ Phase 1: x1.0 [28 days]

Christine. Overall, Christine's standard celeration chart showed favorable but small acceleration growth in daily positives and small deceleration in negatives. AIM values from baseline to the total 32-day 1-minute timing phase improved, ending with an AIM value of x1.2 indicating favorable but small improvement in accuracy. See Figure 11 for Christine's complete standard celeration chart.

Figure 11

Christine's Standard Celeration Chart



Single Phase Analysis. Single phase analyses were conducted on data from baseline, phase 1, phase 2, phase 3, and the entire 32-day duration of the 1-minute timing (evaluated as one phase). Christine's baseline showed a very small deceleration in daily positives and robust deceleration in negatives. The AIM value for baseline was ÷1.2, indicating deteriorating accuracy.

Phase 1 produced the most favorable gains, demonstrated by growth in celeration for daily positives, the 1-minute timing procedure, and accuracy (the AIM value for phase 1 was x1.3, indicating adequate accuracy improvement). Daily negatives during phase 1 decelerated

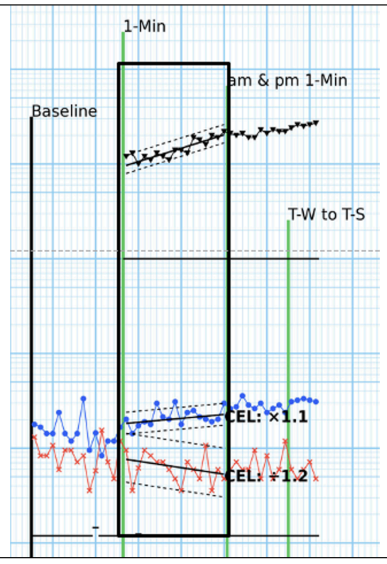
slightly and exhibited more variability compared to bounce in positives. Two acceleration target outliers (highliers) were present on day 21 and day 24; one deceleration target outlier (highlier) was present on day 17 during this phase. Christine reported Special Olympics activities at work on both days the acceleration target highliers were present. The deceleration target highlier coincided with a longer counting window for the day (she woke earlier and went to bed later than usual). See Figure 12 for single phase analysis of phase 1.

Phase 2 showed a deceleration in positives and no celeration in negatives, essentially leveling on the chart with marginally unfavorable trends. No outliers were present. Bounce for both targets became increasingly less variable. Celeration for the 1-minute timing decelerated. The AIM value for phase 2 showed slightly diminished accuracy. Data from phase 3 showed similar trends.

Figure 12

Christine's Single Phase Analysis: Phase 1

Single Phase Analysis: Phase 1
Phase Length- 17 Days



Measures	***Participant Data***
Frequency Range	(a) Acceleration Target (Positives): 12- 26 (b) Deceleration Target (Negatives): 3- 9 (c) 1-Min Timing: 10- 22
Celeration	(a) Acceleration Target (Positives): x1.1 (b) Deceleration Target (Negatives): ÷1.2 (c) 1-Min Timing: x1.4
Bounce	(a) Acceleration Target (Positives): x1.7 (b) Deceleration Target (Negatives): x3.3 (c) 1-Min Timing: x1.6
Outliers	(a) Acceleration Target (Positives): Highliers, Days 21 (25) and 24 (26) (b) Deceleration Target: Highlier, Day 17 (3) (c) 1-Min Timing: None
AIM	x1.3 [17 days]

Multiple Phase Analysis. Multiple phase analyses were conducted on data from (a) baseline to phase 1 (introduction of the intervention and corresponding to the first criterion in the

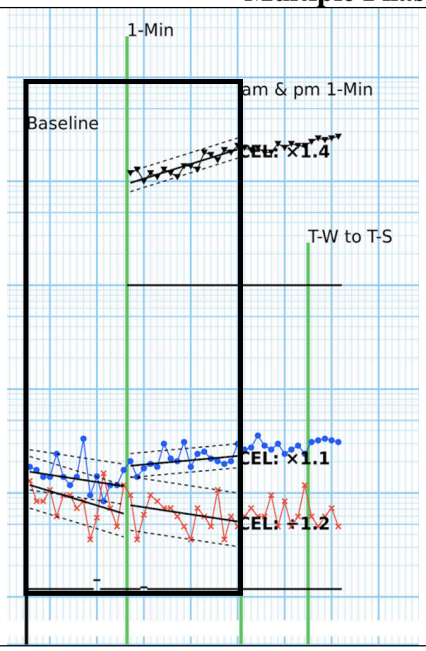
changing criterion design); (b) phase 1 to phase 2 (switch to two daily 1-minute timings—one completed in the morning and another in the afternoon or evening); (c) phase 2 to phase 3 (switch from a think-write to think-say learning channel during the 1-minute timings); and (d) baseline to the complete 32-day 1-minute timing phase.

Baseline to phase 1 produced the most change in target behavior across phases. Frequency and celeration multipliers showed a jump up, turn up in daily positives between baseline and phase 1. This indicates an immediate jump in frequency, or accelerative, impact of the intervention on performance and learning rate. Frequency and celeration multipliers show a very slight jump up, turn down in daily negatives between baseline and implementation of the 1-minute timing. Acceleration target (daily positives) data from baseline to phase 1 show a decrease in variability, but still within the smooth and consistent bounce rating. Deceleration target (daily negatives) data from baseline to implementation of the 1-minute timing show very little change in bounce (moderately variable). AIM values from baseline to phase 1 indicate enhanced accuracy between the two phases. See Figure 13 for multiple phase analysis for baseline to phase 1.

Figure 13

Christine's Multiple Phase Analysis: Baseline to Phase 1

Multiple Phase Analysis: Baseline to Criterion Phase 1



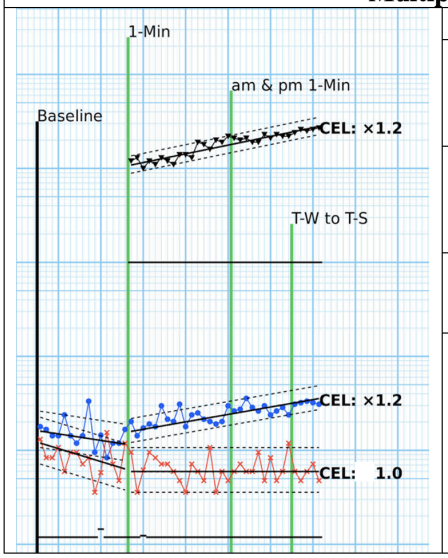
Measures	*Participant Data*
Frequency Multipliers (Jumps)	(a) Acceleration Target (Positives) Baseline to Phase 1: x1.2 (b) Deceleration Target (Negatives) Baseline to Phase 1: ÷1.3
Celeration Multipliers (Turns)	(a) Acceleration Target (Positives) Baseline to Phase 1: x1.3 (b) Deceleration Target (Negatives) Baseline to Phase 1: ÷1.2
Bounce Changes	(a) Acceleration Target (Positives) Baseline to Phase 1: x2.4 to x1.7 (b) Deceleration Target Baseline to Phase 1: x3.1 to x3.3
AIM	○ Baseline: ÷1.2 [15 days] ○ Phase 1: x1.3 [17 days]

As shown in Figure 14, analysis between baseline and Christine's complete 32-day intervention phase showed generally favorable, albeit small, improvement in inner behavior. Frequency and celeration multipliers showed a jump up, turn up in daily positives and a very slight jump down, and turn up (to no celeration) in daily negatives between baseline and implementation of the intervention across 32 days. Acceleration target data from baseline to implementation of the intervention show a slight decrease in variability, still within the smooth and consistent bounce rating. Deceleration target data from baseline to implementation of the intervention show little to no change in bounce. AIM values show a favorable but small improvement in accuracy from baseline to the 1-minute timing phase across 32 days.

Figure 14

Christine's Multiple Phase Analysis: Baseline to 1-Min

Multiple Phase Analysis: Baseline to 1-Min

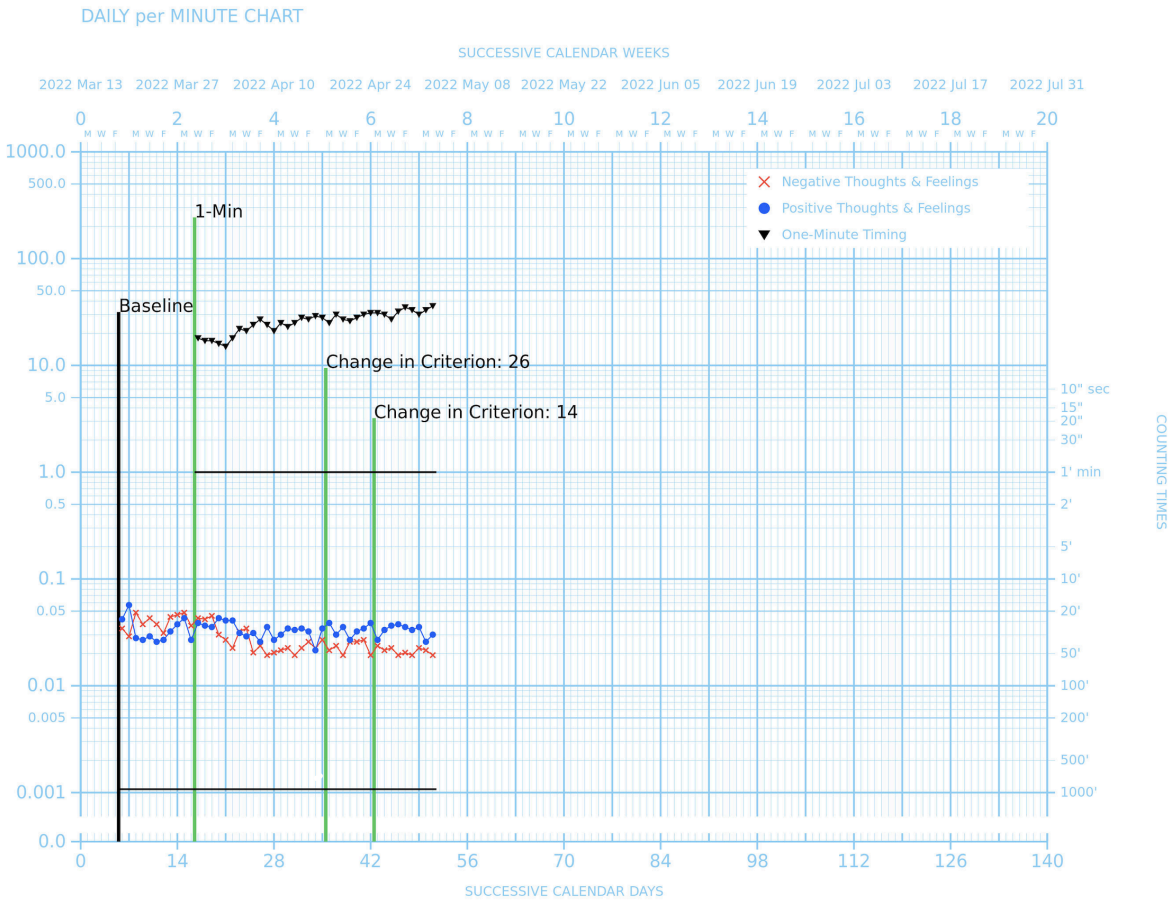


Measures	***Participant Data***
Frequency Multipliers (Jumps)	(a) Acceleration Target (Positives) Baseline to 1-min: x1.2 (b) Deceleration Target (Negatives) Baseline to 1-min: ÷1.3
Celeration Multipliers (Turns)	(a) Acceleration Target (Positives) Baseline to 1-min: x1.4 (b) Deceleration Target (Negatives) Baseline to 1-min: x1.4
Bounce Changes	(a) Acceleration Target (Positives) Baseline to 1-min: x2.4 to x1.8 (b) Deceleration Target Baseline to 1-min: x3.1 to x3.0
AIM	○ Baseline: ÷1.2 [15 days] ○ 1-Min: x1.2 [32 days]

Leslie. Analysis of Leslie's standard celeration chart within each phase and across all phases at first glance may represent a general picture of unresponsiveness to intervention; however, an important but subtle change occurred 4 days after implementation of the 1-minute timing. Crossover, in which her daily positives became more frequent than her daily negatives, occurred on day 15 and continued for the remainder of the study. See Figure 24 for an illustration of this subtle but important change. Insignificant changes in celeration were present between phases, but examination of celeration trends across 35 days of intervention yielded, in general, no change in AIM values and no change in celeration of positives or negatives. See Figure 15 for Leslie's complete standard celeration chart.

Figure 15

Leslie's Standard Celeration Chart



Single Phase Analysis. Single phase analyses were conducted on data from baseline, phase 1, phase 2, phase 3, and the entire 35-day duration of the 1-minute timing (evaluated as one phase). Implementation of intervention over a 35-day span showed celeration values of x1.0 for both the acceleration and deceleration targets and an AIM value of x1.0, indicating, in general, no change in the three measures. The daily 1-minute timing procedure showed an overall celeration value of x1.2, indicating insignificant growth celeration. Little to no changes in bounce occurred over this phase; all bounce values indicated smooth and consistent variability. One outlier (highlier) was present in deceleration data on day 37; however, notes were not

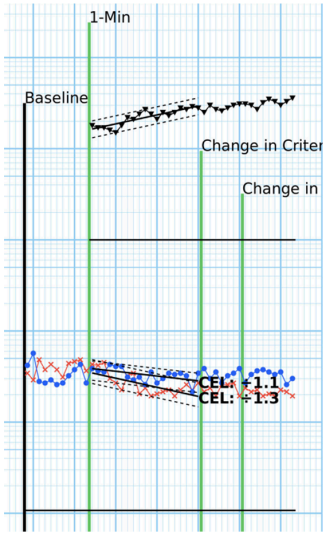
entered on the data sheet to evaluate conditions that may have influenced the favorable drop in negatives.

As mentioned previously, a notable but small change occurred during phase 1 in which daily positives surmounted daily negatives in frequency, termed crossover in precision teaching. A slight deceleration in positives and an acceptable deceleration in negatives occurred on day 15 and continued for the remainder of the study. In addition, the 1-minute timing during phase 1 showed acceptable growth celeration. Bounce was smooth and consistent. The AIM value was x1.2, indicating very slight accuracy improvement. Data in phase 1 may be meaningful considering Alexis had prioritized decelerating daily negatives for her target behavior in the changing criterion design. One caveat to the findings, however, is the slight decrease in positives. A training booster was given on day 24. See Figure 16 for analysis of phase 1.

Figure 16

Leslie's Single Phase Analysis: Phase 1

Single Phase Analysis: Phase 1
Phase Length-19 Days

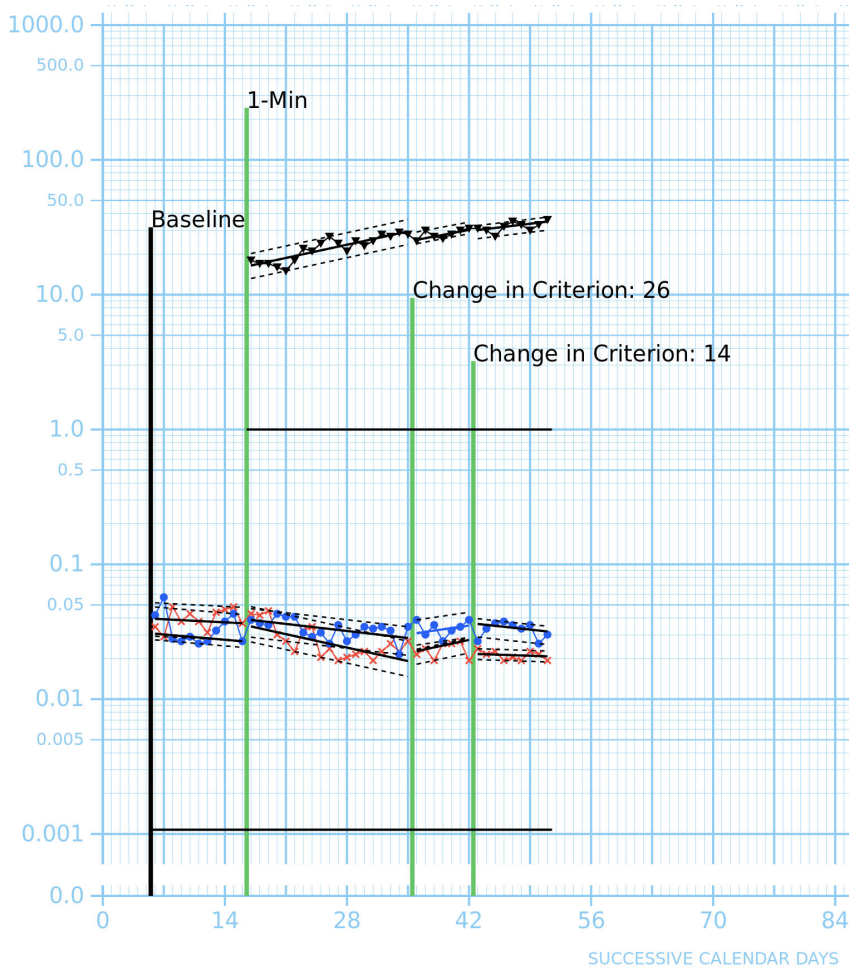


Measures	***Participant Data***
Frequency Range	(a) Acceleration Target (Positives): 20- 40 (b) Deceleration Target (Negatives): 18- 42 (c) 1-Min Timing: 15- 29
Celeration	(a) Acceleration Target (Positives): ÷1.1 (b) Deceleration Target (Negatives): ÷1.3 (c) 1-Min Timing: x1.3
Bounce	(a) Acceleration Target (Positives): x1.6 [19 days] (b) Deceleration Target (Negatives): x1.8 [19 days] (c) 1-Min Timing: 1.5 [7 days]
Outliers	(a) Acceleration Target (Positives): None (b) Deceleration Target: None (c) 1-Min Timing: None
AIM	x1.2 [19 days]

Multiple Phase Analysis. Multiple phase analyses were conducted on data from (a) baseline to phase 1 (introduction of the intervention and corresponding to the first criterion in the changing criterion design); (b) phase 1 to phase 2 (corresponding to the second criterion jump); (c) phase 2 to phase 3; and (d) baseline to the complete 30-day 1-minute timing phase. Multiple phase analyses revealed few changes in Leslie's targeted inner behavior within and across phases. See Figure 17 for presentation of celeration and bounce across all phases.

Figure 17

Leslie's Celeration and Bounce Across All Phases



Changing Criterion- Single-Case Design Results

Effects of the precision teaching-self-management intervention package interpreted within single-case, changing criterion design methodology are presented in Figures 18, 19, 20, and 21. Adherence to changing criterion design guidelines was difficult, as stable responding was not established for any of the participants and two, Christine and Amy, did not meet the first criterion. The changing criterion design was subsequently abandoned in favor of the behavior dynamics design for the two who did not meet the first criterion. The other two participants, Leslie and Alexis, met one or more criterion changes and continued without additional phase or variable manipulation. Results, however, did not satisfy guidelines established by Barlow et al. (2009) and Cooper et al. (2020) to indicate experimental control or support a causal or functional relation between behavior and intervention. Because changing criterion designs can only target one behavior, participants chose which behavior to target for criterion changes. Participants continued to count and record daily positives and negatives for the researcher to plot on standard celeration charts.

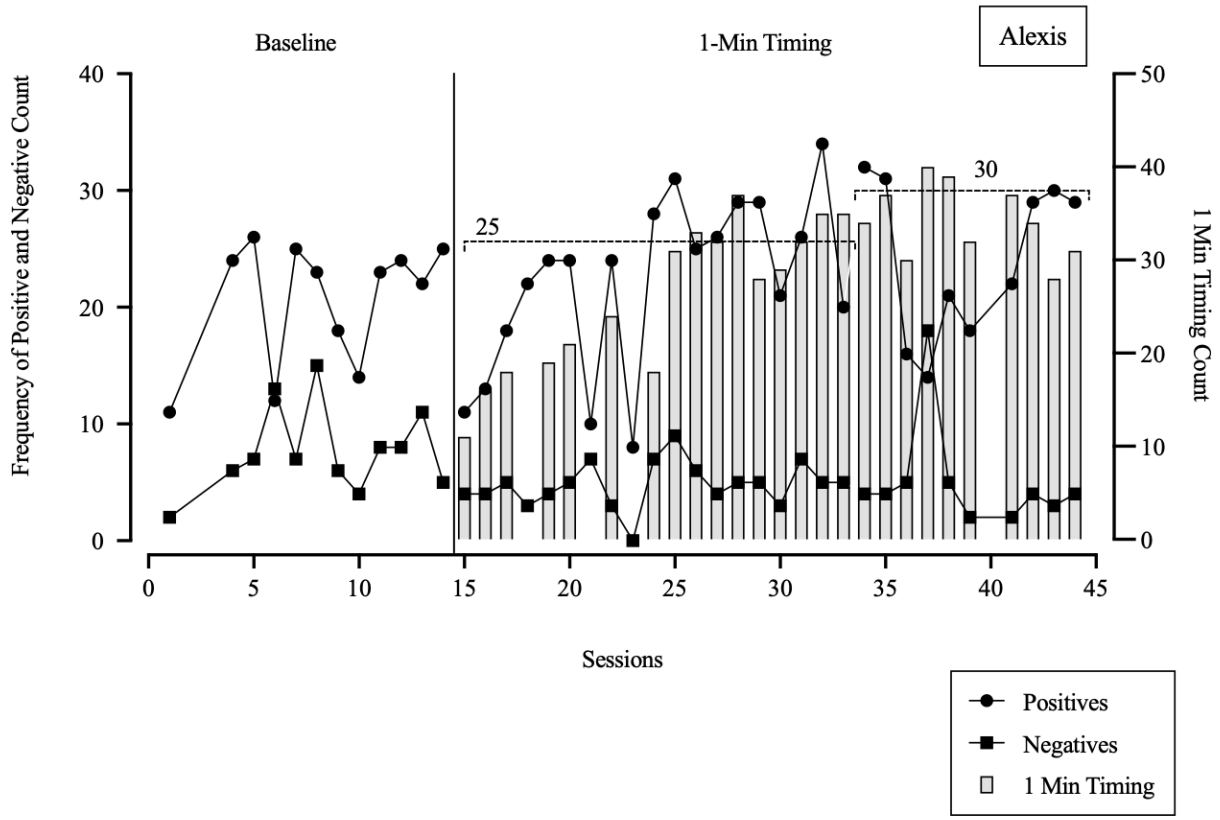
Alexis

Alexis chose positive thoughts and feelings to target for criterion changes in the single-case design component of the study. During baseline, Alexis's daily positives ranged from 11 to 26, with a mean of 20 and median of 23. The first criterion was to increase daily positives to 7% of her baseline median (25 positives per day). From baseline to implementation of the 1-minute timing intervention, Alexis's data showed a significant drop in positives followed by an increase to 24 for two consecutive days with significant variability. She met criterion on days 27 to 29; however, a new criterion was not established due to a lag in documentation of daily counts on the shared data sheet for several days (more discussion on this in the limitations section in Chapter

5). She appeared to be close to meeting criterion again on days 31 and 32 and the second criterion was increased to 30 per day (20% of the first criterion). Alexis had a family emergency in the middle of the second criterion phase and ultimately dropped out of the study early, attaining the second criterion the last three days of participation. Nevertheless, visual analysis of Alexis's data in Figure 18 shows that her behavior did not conform closely to the changing criteria and the 1-minute timing intervention did not demonstrate experimental control over daily frequency of the target behavior.

Figure 18

Alexis's Changing Criterion Graph



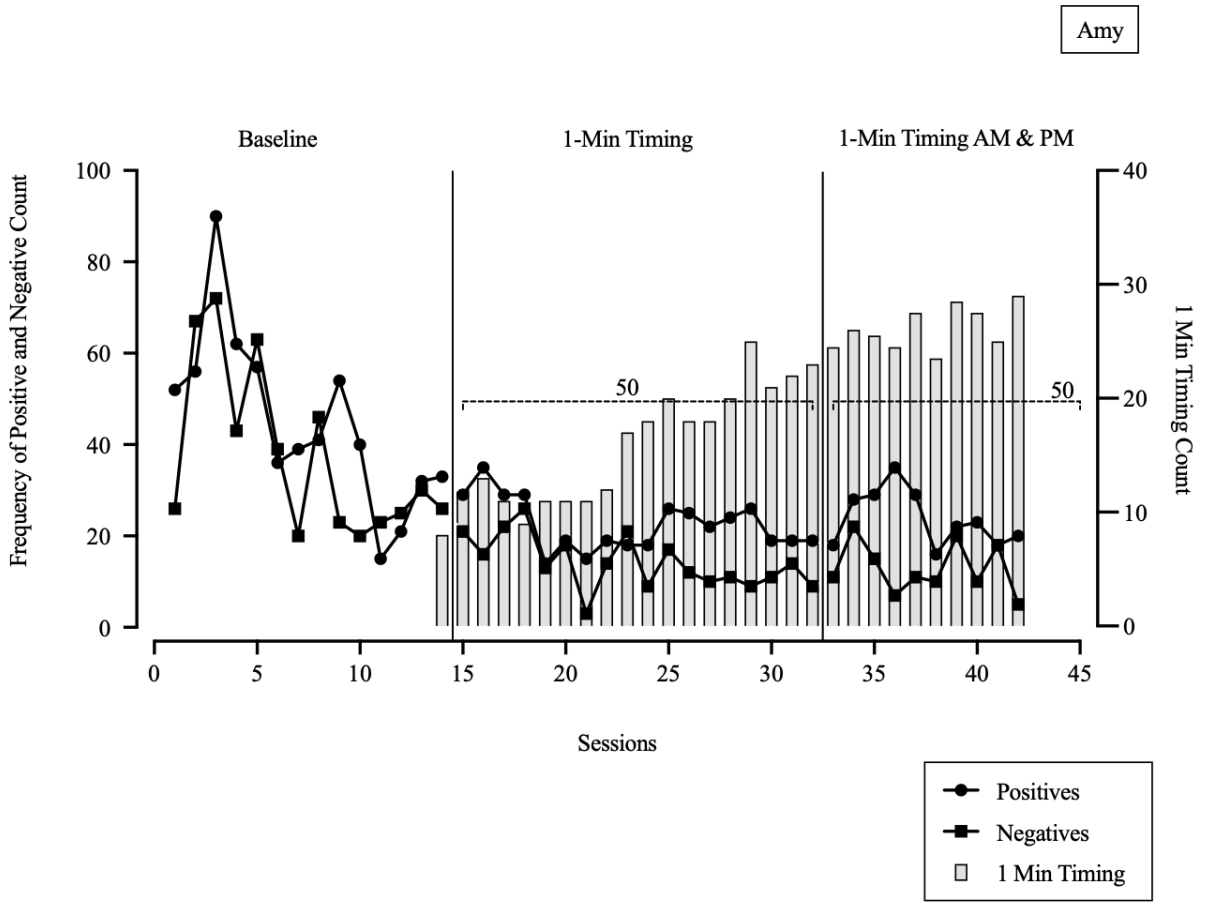
Amy

Amy chose positive thoughts and feelings to target for criterion changes in the single-case design component of the study. Amy's daily positives ranged from 15 to 90 across 14 days,

with a mean and median of 47. The selected goal for the first criterion was to increase daily positives to 7% above her baseline median, or 50 positives per day. Amy did not meet the first criterion and reported multiple variables potentially interfering with her progress, such as several reductions in her anti-depressant medication and a vacation during which time she did not count. As with Christine, efforts were then shifted after 18 days to focus on behavior change exclusively within precision teaching methodology using the standard celeration chart. Visual analysis of Amy's data depicted in Figure 19 shows a deteriorating baseline and small but unfavorable intervention effect. Amy's target behavior did not conform to the first criterion or the phase change in which the daily 1-minute timing intervention was switched to two 1-minute timings.

Figure 19

Amy's Changing Criterion Graph



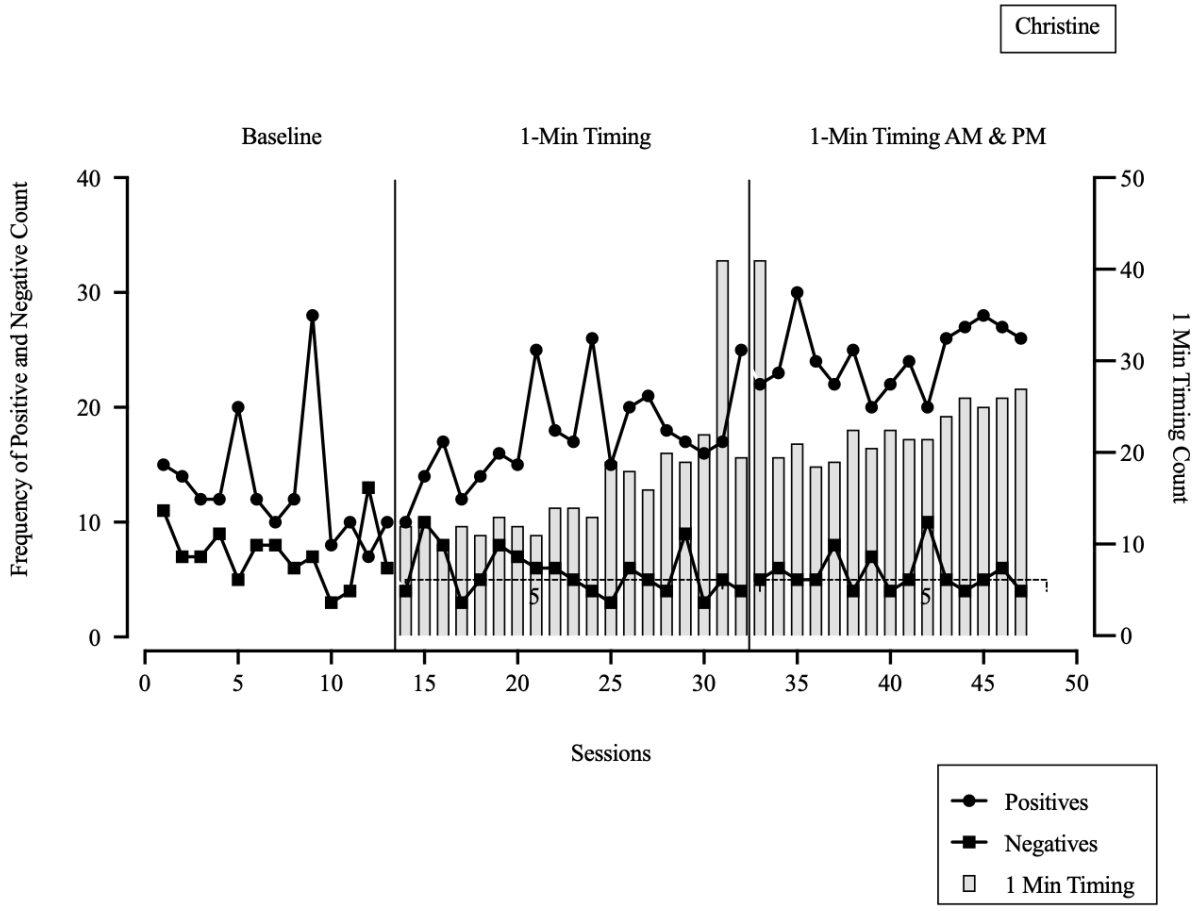
Christine

Christine chose negative thoughts and feelings to target for criterion changes in the single-case design component of the study, even though they occurred infrequently during 15 days of baseline data (ranging from 3 to 13, with a mean and median of 7). She reasoned that her negatives were a significant disruption to her moods at work and, while a goal of reducing them to zero was unrealistic, she wanted to get them as low as possible throughout the day. The selected goal for the first criterion was to decrease daily negatives to 5 per day. Visual analysis of Christine's data shows the immediacy of intervention effect was very small. Variability was

significant and stable responding was not achieved. She met criterion between days 23 to 25, but inconsistencies and delays in daily data entry created problems with timing the criterion changes. Efforts were then shifted after 17 days to focus on behavior change exclusively within precision teaching methodology using the standard celeration chart. Christine's target behavior did not conform to the pre-specified first criterion or the phase change in which the daily 1-minute timing intervention was switched to two 1-minute timings, one in the morning and one in the afternoon or evening. See Figure 20.

Figure 20

Christine's Changing Criterion Graph

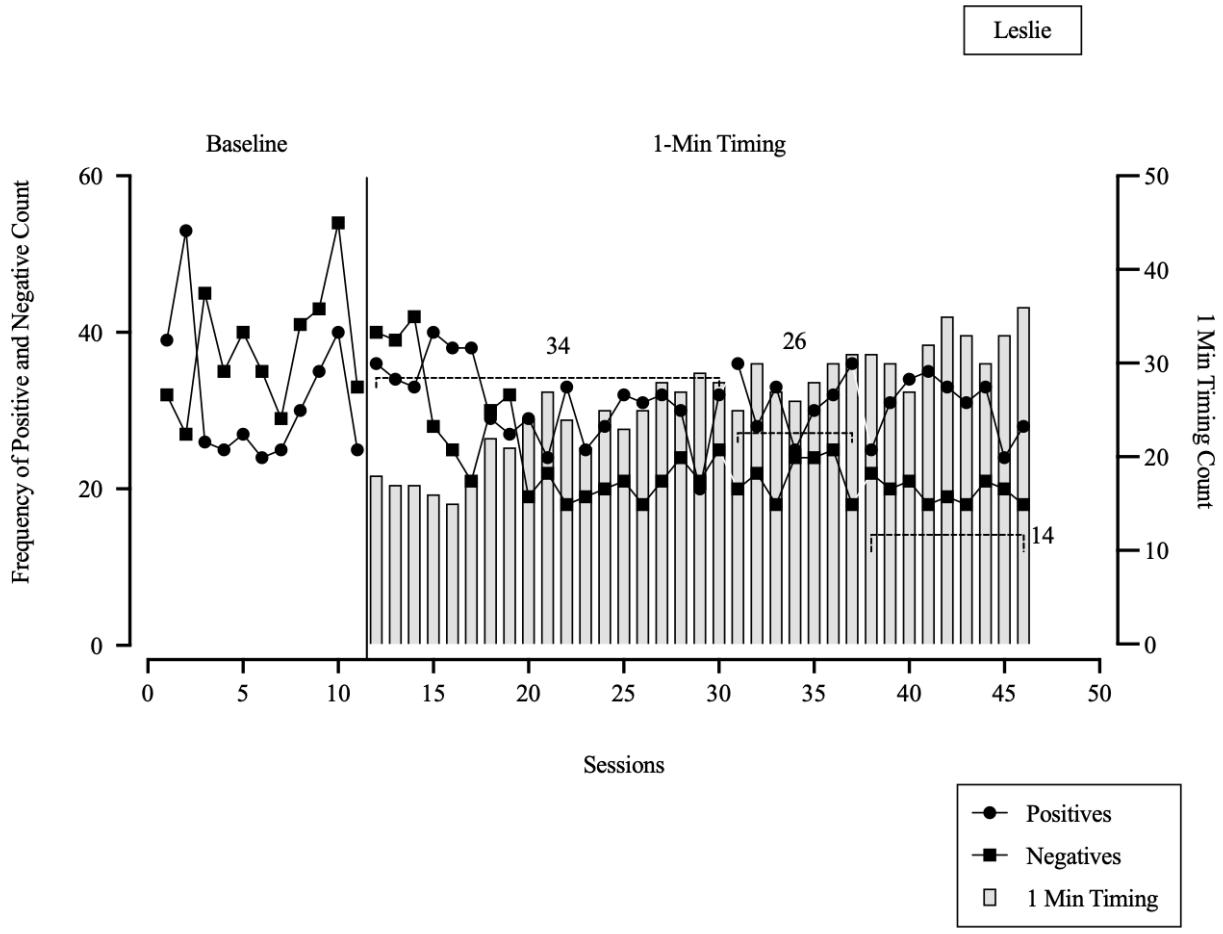


Leslie

Leslie chose negative thoughts and feelings to target for criterion changes in the single-case design component of the study. Leslie's daily baseline negatives ranged from 27 to 45, with a mean of 37 and median of 36. The selected goal for the first criterion was to decrease daily negatives to 7% below her baseline median, or 34 negatives per day. As depicted in Figure 21, a delayed effect from baseline to intervention occurred for three days, followed by a significant drop in negatives that exceeded the first criterion and continued for 16 days. As with Alexis, a new criterion was not established due to a lag in documentation of daily counts on the shared data sheet which continued for over one week. A criterion change to 26, or 20% below the first criterion, was made after data was entered on the shared data sheet. Leslie met the second criterion but did not meet the final criterion change to 14 daily negatives per day. A visual analysis of Leslie's graph shows that her negative inner behavior did not conform to the changing criteria and the 1-minute timing intervention did not demonstrate experimental control over daily frequency of the target behavior.

Figure 21

Leslie's Changing Criterion Graph



Research Question 2: What effect will the intervention package have on participant identification of contextual and environmental variables that occasion unwanted thoughts and feelings?

The intervention appeared to improve the ability of three of the four participants to identify variables that occasion both positive and negative inner behavior. Participants were encouraged to identify any environmental variables that may coincide with an increase or decrease in target behaviors (e.g., changes in regular routines at home or work, leisure activities, relationships, work activities) and enter them in the notes section of their data sheets. Throughout

the study, three of the four participants commented on various contextual and environmental variables that occasioned inner behavior, both positive and negative. For example, Amy noticed her daily negatives were more frequent at night and on days she did not finish work. Christine identified a specific work scenario in which administrators at school complicated behavioral issues among students and staff. Alexis noticed that even minor disruptions in her sleep patterns were closely related to the frequency of her daily negatives.

Some variables identified by the researcher as potential influences on behavior were not identified initially by participants. Amy's decreases in anti-depressant medication closely coincided with drastic changes in her data. Christine had high counts of positives and low counts of negatives on most days she had Special Olympics activities with her students. Christine's daily counts on day 35 may have quantified the pride she feels as a parent when her daughter had her Occupational Therapist Assistant pinning. One participant, Leslie, did not enter notes in her data sheet.

Research Question 3: Will a decrease of negative thoughts and feelings and/or an increase of positive thoughts and feelings improve scores on the MBI?

Participants completed pre and post-tests of the Maslach Burnout Toolkit for Educators. The toolkit comprises two assessments, the Maslach Burnout Inventory (MBI), and the Areas of Worklife Survey (AWS). The MBI assesses occupational burnout by measuring emotional exhaustion, depersonalization, and personal accomplishment. The AWS aims to identify variables in the work environment that may be contributing to burnout by measuring six factors: workload, control, reward, community, fairness, and values. Pre and post changes in MBI and AWS scores are presented in Table 2.

Alexis

Alexis's pre-test MBI scores indicated a moderate level of emotional exhaustion, low level of depersonalization, and moderate level of personal accomplishment. Post scores indicated low levels of both emotional exhaustion and depersonalization and a high level of personal accomplishment.

Pre AWS scores indicated a match between Alexis and her work environment in the areas of control, reward, community, and values. Pre-test scores indicated a mismatch in fairness and a strong mismatch in workload. Post AWS scores indicated neutral or undecided matches in workload, fairness, and values. A match was indicated in community and strong matches between Alexis and her work environment were indicated in control and reward.

Amy

Amy's pre MBI scores indicated a high level of emotional exhaustion, moderate level of depersonalization, and low level of personal accomplishment. Post-tests indicated a high level of emotional exhaustion, moderate level of depersonalization, and low level of personal accomplishment. Pre and post-tests of the MBI showed identical scores for Amy in emotional exhaustion and personal accomplishment and a 1-point higher score for depersonalization.

Pre scores on the AWS indicated a mismatch between Amy and her work environment in the areas of control, reward, and community. A strong mismatch was indicated in workload and fairness. Pre-tests indicated a neutral or undecided match in values. Post-tests indicated a mismatch between Amy and her work environment in control and community and a strong mismatch in workload and fairness. Post scores indicated a neutral or undecided match in reward and values.

Christine

Christine's pre MBI scores indicated a high level of emotional exhaustion, low level of depersonalization, and moderate level of personal accomplishment. Post-tests indicated a moderate level of emotional exhaustion, low level of depersonalization, and high level of personal accomplishment.

Pre scores on the AWS indicated matches between Christine and her work environment in the areas of control and values. A mismatch was indicated in fairness and strong mismatches were indicated in workload and reward. Scores indicated a neutral or undecided match in community. Post-tests indicated neutral or undecided matches between Christine and her work environment in workload, fairness, and values. A match was indicated in community. A strong mismatch remained for reward.

Leslie

Leslie's pretest MBI scores indicated moderate levels of emotional exhaustion and depersonalization and a high level of personal accomplishment. Post-test scores on the MBI indicated low levels of emotional exhaustion and depersonalization and a high level of personal accomplishment.

Leslie's pretest AWS scores indicated only one area, fairness, as a good match between Leslie and her work environment. Pre-test AWS scores indicated a neutral or undecided match in the areas of workload, control, and values. The AWS indicated a mismatch between Leslie and her work environment in community and a strong mismatch in the area of reward. Post-test scores on the AWS improved in the areas of control and reward (match and strong match, respectively). Scores in the community aspect of work worsened.

Table 2.

Comparison of Participant Pre- and Post-Test Scores on the MBI and AWS.

Maslach Burnout Inventory

	Subsections	*Pre-Test*	*Post-Test*	*Increased/Decreased*	*Favorable Outcome*
Alexis	Emotional Exhaustion	22	12	Decreased	√
	Depersonalization	4	1	Decreased	√
	Personal Accomplishment	33	44	Increased	√
Amy	Emotional Exhaustion	39	39	No change	
	Depersonalization	7	12	Increased	
	Personal Accomplishment	30	30	No change	
Christine	Emotional Exhaustion	42	24	Decreased	√
	Depersonalization	8	6	Decreased	√
	Personal Accomplishment	36	40	Increased	√
Leslie	Emotional Exhaustion	18	15	Decreased	√
	Depersonalization	7	6	Decreased	√
	Personal Accomplishment	39	38	Decreased	

Areas of Worklife Survey

	Subsections	*Pre-Test*	*Post-Test*	*Increased/Decreased Match to Work Environment*	*Favorable Outcome*
Alexis	Workload	1.4	3	Increased match	√
	Control	4	5	Increased match	√
	Reward	4.3	4.8	Increased match	√
	Community	4.2	4.2	No change	
	Fairness	2.7	3.2	Increased match	√
	Values	4	3.75	Decreased match	
Amy	Workload	1	1.6	Increased match	√
	Control	2.3	2	Decreased match	
	Reward	2.5	3.8	Increased match	√
	Community	2.8	2.8	No change	
	Fairness	1.5	1.5	No change	
	Values	3	3	No change	
Christine	Workload	1.6	3.2	Increased match	√
	Control	4	4	No change	
	Reward	1.8	1.8	No change	
	Community	3.8	4.2	Increased match	√
	Fairness	2.5	3	Increased match	√
	Values	4	3.25	Decreased match	
Leslie	Workload	3.4	3.4	No change	
	Control	3	4	Increased match	√
	Reward	1	4.5	Increased match	√
	Community	2	1.6	Decreased match	
	Fairness	4.3	4	Decreased match	
	Values	3	3.5	Increased match	√

Social Validity

A social validity survey with 18 items was included in post-tests. As indicated in Table 3, in general, participants found the training for the study adequate and the researcher responsive to concerns, questions, and needs. The length of time to complete the study was reasonable, as was daily data collection requirements. Three of the four participants felt participating in the study had a positive impact on their lives; one special educator indicated the study had only a slight positive impact on her life. One teacher noted students and coworkers "cheered me on. They loved to see the numbers or even just checked to make [sure] I was wearing my trackers." When the study concluded, Alexis shared through email correspondence the overall impact the study had on her life:

> Thank you again for selecting me and working with me along the way. I definitely still use the 1-minute technique often… Even though I don't keep daily tallies anymore - I do notice when I need the extra boost that the one minute of positivity brings! I also use it for times like this week when I know I will be challenged.

Table 3

Social Validity Survey Results

Statements	Alexis's Score	Amy's Score	Christine's Score	Leslie's Score
1. The training provided by the researcher was adequate for this study.	5	5	5	4
2. The length of time to complete the study was reasonable.	5	5	5	5
3. It was easy to define and identify behaviors as positive and negative.	4	3	4	5
4. It was easy to count positive and negative thoughts every day.	4	3	5	3
5. Recording my daily data on the data sheet was easy.	5	5	5	5
6. I found it easy to write a list of positive attributes about myself.	2	4	4	2
7. Generally speaking, being aware of my positive thoughts has made me think more positively.	4	3	5	4
8. Generally speaking, being aware of my negative thoughts has made me think less negatively.	2	2	4	3
9. Toward the end of the study, I found it easier to count and record my positive and negative thoughts during the day.	3	2	5	5
10. Recording my positive thoughts for one minute each day was manageable.	5	5	5	4
11. Recording my positive thoughts for one minute each day while still counting my positive and negative thoughts throughout the day was manageable.	5	5	4	5
12. The purpose of the interventions was clear.	5	4	5	5
13. I will continue to use the techniques I have learned during this study.	5	3	5	4
14. Participating in this study has had a positive impact on my life.	5	2	5	4
15. The things I have learned in this study have had a positive impact on my partner/family/friend's life.	5	0	5	1
16. I followed the recommended self-management guidelines during this study (e.g., rewarding myself and graphing my data).	4	3	4	3
17. The researcher was responsive to my needs, concerns, and/or questions.	5	5	5	5
18. Please enter additional comments here.	*My students and co-workers cheered me on. They loved to see the numbers or even just checked to make I was wearing my trackers.*			

CHAPTER 5: DISCUSSION

A copious amount of published work exists on conceptual interpretations of occupational burnout and the deleterious toll it takes on emotional and physical health; few quality studies have been published in applied research, however, identifying effective interventions to alleviate the symptoms of burnout (Maslach & Leiter, 2018). Even fewer have addressed teacher burnout. Burnout is defined as a response to prolonged occupational stress consisting of three distinct dimensions: emotional exhaustion, depersonalization, and reduced personal accomplishment (Maslach et al., 1986; Skaalvick & Skaalvick, 2017). As mentioned previously, teachers who are burned out often have poor emotion regulation that results in inadequate implementation of instructional strategies; lack of positive behavior interventions and supports (PBIS); impeded access to enriching, reinforcing classroom environments; and higher rates of externalizing and internalizing problem student behavior (Aloe et al., 2014; Herman et al., 2018; Jennings & Greenberg, 2009; Jennings et al., 2017; Madigan & Kim, 2021; Skaalvik & Skaalvik, 2017). Special education teachers, particularly those who work with students with significant behavioral needs, are at greater risk for burnout (Gilmour et al., 2021; Hopman et al., 2018). It is imperative this at-risk group gains skills to cope with the increasing demands placed on them by their profession and the larger community. Decades of research have revealed specific work-related and personal variables that contribute to the burnout phenomenon (Maslach & Leiter, 2018). Teachers rarely have the autonomy or authority to control all work-related variables contributing to burnout. They do, however, have some control over influential behavioral patterns and personal variables related to burnout. This study aimed to: (a) measure the effect precision teaching and self-management strategies have on the inner behavior (thoughts and feelings) of classroom special education teachers; (b) examine the effect of interventions on participant

identification of contextual and environmental variables that occasion inner behavior; and (c) examine subsequent changes in symptoms of teacher burnout as measured by pre and post-tests of the Maslach Burnout Toolkit for Educators (MBI).

Experimental Analysis of Inner Behavior

Discussion related to the purpose, methods, and results of this study is firmly grounded in the spirit of radical behaviorism, its overarching purpose, and its assumptions about the role private events play within behavior analysis. Skinner considered private events distinguishable from public only in their inaccessibility to outside observers (Skinner, 1965). Private events are not products of a nonphysical mental world. Inner behavior is therefore a function of the environment and subject to the same contingencies as outer behavior. The influence of environment makes it possible to "examine the effect of the world within the skin and the nature of self-knowledge" (Skinner, 1976, p. 19). Given this assumption, the field of applied behavior analysis is in a unique position to expand its influence and improve the lives of countless people. Controversies endure, however, regarding the role private events play in the science and analysis of behavior (Dixon et al., 2018). This debate continues within the field of behavior analysis despite numerous empirical examples in the literature demonstrating that inner behavior conforms to Skinner's assumptions about private events and can be measured directly through self-measurement. No scientific method is perfect, and improvements must be made regarding accuracy, reliability, and lack of interobserver agreement (Kostewicz et al., 2000). This is not a sound reason to delay experimental analysis of inner behavior. To quote Calkin (2009):

> We could wait until we find some guaranteed way to monitor inner behaviors, or we can proceed with the knowledge and skills we have now, knowing that some mistakes may be made. I think these potential mistakes will be minor, procedural, and correctable. It is not

a strategic error to proceed, but quite the opposite: It is a strategic error not to proceed. (p. 64)

Summary and Interpretation of Key Findings Related to Research Questions

The research questions of this study examined the extent to which an intervention package with elements of precision teaching and self-management would (a) influence targeted inner behaviors of special education teachers; (b) aid in participant identification of environmental variables that occasion targeted inner behaviors; and (c) result in a subsequent improvement in post-assessment measures of burnout. In general, findings from analyses of the standard celeration charts indicated two participants responded favorably to the intervention, one participant responded slightly favorably to the intervention, and one participant's inner behavior slightly worsened after the intervention. Single and multiple phase analyses indicated favorable behavior changes were often small and varied between phases for all participants. A functional relation was not demonstrated for any of the participants in the single-case design component of the study, as three demonstrations of effect were not present and the recommended guidelines for a changing criterion design were not met, such as the presence of at least three criterion changes in which the target behavior closely conformed to the changing criteria (Cooper et. al, 2020; McDougall, 2005). In addition, visual analysis of the changing criterion graphs for all three participants indicated they did not respond in predicted ways from baseline to intervention implementation.

Three of the four participants regularly entered notes in their shared data sheet on days they felt their daily counts had been influenced by environmental events or other variables. Analyses of outliers on standard celeration charts identified data points coinciding with these events, suggesting participants did become more competent at identifying variables that

occasioned positive and negative inner behavior. Some were obvious situations one would expect, such as an increase in negatives on the day of a spouse's mental health emergency, or reductions in antidepressant medication and a delayed concurrent decrease in positives. Some correlations were more subtle and unexpected, however, such as consistently higher counts in positives on days Special Olympics activities happened during the workday, or the realization that student behavior issues in the classroom occasioned an increase in negatives only when administrators became involved. The researcher and participants corresponded regularly about these incidents, and participants were able to make changes to their schedules and engage in activities to manage work stressors. Participants were also prompted to self-reinforce for identifying and managing variables within their control. These findings are notable because they underscore the importance of providing skills training to identify and manage work-related variables that contribute to burnout.

The MBI measures burnout in three broad domains—emotional exhaustion, depersonalization, and personal accomplishment. Pre and post MBI scores improved for three participants and reflected no change for one participant. Alexis and Christine's average pre and post scores on the MBI showed an improvement in all three subscales. While direct relations cannot necessarily be concluded between the intervention and improvements in scores, one can speculate the intervention's influence on feelings of emotional exhaustion, depersonalization, and personal accomplishment were positive. For these two participants in particular, the outcome of this intervention resulted in an increase in feelings of coping and self-efficacy and a decrease in feelings of helplessness and dependence. Prior research, discussed at length in Chapter 2, has shown teachers who have lower emotional exhaustion have better classroom management skills, which can affect student academic and behavioral outcomes. Because 12 or more weeks elapsed

from pre to post-tests, it is impossible to rule out various confounds such as maturation when interpreting results. Qualitative data from the data collection sheets, as well as data from standard celeration charts, do generally correspond to changes in MBI scores.

The AWS measures six work-related variables—workload, control, reward, community, fairness, and values—to indicate if there is a match or mismatch between an individual and their work environment. Improvements in pre and post scores on the AWS were comparable to changes in pre and post scores on the MBI for all four participants. As with MBI post-test scores, direct relations cannot be concluded between the intervention and improvements in scores; however, improvements could indicate teachers became more competent at identifying and changing real or perceived work-related variables contributing to burnout. Worsening scores could signify an incompatible workplace in which work-related variables contributed more significantly to burnout than individual variables. For example, Alexis's improved scores on the control and reward subscales may indicate she became more adept at identifying and accessing a broader range of reinforcers in her work environment. She involved her students and colleagues in the goals of the study, and they provided encouragement and support. Christine's improvement on the values subscale from neutral or undecided to a match with her school could indicate a similar expansion of access to reinforcement—Christine noticed a substantial increase in daily positive inner behavior on days she had Special Olympics activities at work. Leslie's improved match with her school on the reward subscale could indicate increased recognition and greater reinforcement for her performance as a teacher. Finally, Amy's pre and post scores on the AWS showed improvement only in reward, moving from an average score of 2.5 (mismatch) to 3.8 (neutral or undecided). Amy's static scores on AWS subscales may indicate work-related

variables contributing to her burnout were sizable and resistant to change. Amy's data and participation are discussed in depth in the Implications for Practice section.

Inner Behavior and Consistencies in Standard Celeration Charts

Behavior changes that occurred among the four participants cannot be attributed solely to the 1-minute timing procedure or any individual intervention component; however, it is important to note expected patterns emerged in the standard celeration charts. Figure 22 presents a comparison of Alexis and Christine's charts replicating findings from previous studies on inner behavior. Introduction of the 1-minute timing corresponds with an increasing separation of daily positives and negatives compared to baseline (positives accelerate and negatives decelerate). Figure 23 illustrates this within phases and across phases. Single phase analysis of Alexis's chart shows a robust deceleration in negatives and accuracy improvement measure (AIM) indicating substantial improvement in accuracy during phase 2. Similarly, single phase analysis of Christine's chart shows the separation occurring during phase 1.

Figure 22

Comparison of Alexis's and Christine's Standard Celeration Charts

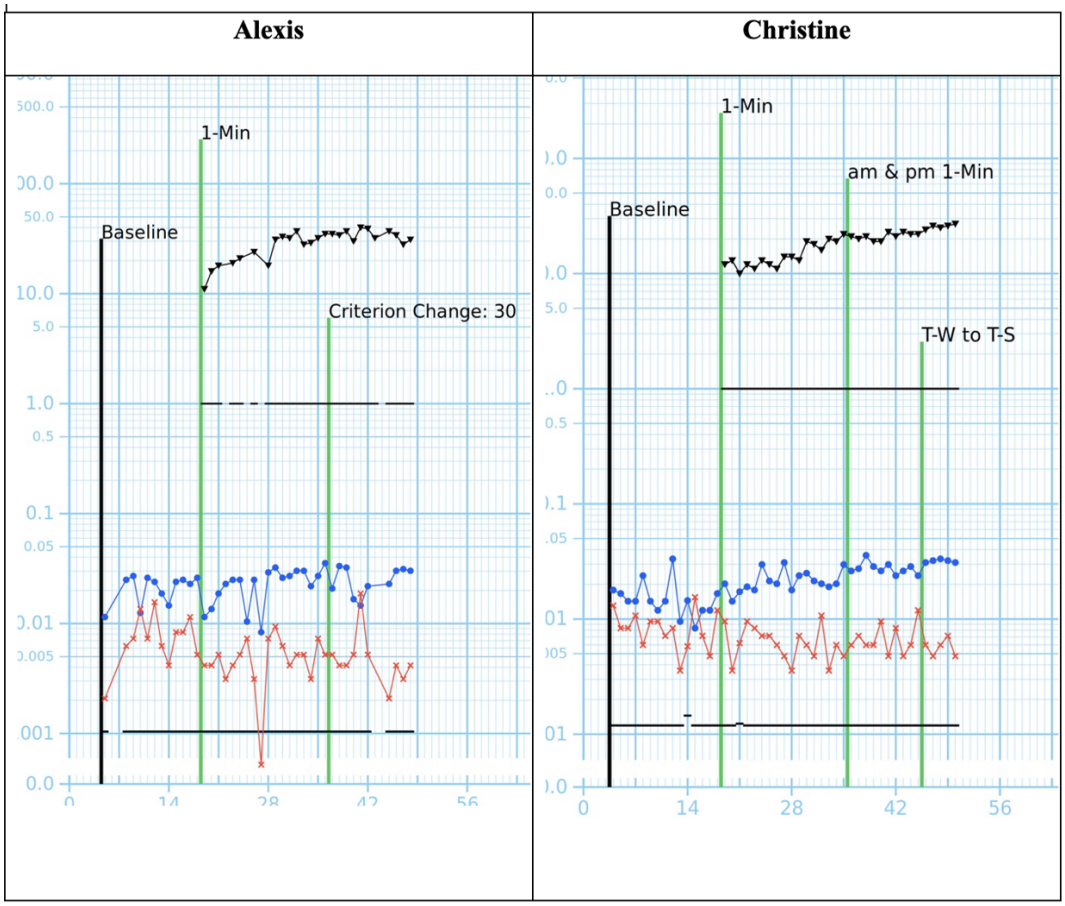
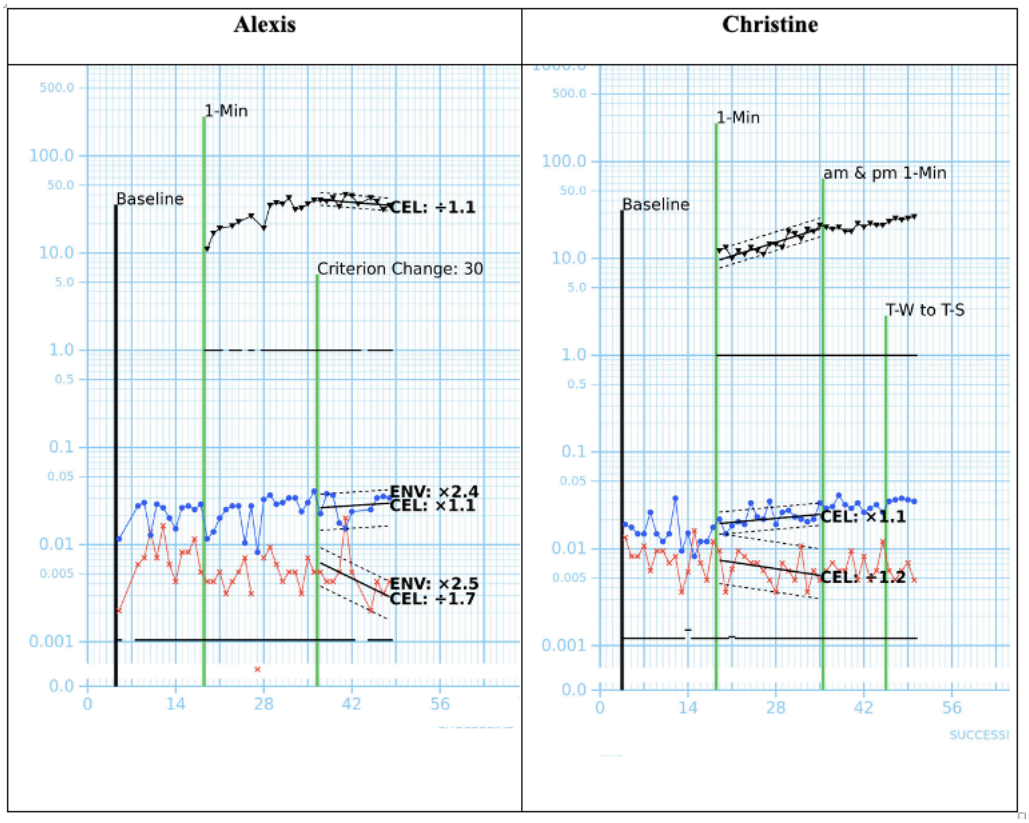


Figure 23

Single Phase Analysis of Alexis's and Christine's Standard Celeration Charts

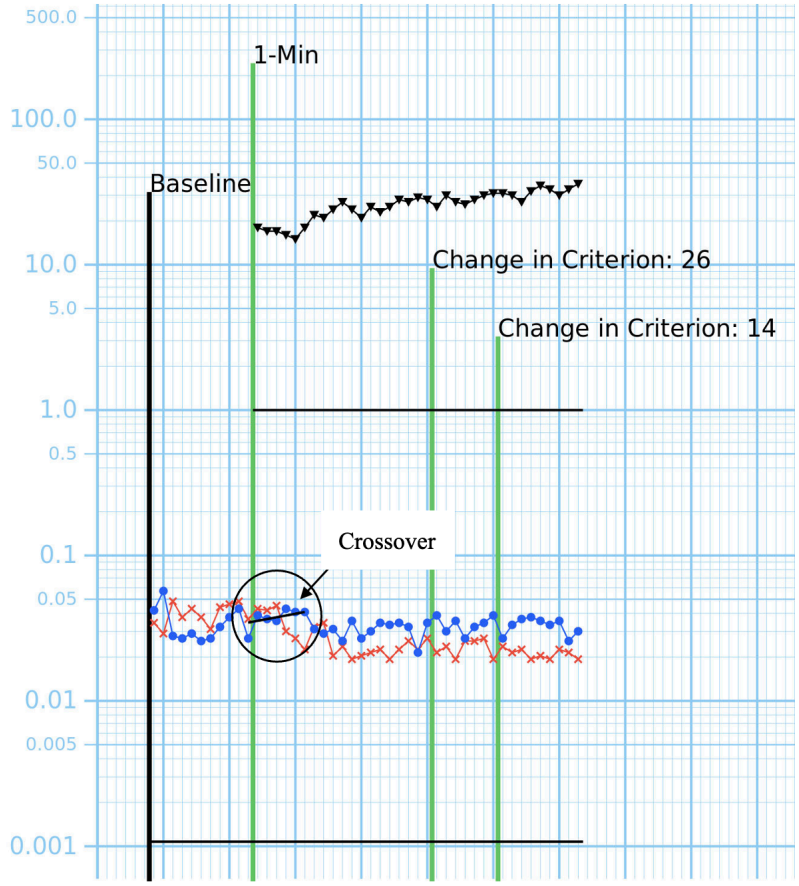


A close look at Leslie's standard celeration chart reveals a subtle but important change that occurred when the 1-minute timing intervention began: crossover between positives and negatives with a celeration value of x1.2. Figure 24 shows this change occurred on day 15 and, with the exception of day 19, continued for the rest of the study. The standard celeration chart allows analysis of very subtle changes in behavior often overlooked at first glance. While one might first conclude the celeration growth on Leslie's chart is unimpressive or insignificant, the fact that she began the study with a higher frequency of daily negatives and ended the study with a higher frequency of daily positives—a trend lasting for 27 days—is impressive. Progress can be gauged in multiple ways using the standard celeration chart, highlighting the many benefits of

this approach to charting behavior and the powerful behavior change recorded via behavior dynamics.

Figure 24

Crossover in Leslie's Standard Celeration Chart



This study produced similar findings cited by Calkin (2009) in several of the conclusions about inner behavior from 50 years of prior research. For example, all four participants were able to count their own thoughts and feelings. Combined, their inner behaviors showed consistent frequency ranges from 0 to 90 and did not go above 100 (positives ranged from 7 to 90; negatives ranged from 0 to 72). Inner behaviors changed by a multiply factor. Based on analyses of the standard celeration charts and qualitative data from participants, it is reasonable to conclude three of the four participants' inner behavior was influenced by the 1-minute timing to

some degree. Frequency and celeration co-varied, counter-varied and varied independently across participants. Because maintenance data were not taken on the four participants, this investigation cannot confirm that a x10 to x20 accuracy ratio of positives and negatives, with positives being higher, must occur to maintain significant change in inner behavior. At conclusion of the study, Alexis had an accuracy ratio of x7.5; Christine had an accuracy ratio of x6; Amy had an accuracy ratio of x2.4; and Leslie had an accuracy ratio of x1.5. All four participants exited the study with a higher daily number of positive thoughts and feelings than negative thoughts and feelings. When considering this last statement at an individual level, the social significance of having more positive thoughts about oneself could be monumental. For someone who was experiencing burnout to shift their inner thoughts about themselves to become more positively framed may potentially lead to more contented, effective teachers who stay in their teaching positions the following year.

Implications for Practice

Behavior analysis as a science and practice is devoted to improving socially significant behavior. Because many behavior analysts remain hesitant to include private events as subjects of study in applied or experimental settings, our influence and ability to affect change in socially significant areas of human behavior are limited. Skinner (1974) asserted radical behaviorism does not require truth by agreement, does not consider private events to be unobservable, and does not "dismiss them as subjective" (p. 18). Lindsley stated in 1971 precision teaching's greatest contribution to humanity would be its ability to effectively chart and change inner behavior (Calkin, 2009). This study made contributions to the fields of applied behavior analysis and special education by replicating precision teaching research in inner behavior to alleviate

symptoms of burnout in K-12 special education teachers. Findings from the current investigation indicate five general implications for practice.

Therapeutic Alliance

First, professional and therapeutic relationships teachers build have the potential to mediate behavioral outcomes (Baier et al., 2020). A positive school climate fostering equitable, trusting alliances among staff may aid in burnout prevention, identification, and treatment (Jennings & Greenberg, 2009; Maslach & Leiter, 2017; Pressley, 2021). For example, the positive researcher-participant relationship that developed during this study helped navigate concerns over Amy's lack of progress, despite her enthusiasm and willingness to carry out all tasks. Multiple events occurred in Amy's possibly contributing to worsening data, including antidepressant medication changes. The researcher monitored daily progress and conducted daily check-ins with Amy, encouraging her to exit the study at any time she felt she was not benefitting from the intervention. She expressed a desire to continue and completed all tasks. Trust and open communication allowed her to stay in the study and potentially gain skills which could help her later. This situation beckons a larger discussion regarding researcher-participant relationships, with implications for administrator-teacher relationships in school settings.

Baier et al. (2020) presented a compelling case for practitioners in behavioral science to establish strong positive relationships with clients. Therapeutic alliance is characterized by agreement on treatment goals and the "formation of a positive emotional bond" between client and therapist (Baier et al., 2020, p. 2). Under the right conditions, therapeutic alliance can be a mechanism of change and mediate positive therapeutic outcomes, including symptom reduction. Recommended practices fostering therapeutic alliance include regular monitoring of progress, adjusting therapy accordingly, and gathering client feedback specifically on the alliance. The

process of therapeutic alliance can be established between researcher and participant to protect participants in behavioral research, particularly when they are not responding as expected to the intervention but wish to remain in the study. In schools, administrators can adopt a similar approach to mediate outcomes related to teacher social and emotional well-being (Pressley, 2021).

Stakeholder Involvement in the Process

Second, schools can reduce the occurrence of teacher burnout by involving all stakeholders in the process of burnout identification, prevention, and treatment. One participant noted in the social validity survey her students and coworkers became enthusiastically involved with her daily data collection, cheering her on as she progressed. This allowed her access to potent reinforcers in the work environment as she modeled self-management to her students and colleagues. The process created a positive, supportive climate and provided critical components of social and emotional learning (SEL) to teachers and students (Jennings et al., 2017; Skaalvick & Skaalvick, 2011; 2017).

Behavior Documentation Using the Standard Celeration Chart

Third, the standard celeration chart provides documentation of behavior change and the variables that occasion them better than typical procedures used in employment settings. Teachers who are experiencing stress at work or who have been placed on improvement plans can use these strategies to provide tangible measurement of progress to administrators. Measurement by self-reports, surveys, and teacher evaluations give only a momentary glimpse or snapshot of behavior at the time it is reported. They do not measure change in behavior across time. For this reason, precision teaching and the standard celeration chart have several advantages (Calkin, 2005; Lindsley, 2010); however, explicit and systematic training is required.

Designated Burnout Specialist

Fourth, the spillover effect from work to home, a common result of burnout (Maslach & Leiter, 2017) may be mitigated in schools by abandoning the erroneous conception that teachers can effectively separate their personal and professional lives. Three of the four participants in this study commented frequently regarding how difficult it is for them to separate the two. Efforts to do so compounded their feelings of burnout. Thoughts and feelings teachers have about self-efficacy, personal identity, and personal values are deeply rooted in their professional identity as teachers (Skaalvick & Skaalvick, 2017). Because teachers' personal and professional lives are often inextricably connected, schools may see reductions in burnout if they accept this actuality and use it to their advantage. One possible strategy could be the assignment of a designated on-site staff or counselor to take on the role of burnout specialist, providing incentives to teachers for early screening and coaching. In addition, long-term monitoring and reinforcement for measured progress would likely maintain behavior changes.

Increased Use of Precision Teaching in Schools

Finally, this study demonstrated the influence precision teaching methods had on teacher inner behavior. Likewise, these methods could control academic and nonacademic student behavior with subtle and fine-grained accuracy. Currently, schools in 35 American states and 12 countries use comprehensive precision teaching techniques (Haring et al., 2019). Morningside Academy, a "laboratory school" in Seattle, Washington, combines precision teaching with other methods in the Morningside Model of Generative Instruction, which has produced such significant gains in student achievement it guarantees parents two or more years' growth in the area of their children's greatest deficit (Johnson et al., 2021, p.1). In 40 years, Morningside Academy has returned less than 1 percent of school year tuition. Classroom management, a

significant contributor to teacher burnout, is prioritized at Morningside with use of strategies such as the daily support card. Adopting these strategies in more schools may improve variables commonly cited as causes of teacher burnout.

Limitations

As with all studies, this study presented several limitations. First, all training, communication, and data collection procedures transpired online. Participants entered daily counts and notes from the previous day into a word document on the shared GoogleDrive. All four participants reported it was more convenient to download and print the document, write daily counts on it, and enter data later on the shared drive. Thus, all four participants were regularly one to three days behind entering data and decisions about criterion changes and other variables were often delayed. In-person communication, particularly during training, may be more effective.

Second, the self-management component of the intervention package was not explicitly monitored by the researcher. Self-management includes self-monitoring, or observing and recording one's own behavior, and graphing or charting progress. A crucial part of precision teaching is self-charting on the standard celeration chart. Participants in this study were not trained to use the standard celeration chart; they were given simple line graphs and encouraged to graph their own daily data. All four participants reported only loosely following recommended self-management strategies. Progress may have been more significant if participants, rather than the researcher, had charted their own data on standard celeration charts.

Third, precision teaching research and single-case design are two different methodologies with different goals. While research exists successfully utilizing both methods with academic behavior (e.g., Datchuk et al., 2015), this study did not benefit from this approach. Precision

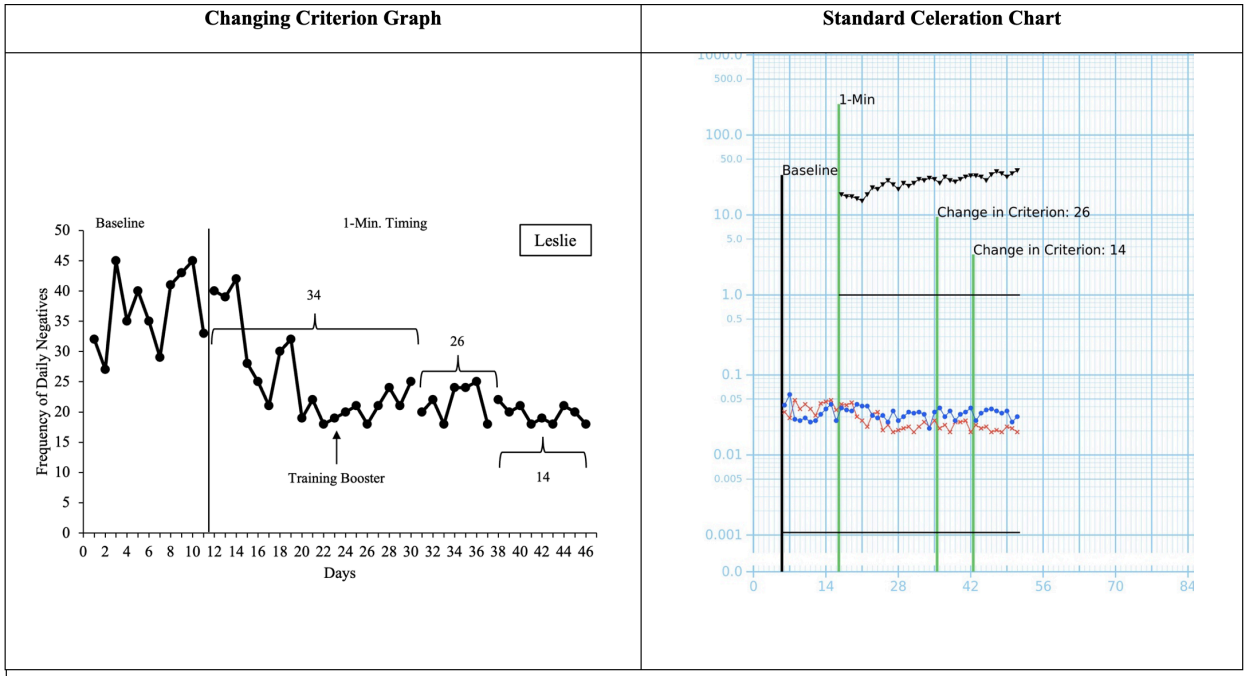
teaching employs a design called behavior dynamics, which is the study of behavior change. Change is measured on the standard celeration chart within and across phases, instructional decisions are made, and variables or interventions are manipulated to produce successful behavior change (Kubina, 2020; Kubina & Yurich, 2013). Single-case designs aim to establish experimental control by demonstrating functional relations between independent and dependent variables, primarily focusing on steady state responding. Thus, a competing situation between the two methodologies occurred in which behavior changes on participants' standard celeration charts, which would normally signal an instructional decision by the researcher to manipulate the intervention or change other variables, had to be ignored because steady state responding on the changing criterion graphs had not been established. In addition, the two visual displays illustrated different and conflicting pictures of behavior change. For example, in Figure 25 Leslie's changing criterion graph suggests a more significant change in behavior from baseline to intervention than her standard celeration chart does. One major advantage of the standard celeration chart is the ability to monitor subtle changes in multiple behaviors simultaneously.

Finally, the daily data collection tasks of the current study may be overwhelming for some teachers to carry out when they are experiencing higher levels of burnout or stress. Several weeks elapsed from MBI pre-tests and consent to baseline data collection. Before the study began, concerns arose over potential changes in levels of burnout that may have transpired over time. To ensure participants were not experiencing crisis-level burnout symptoms, participant training included a short interview regarding their current emotional state. All participants confirmed during training that their current burnout level was manageable and not severe. Nevertheless, Amy's participation in the study occurred simultaneously with significant antidepressant medication changes. Changes in the data on her standard celeration chart appeared

to correspond with changes one might expect in inner behavior with antidepressant medication reduction. Methods used in the current study may not be appropriate for teachers who are experiencing significant medication changes or who cannot commit fully to daily data collection procedures due to their lifestyles, workloads, schedules, or other personal factors.

Figure 25

Comparison of Leslie's Standard Celeration Chart and Changing Criterion Graph



Future Research

Future research should include participant trainings that: (a) specify targeted inner behavior explicitly, with discussions about what qualifies as one discrete instance of behavior, including many examples and nonexamples; (b) include components of in-person and synchronous training and communication; and (c) include complete training and self-charting on the standard celeration chart. Participants in the current study had a difficult time distinguishing one discrete occurrence of inner behavior from another. For example, the inner behavior chain referred to as "rumination" often starts with one thought and is accompanied by more thoughts

and feelings, occurring simultaneously, that go on for some duration of time before the participant becomes aware it is happening. A rule regarding what qualifies as one occurrence of inner behavior, applied consistently across participants, can produce a more accurate count. Other dimensions of inner behavior, such as duration, should be included.

Future studies must include investigations exclusively employing behavior dynamics designs. Researchers should be cautious when combining precision teaching methods for inner behavior and other methods such as a single-case design like changing criterion design. Precision teaching is an inherently elegant, efficient measurement and decision-making system on its own. Participants who experience undesirable changes in inner behavior, or who are not responding to an intervention, deserve a swift and decisive instructional change. Waiting for steady state responding in these scenarios is unethical and the additional method often interferes with mechanisms automatically built into precision teaching that produce significant behavior change. The learner knows best.

Finally, future research should focus on examining the standard celeration charts we have thus far on inner behavior and establishing significance guidelines with new language. Inner behavior changes, as with outer behavior changes, are often subtle. While it is entirely appropriate to refer to growth celerations of x1.2 as “unacceptable” when analyzing academic behavior change, a growth celeration of x1.2 in positive thoughts and feelings in a participant experiencing burnout is welcome and acceptable. We need to create different and better ways of talking about changes in inner behavior.

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APPENDIX A

Participant Data Sheet

Participant Identifier:

Day. Date	Total # of Daily Positives	Total # of Daily Negatives	Total #- One-Minute Timing	Notes/Questions
1.			X	
2.			X	
3.			X	
4.			X	
5.			X	
6.			X	
7.			X	
8.			X	
9.			X	
10.			X	
11.			X	
12.			X	
13.			X	
14.			X	
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APPENDIX B

Precision Teaching Significance Tables

Significance for Acceleration Data	
Unacceptable growth celerations	x1.0- x1.25
Acceptable growth celerations	x1.25- x1.4
Robust growth celerations	x1.4- x1.8
Exceptional growth celerations	x1.8- x2.0
Massive growth celerations	x2.0- x3.0
Super-massive growth celerations	x3.0+

(Kubina & Yurich, 2012; Pennypacker et al., 2003)

Bounce Smoothness/Regularity Rating	
Smooth and consistent	x1.0- x3.0
Bumpy, less regular, and moderately variable	x3.0- x6.0
Choppy, inconsistent, and variable	x6.0- x10
Exceptionally erratic and very irregular	x10+

(Kubina & Yurich, 2012; Pennypacker et al., 2003)

Significance for AIM Values	
AIM Value	Significance
x1.0	No change
x1.0 – x1.2	Very slight accuracy improvement
x1.2 – x1.3	Small accuracy improvement
x1.3 – x1.5	Adequate accuracy improvement
x1.5 – x2.0	Substantial accuracy improvement
x2.0 – x3.0	Exceptional accuracy improvement
x3.0+	Extraordinarily remarkable accuracy improvement

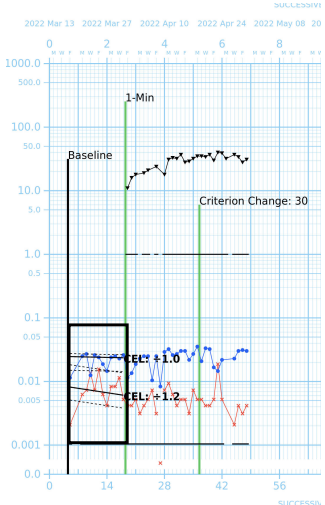
(Kubina & Yurich, 2012; Pennypacker et al., 2003)

APPENDIX C

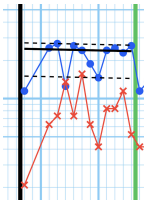
Participant Single and Multiple Phase Analysis Figures

Alexis

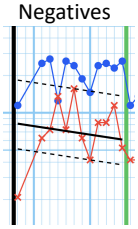
SCC Single Phase Analysis: **Baseline**



Positives



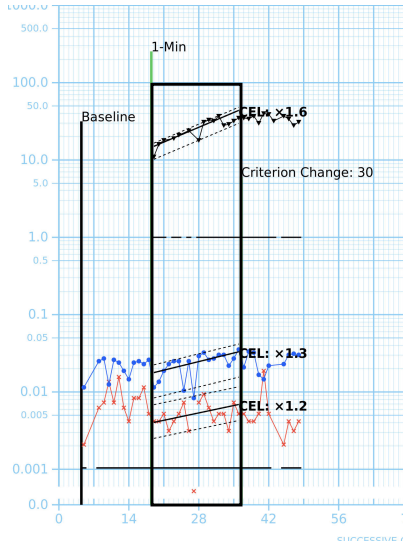
Negatives



Baseline Baseline Length- 14 Days	
Measures	Participant Data
Frequency Range	(a) Acceleration Target (Positives): 11- 26 (b) Deceleration Target (Negatives): 2- 15
Celeration	(a) Acceleration Target (Positives): x1.0 (b) Deceleration Target (Negatives): ÷1.2
Bounce	(a) Acceleration Target (Positives): x1.8 [14 days] (b) Deceleration Target (Negatives): x3.6 [14 days]
Outliers	(a) Acceleration Target (Positives): Lowliers, days 1 (11) and 6 (12) (b) Deceleration Target: Highlier, day 1 (2)
AIM	x1.2 [14 days]

Alexis

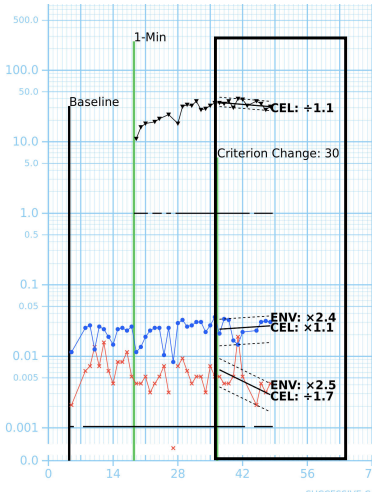
SCC Single Phase Analysis: **Phase 1**



Single Phase Analysis: First Criterion- Acceleration to 25 Positives Phase Length- 18 Days	
Measures	Participant Data
Frequency Range	(a) Acceleration Target (Positives): 8- 34 (b) Deceleration Target (Negatives): 0- 9 (c) 1-Min Timing: 11- 35
Celeration	(a) Acceleration Target (Positives): x1.3 (b) Deceleration Target (Negatives): x1.2 (c) 1-Min Timing: x1.6
Bounce	(a) Acceleration Target (Positives): x2.7 [18 days] (b) Deceleration Target (Negatives): x2.7 [18 days] (c) 1-Min Timing: x1.6
Outliers	(a) Acceleration Target (Positives): One lowlier, day 23 (8) (b) Deceleration Target: Two highliers, day 23 (0) and day 30 (3) (c) 1-Min Timing: None
AIM	÷1.1 [18 days]

Alexis

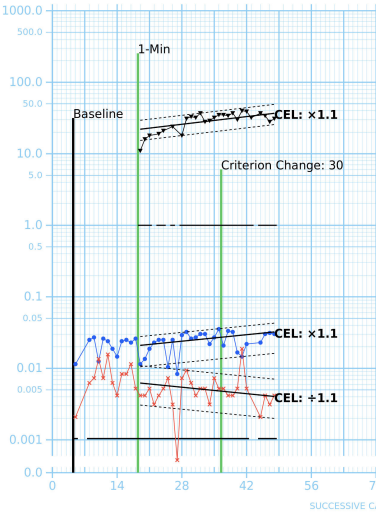
SCC Single Phase Analysis: **Phase 2**



Single Phase Analysis: Second Criterion- Acceleration to 30 Positives Phase Length- 12 Days	
Measures	Participant Data
Frequency Range	(a) Acceleration Target (Positives): 14- 32 (b) Deceleration Target (Negatives): 2- 18 (c) 1-Min Timing: 28- 40
Celeration	(a) Acceleration Target (Positives): x1.1 (b) Deceleration Target (Negatives): ÷1.7 (c) 1-Min Timing: ÷1.1
Bounce	(a) Acceleration Target (Positives): x2.4 [12 days] (b) Deceleration Target (Negatives): x2.5 [12 days] (c) 1-Min Timing: x1.3
Outliers	(a) Acceleration Target (Positives): None (b) Deceleration Target: Lowlier on Day 37 (c) 1-Min Timing: None
AIM	x1.9 [12 days]

Alexis

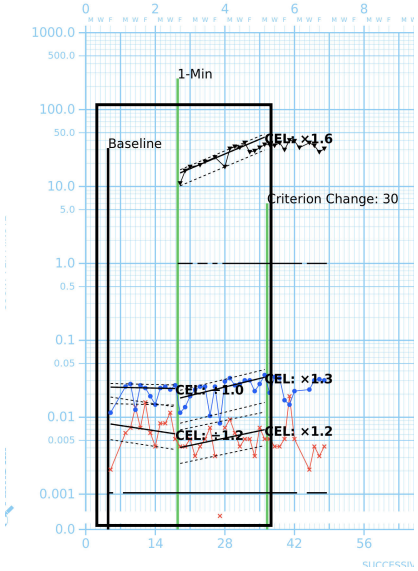
SCC Single Phase Analysis: Total **1-Min.**



Single Phase Analysis: 1-Min. Timing Phase Length- 30 Days	
Measures	Participant Data
Frequency Range	(a) Acceleration Target (Positives): 8- 34 (b) Deceleration Target (Negatives): 0- 18 (c) 1-Min Timing: 11- 40
Celeration	(a) Acceleration Target (Positives): x1.1 (b) Deceleration Target (Negatives): ÷1.1 (c) 1-Min Timing: x1.1
Bounce	(a) Acceleration Target (Positives): x2.6 (b) Deceleration Target (Negatives): x3.5 (c) 1-Min Timing: x1.9
Outliers	(a) Acceleration Target (Positives): Lowliers, Days 21 (10) and 23 (8) (b) Deceleration Target: Lowlier, Day 37 (c) 1-Min Timing: Lowlier, Day 15 (11)
AIM	x1.2 [30 days]

Alexis

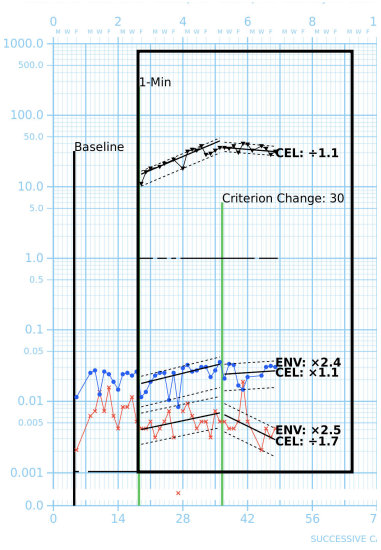
SCC Multiple Phase Analysis: **Baseline to Phase 1**



Multiple Phase Analysis: Baseline to First Criterion- Acceleration to 25 Positives	
Measures	Participant Data
Frequency Multipliers (Jumps)	(a) Acceleration Target (Positives) Baseline to 1-min: ÷2.3 (b) Deceleration Target (Negatives) Baseline to 1-min : ÷1.3
Celeration Multipliers (Turns)	(a) Acceleration Target (Positives) Baseline to 1-min: x1.3 (b) Deceleration Target (Negatives) Baseline to 1-min: x1.4
Bounce Changes	(a) Acceleration Target (Positives) Baseline to 1-min: x1.8 to x2.7 (b) Deceleration Target Baseline to 1-min: x3.6 to x2.7
AIM	○ Baseline: x1.2 [14 days] ○ Phase 1: ÷1.1 [18 days]

Alexis

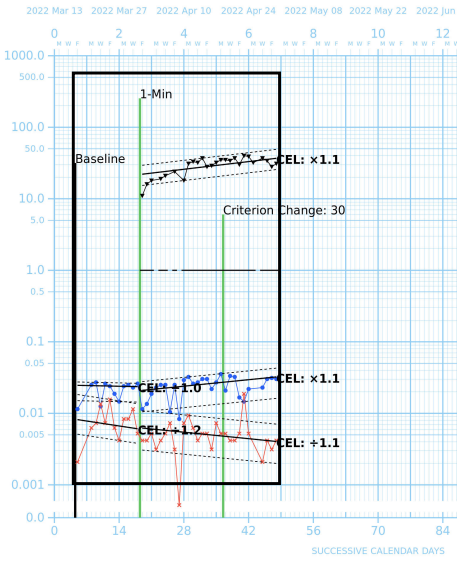
SCC Multiple Phase Analysis: **Phase 1 to Phase 2**



Multiple Phase Analysis: Criterion Phase 1 to Phase 2	
Measures	Participant Data
Frequency Multipliers (Jumps)	(a) Acceleration Target (Positives) Phase 1 to Phase 2: ÷1.7 (b) Deceleration Target (Negatives) Phase 1 to Phase 2: x1 (no change)
Celeration Multipliers (Turns)	(a) Acceleration Target (Positives) Phase 1 to Phase 2: ÷1.2 (b) Deceleration Target (Negatives) Phase 1 to Phase 2: ÷2.0
Bounce Changes	(a) Acceleration Target (Positives) Phase 1 to Phase 2: x2.7 to x2.4 (b) Deceleration Target Phase 1 to Phase 2: x2.7 to x2.5
AIM	○ Phase 1: ÷1.1 [18 days] ○ Phase 2: x1.9 [12 days]

Alexis

SCC Multiple Phase Analysis: **Baseline to Total 1-Min**

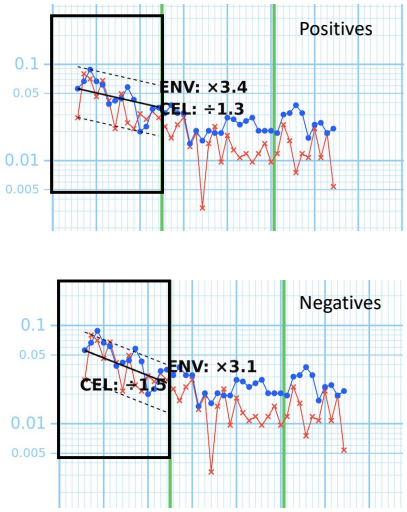


Multiple Phase Analysis: Baseline to 1-Min.	
Measures	Participant Data
Frequency Multipliers (Jumps)	(a) Acceleration Target (Positives) Phase 1 to Phase 2: ÷2.0 (b) Deceleration Target (Negatives) Phase 1 to Phase 2: ÷2.8
Celeration Multipliers (Turns)	(a) Acceleration Target (Positives) Phase 1 to Phase 2: x1.1 (b) Deceleration Target (Negatives) Phase 1 to Phase 2: ÷1.1
Bounce Changes	(a) Acceleration Target (Positives) Phase 1 to Phase 2: x1.8 to x2.6 (b) Deceleration Target Phase 1 to Phase 2: x3.6 to x3.5
AIM	○ Baseline: x1.2 [14 days] ○ 1-Min: x1.2 [30 days]

Alexis

Amy

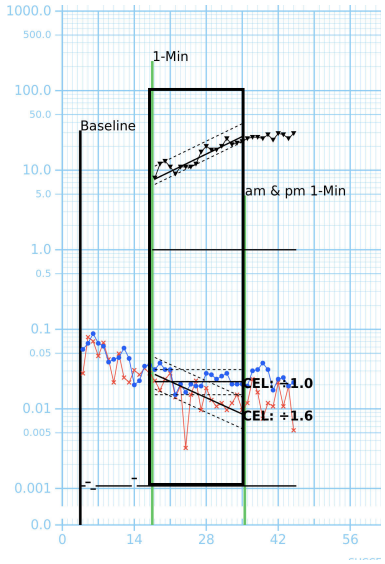
SCC Single Phase Analysis: **Baseline**



Baseline Baseline Length- 14 Days	
Measures	**Participant Data**
Frequency Range	(a) Acceleration Target (Positives): 15- 90 (b) Deceleration Target (Negatives): 20- 72
Celeration	(a) Acceleration Target (Positives): ÷1.3 (b) Deceleration Target (Negatives): ÷1.5
Bounce	(a) Acceleration Target (Positives): x3.4 (b) Deceleration Target (Negatives): x3.1
Outliers	(a) Acceleration Target (Positives): None (b) Deceleration Target: None
AIM	÷1.2 [14 days]

Amy

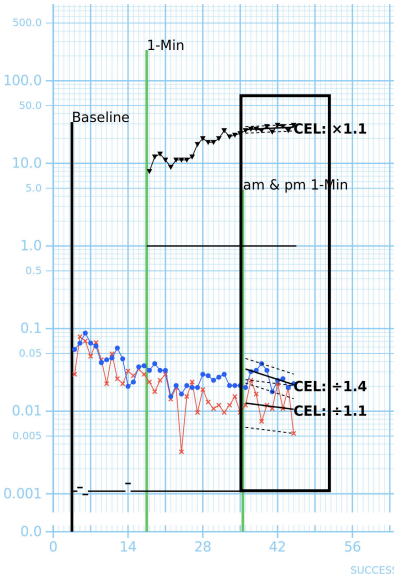
SCC Single Phase Analysis: **Phase 1**



Single Phase Analysis: First Criterion- Acceleration to 50 Positives Phase Length- 18 Days	
Measures	Participant Data
Frequency Range	(a) Acceleration Target (Positives): 14- 35 (b) Deceleration Target (Negatives): 3- 26 (c) 1-Min Timing: 8- 25
Celeration	(a) Acceleration Target (Positives): x1.0 (b) Deceleration Target (Negatives): ÷1.6 (c) 1-Min Timing: x1.7
Bounce	(a) Acceleration Target (Positives): x2.1 (b) Deceleration Target (Negatives): x2.5 (c) 1-Min Timing: x1.7
Outliers	(a) Acceleration Target (Positives): None (b) Deceleration Target: Highlier, Day 21 (3) (c) 1-Min Timing: None
AIM	÷1.6 [18 days]

Amy

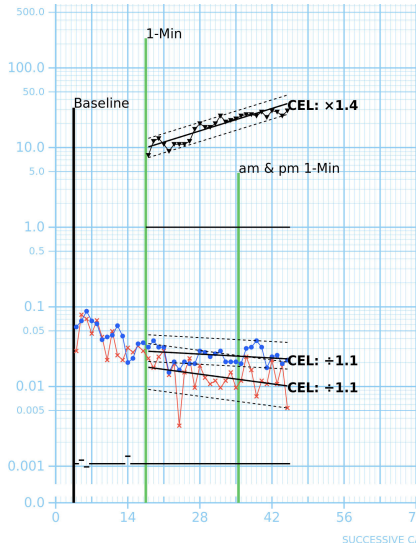
SCC Single Phase Analysis: **Phase 2**



Single Phase Analysis: am & pm 1-Min. Phase Length- 10 Days	
Measures	Participant Data
Frequency Range	(a) Acceleration Target (Positives): 16- 35 (b) Deceleration Target (Negatives): 5- 22 (c) 1-Min Timing: 24- 29
Celeration	(a) Acceleration Target (Positives): ÷1.4 (b) Deceleration Target (Negatives): ÷1.1 (c) 1-Min Timing: x1.1
Bounce	(a) Acceleration Target (Positives): x2.0 (b) Deceleration Target (Negatives): x3.8 (c) 1-Min Timing: x1.2
Outliers	(a) Acceleration Target (Positives): None (b) Deceleration Target: None (c) 1-Min Timing: None
AIM	÷1.3 [10 days]

Amy

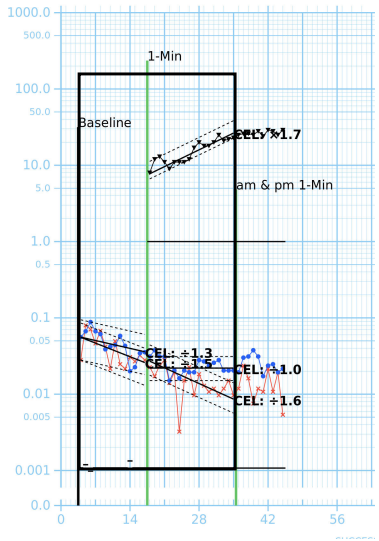
SCC Single Phase Analysis: Total **1-Min.**



Single Phase Analysis: Total 1-Min. Phase Length- 28 Days	
Measures	Participant Data
Frequency Range	(a) Acceleration Target (Positives): 14- 35 (b) Deceleration Target (Negatives): 3- 26 (c) 1-Min Timing: 8- 29
Celeration	(a) Acceleration Target (Positives): ÷1.1 (b) Deceleration Target (Negatives): ÷1.1 (c) 1-Min Timing: x1.4
Bounce	(a) Acceleration Target (Positives): x2.2 (b) Deceleration Target (Negatives): x3.8 (c) 1-Min Timing: x1.7
Outliers	(a) Acceleration Target (Positives): None (b) Deceleration Target: Highlier, Day 21 (3) (c) 1-Min Timing: None
AIM	x1.0 [28 days]

Amy

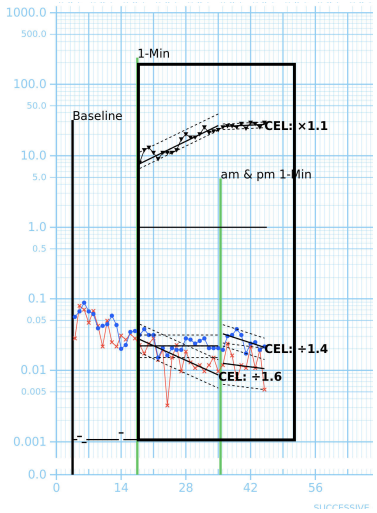
SCC Multiple Phase Analysis: **Baseline to Criterion Phase 1**



Multiple Phase Analysis: Baseline to 1-Min. & Criterion Phase 1 (50)	
Measures	Participant Data
Frequency Multipliers (Jumps)	(a) Acceleration Target (Positives) Baseline to 1-min: ÷1.1 (b) Deceleration Target (Negatives) Baseline to 1-min: ÷1.2
Celeration Multipliers (Turns)	(a) Acceleration Target (Positives) Baseline to 1-min: ÷1.3 (b) Deceleration Target (Negatives) Baseline to 1-min: ÷1.1
Bounce Changes	(a) Acceleration Target (Positives) Baseline to 1-min: x3.4 to x1.7 (b) Deceleration Target Baseline to 1-min: x3.1 to x2.1
AIM	○ Baseline: ÷1.2 [14 days] ○ Phase 1: ÷1.6 [18 days]

Amy

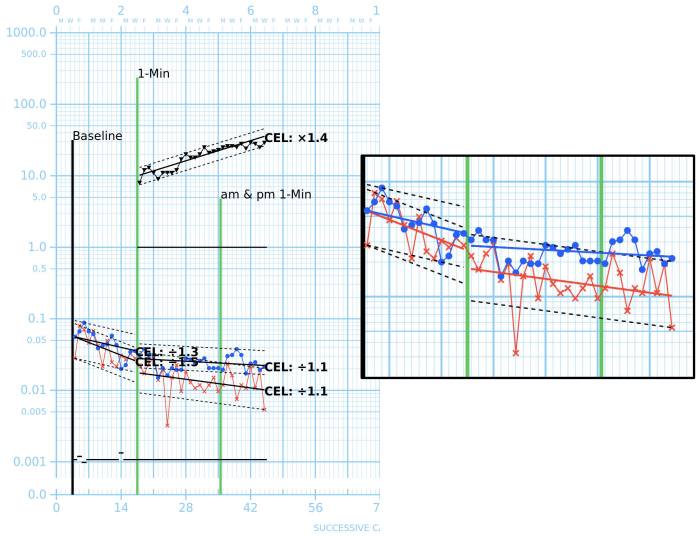
SCC Multiple Phase Analysis: **Phase 1 to Phase 2**



Multiple Phase Analysis: Criterion Phase 1 (50) to Phase 2 (am & pm 1-Min.)	
Measures	Participant Data
Frequency Multipliers (Jumps)	(a) Acceleration Target (Positives) Phase 1 to Phase 2: ÷1.5 (b) Deceleration Target (Negatives) Phase 1 to Phase 2: ÷2.3
Celeration Multipliers (Turns)	(a) Acceleration Target (Positives) Phase 1 to Phase 2: ÷1.4 (b) Deceleration Target (Negatives) Phase 1 to Phase 2: ÷1.5
Bounce Changes	(a) Acceleration Target (Positives) Phase 1 to Phase 2: x1.7 to x2.0 (b) Deceleration Target Phase 1 to Phase 2: x2.1 to x3.8
AIM	○ Phase 1: ÷1.6 [18 days] ○ Phase 2: ÷1.3 [10 days]

Amy

SCC Multiple Phase Analysis: **Baseline to Total 1-Min**

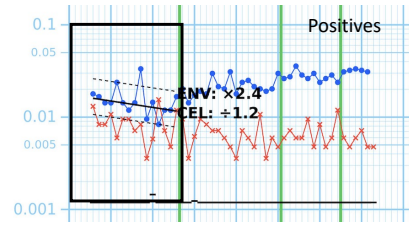


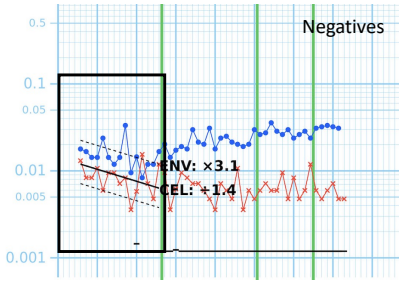
Multiple Phase Analysis: Baseline to 1-Min.	
Measures	Participant Data
Frequency Multipliers (Jumps)	(a) Acceleration Target (Positives) Baseline to 1-min: ÷1.1 (b) Deceleration Target (Negatives) Baseline to 1-min: ÷1.2
Celeration Multipliers (Turns)	(a) Acceleration Target (Positives) Baseline to 1-min: ÷1.2 (b) Deceleration Target (Negatives) Baseline to 1-min: ÷1.4
Bounce Changes	(a) Acceleration Target (Positives) Baseline to 1-min: x3.4 to x2.2 (b) Deceleration Target Baseline to 1-min: x3.1 to x3.8
AIM	○ Baseline: ÷1.2 [14 days] ○ Phase 1: x1.0 [28 days]

Amy

Christine

SCC Single Phase Analysis: **Baseline**

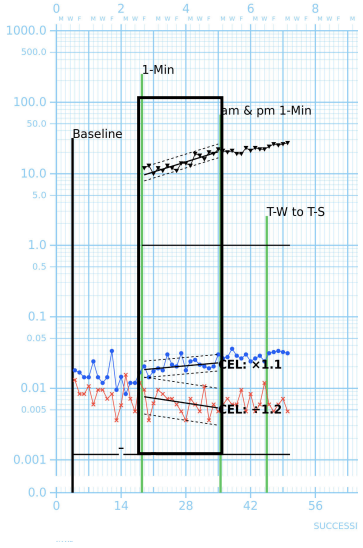




Baseline Baseline Length- 15 Days	
Measures	Participant Data
Frequency Range	(a) Acceleration Target (Positives): 7- 28 (b) Deceleration Target (Negatives): 3- 13
Celeration	(a) Acceleration Target (Positives): ÷1.2 (b) Deceleration Target (Negatives): ÷1.4
Bounce	(a) Acceleration Target (Positives): x2.4 (b) Deceleration Target (Negatives): x3.1
Outliers	(a) Acceleration Target (Positives): Highlier, Day 9 (28) (b) Deceleration Target: Highlier, Day 10 (3); Lowlier, Day 12 (13)
AIM	÷1.2 [15 days]

Christine

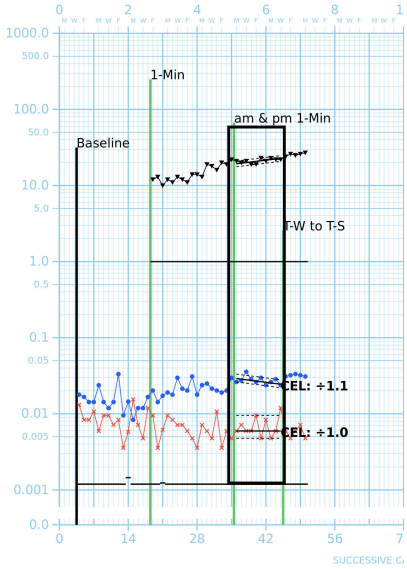
SCC Single Phase Analysis: **Phase 1**



Single Phase Analysis: First Criterion- Deceleration to 5 Negatives Phase Length- 17 Days	
Measures	Participant Data
Frequency Range	(a) Acceleration Target (Positives): 12- 26 (b) Deceleration Target (Negatives): 3- 9 (c) 1-Min Timing: 10- 22
Celeration	(a) Acceleration Target (Positives): x1.1 (b) Deceleration Target (Negatives): ÷1.2 (c) 1-Min Timing: x1.4
Bounce	(a) Acceleration Target (Positives): x1.7 [17 days] (b) Deceleration Target (Negatives): x3.3 [17 days] (c) 1-Min Timing: x1.6
Outliers	(a) Acceleration Target (Positives): Highliers, Days 21 (25) and 24 (26) (b) Deceleration Target: Highlier, Day 17 (3) (c) 1-Min Timing: None
AIM	x1.3 [17 days]

Christine

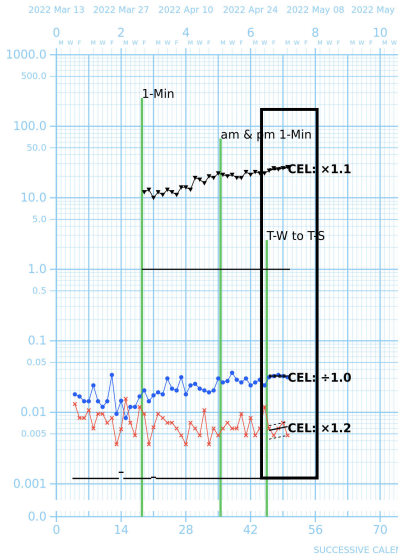
SCC Single Phase Analysis: **Phase 2**



Single Phase Analysis: am & pm 1-Min. Phase Length- 10 Days	
Measures	Participant Data
Frequency Range	(a) Acceleration Target (Positives): 20- 30 (b) Deceleration Target (Negatives): 4- 10 (c) 1-Min Timing: 19- 23
Celeration	○ Acceleration Target (Positives): ÷1.1 ○ Deceleration Target (Negatives): x1.0 ○ 1-Min Timing: x1.1
Bounce	(a) Acceleration Target (Positives): x1.3 (b) Deceleration Target (Negatives): x2.0 (c) 1-Min Timing: x1.2
Outliers	(a) Acceleration Target (Positives): Highlier, Day 35 (30) (b) Deceleration Target: Lowlier, Day 42 (10) (c) 1-Min Timing: None
AIM	÷1.1 [10 days]

Christine

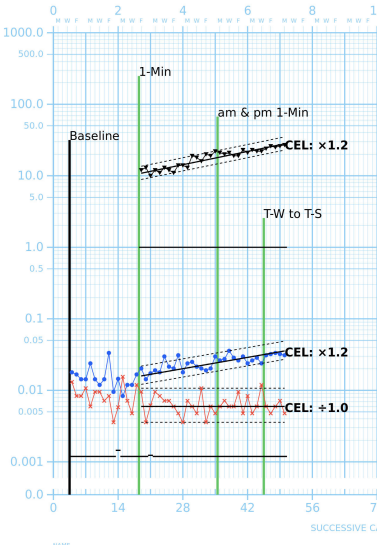
SCC Single Phase Analysis: **Phase 3**



Single Phase Analysis: am & pm 1-Min./Think-Write to Think-Say Phase Length- 5 Days	
Measures	Participant Data
Frequency Range	(a) Acceleration Target (Positives): 26- 28 (b) Deceleration Target (Negatives): 4- 6 (c) 1-Min Timing:
Celeration	○ Acceleration Target (Positives): x1.0 ○ Deceleration Target (Negatives): x1.2 ○ 1-Min Timing: x1.1
Bounce	(a) Acceleration Target (Positives): x1.1 (b) Deceleration Target (Negatives): x1.5 (c) 1-Min Timing: x1.1
Outliers	(a) Acceleration Target (Positives): None (b) Deceleration Target: None (c) 1-Min Timing: None
Overall Phase Analysis	The last phase showed an unfavorable acceleration in daily negatives and no celeration in daily positives. Bounce was nearly nonexistent in the 1-min. timing and daily positives; smooth and consistent Bounce in daily negatives. No outliers. AIM value shows very slight diminished accuracy.

Christine

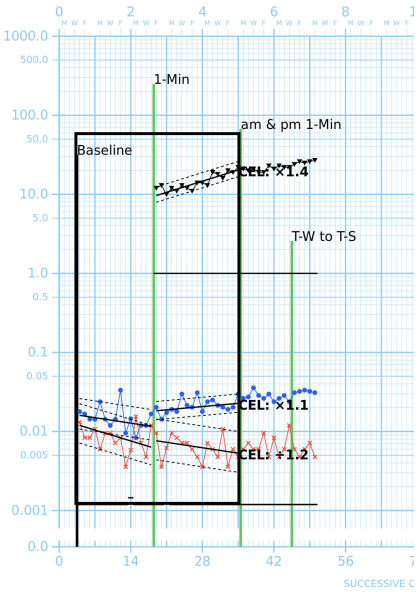
SCC Single Phase Analysis: Total **1-Min.**



Single Phase Analysis: 1-Min. Timing Phase Length- 32 Days	
Measures	Participant Data
Frequency Range	(a) Acceleration Target (Positives): 12- 30 (b) Deceleration Target (Negatives): 3- 10 (c) 1-Min Timing: 10- 27
Celeration	(a) Acceleration Target (Positives): x1.2 (b) Deceleration Target (Negatives): x1.0 (c) 1-Min Timing: x1.1
Bounce	(a) Acceleration Target (Positives): x1.8 (b) Deceleration Target (Negatives): x3.0 (c) 1-Min Timing: x1.5
Outliers	(a) Acceleration Target (Positives): Highliers, Days 21 (25) and 24 (26) (b) Deceleration Target: Lowlier, Day 42 (10) (c) 1-Min Timing: None
AIM	x1.2 [32 days]

Christine

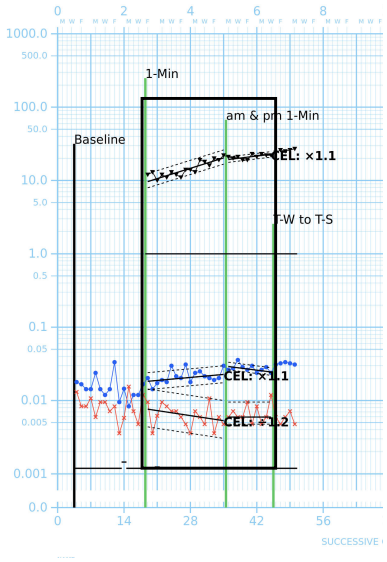
SCC Multiple Phase Analysis: **Baseline to Criterion Phase 1**



Multiple Phase Analysis: Baseline to Criterion Phase 1	
Measures	Participant Data
Frequency Multipliers (Jumps)	(a) Acceleration Target (Positives) Baseline to Phase 1: x1.2 (b) Deceleration Target (Negatives) Baseline to Phase 1: ÷1.3
Celeration Multipliers (Turns)	(a) Acceleration Target (Positives) Baseline to Phase 1: x1.3 (b) Deceleration Target (Negatives) Baseline to Phase 1: ÷1.2
Bounce Changes	(a) Acceleration Target (Positives) Baseline to Phase 1: x2.4 to x1.7 (b) Deceleration Target Baseline to Phase 1: x3.1 to x3.3
AIM	○ Baseline: ÷1.2 [15 days] ○ Phase 1: x1.3 [17 days]

Christine

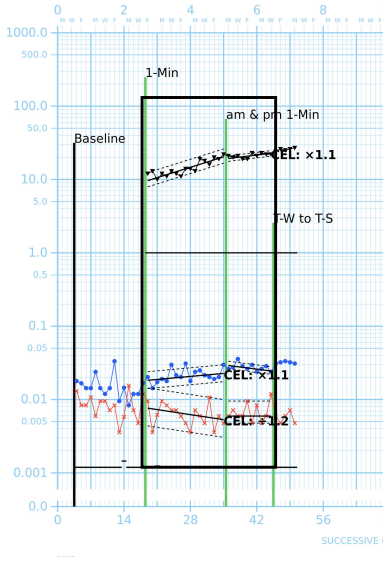
SCC Multiple Phase Analysis: **Phase 1 to Phase 2**



Multiple Phase Analysis: Criterion Phase 1 to Phase 2 (am & pm 1-Min.)	
Measures	Participant Data
Frequency Multipliers (Jumps)	(a) Acceleration Target (Positives) Phase 1 to Phase 2: ÷1.1 (b) Deceleration Target (Negatives) Phase 1 to Phase 2: x1.3
Celeration Multipliers (Turns)	(a) Acceleration Target (Positives) Phase 1 to Phase 2: ÷1.2 (b) Deceleration Target (Negatives) Phase 1 to Phase 2: x1.2
Bounce Changes	(a) Acceleration Target (Positives) Phase 1 to Phase 2: x1.7 to x1.3 (b) Deceleration Target Phase 1 to Phase 2: x3.3 to x2.0
AIM	○ Phase 1: x1.3 [17 days] ○ Phase 2: ÷1.1 [10 days]

Christine

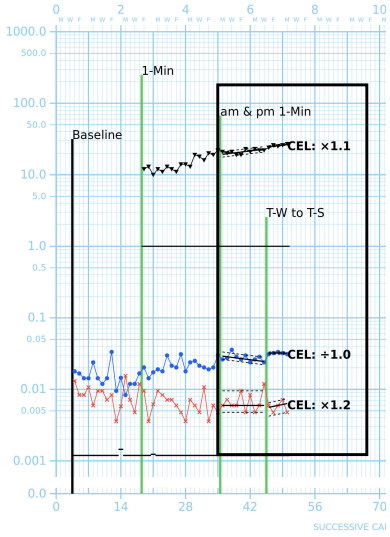
SCC Multiple Phase Analysis: **Phase 1 to Phase 2**



Multiple Phase Analysis: Criterion Phase 1 to Phase 2 (am & pm 1-Min.)	
Measures	Participant Data
Frequency Multipliers (Jumps)	(a) Acceleration Target (Positives) Phase 1 to Phase 2: ÷1.1 (b) Deceleration Target (Negatives) Phase 1 to Phase 2: x1.3
Celeration Multipliers (Turns)	(a) Acceleration Target (Positives) Phase 1 to Phase 2: ÷1.2 (b) Deceleration Target (Negatives) Phase 1 to Phase 2: x1.2
Bounce Changes	(a) Acceleration Target (Positives) Phase 1 to Phase 2: x1.7 to x1.3 (b) Deceleration Target Phase 1 to Phase 2: x3.3 to x2.0
AIM	○ Phase 1: x1.3 [17 days] ○ Phase 2: ÷1.1 [10 days]

Christine

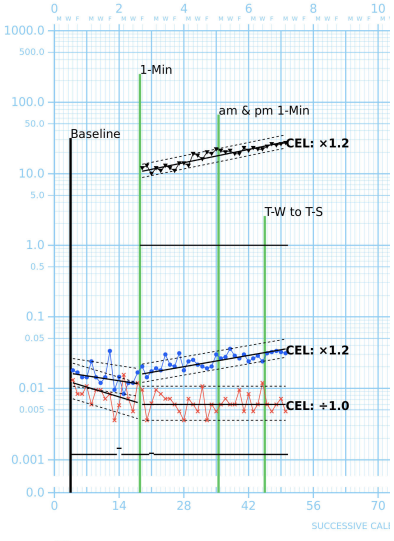
SCC Multiple Phase Analysis: **Phase 2 to Phase 3**



Multiple Phase Analysis: Phase 2 (am & pm 1-Min.) to Phase 3 (Think-Write to Think-Say)	
Measures	Participant Data
Frequency Multipliers (Jumps)	(a) Acceleration Target (Positives) Phase 2 to Phase 3: x1.3 (b) Deceleration Target (Negatives) Phase 2 to Phase 3: ÷2
Celeration Multipliers (Turns)	(a) Acceleration Target (Positives) Phase 2 to Phase 3: ÷1.1 (b) Deceleration Target (Negatives) Phase 2 to Phase 3: x1.2
Bounce Changes	(a) Acceleration Target (Positives) Phase 2 to Phase 3: x1.3 to x1.1 (b) Deceleration Target Phase 2 to Phase 3: x2.0 to x1.5
AIM	○ Phase 2: ÷1.1 [10 days] ○ Phase 3: ÷1.2 [5 days]

Christine

SCC Multiple Phase Analysis: **Baseline to Total 1-Min**

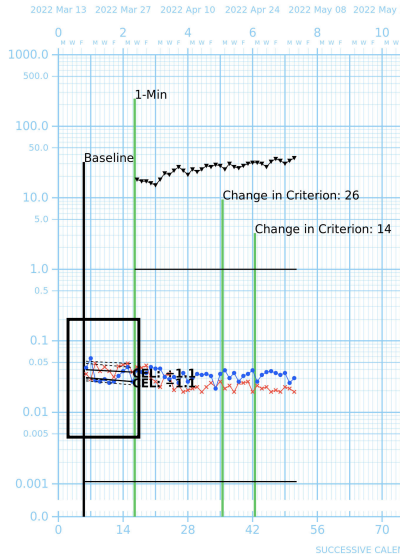


Multiple Phase Analysis: Baseline to 1-Min.	
Measures	Participant Data
Frequency Multipliers (Jumps)	(a) Acceleration Target (Positives) Baseline to 1-min: x1.2 (b) Deceleration Target (Negatives) Baseline to 1-min: ÷1.3
Celeration Multipliers (Turns)	(a) Acceleration Target (Positives) Baseline to 1-min: x1.4 (b) Deceleration Target (Negatives) Baseline to 1-min: x1.4
Bounce Changes	(a) Acceleration Target (Positives) Baseline to 1-min: x2.4 to x1.8 (b) Deceleration Target Baseline to 1-min: x3.1 to x3.0
AIM	○ Baseline: ÷1.2 [15 days] ○ 1-Min: x1.2 [32 days]

Christine

Leslie

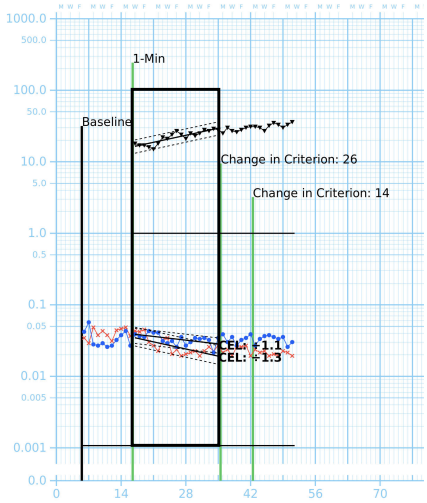
SCC Single Phase Analysis: **Baseline**



Baseline Baseline Length- 11 Days	
Measures	Participant Data
Frequency Range	(a) Acceleration Target (Positives): 24- 53 (b) Deceleration Target (Negatives): 27- 45
Celeration	(a) Acceleration Target (Positives): ÷1.1 (b) Deceleration Target (Negatives): ÷1.1
Bounce	(a) Acceleration Target (Positives): x1.8 [11 days] (b) Deceleration Target (Negatives): x1.8 [11 days]
Outliers	(a) Acceleration Target (Positives): Highlier, Day 2 (53) (b) Deceleration Target: None
AIM	x1.0 [11 days]

Leslie

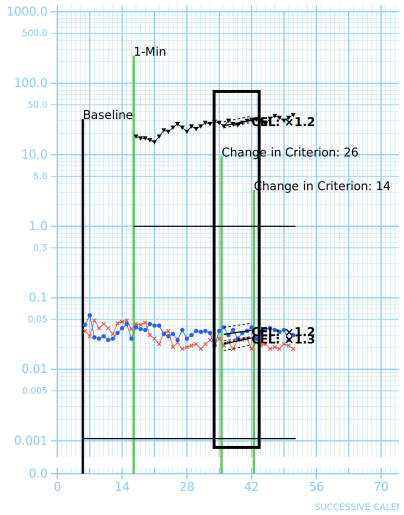
SCC Single Phase Analysis: **Phase 1**



Single Phase Analysis: First Criterion- Deceleration to 34 Negatives Phase Length-19 Days	
Measures	Participant Data
Frequency Range	(a) Acceleration Target (Positives): 20- 40 (b) Deceleration Target (Negatives): 18- 42 (c) 1-Min Timing: 15- 29
Celeration	(a) Acceleration Target (Positives): ÷1.1 (b) Deceleration Target (Negatives): ÷1.3 (c) 1-Min Timing: x1.3
Bounce	(a) Acceleration Target (Positives): x1.6 [19 days] (b) Deceleration Target (Negatives): x1.8 [19 days] (c) 1-Min Timing: 1.5 [7 days]
Outliers	(a) Acceleration Target (Positives): None (b) Deceleration Target: None (c) 1-Min Timing: None
AIM	x1.2 [19 days]

Leslie

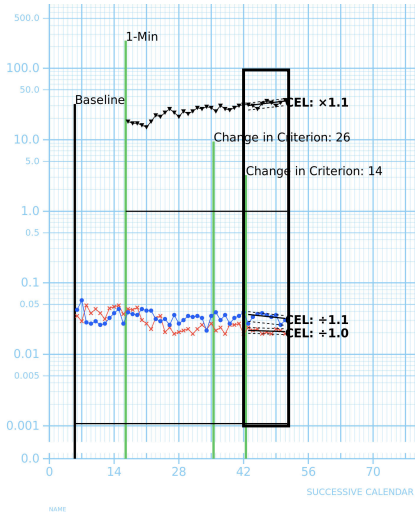
SCC Single Phase Analysis: **Phase 2**



Single Phase Analysis: Second Criterion- Deceleration to 26 Negatives Phase Length- 7 Days	
Measures	Participant Data
Frequency Range	(a) Acceleration Target (Positives): 25- 36 (b) Deceleration Target (Negatives): 18- 25 (c) 1-Min Timing: 25- 31
Celeration	(a) Acceleration Target (Positives): x1.2 (b) Deceleration Target (Negatives): x1.3 (c) 1-Min Timing: x1.2
Bounce	(a) Acceleration Target (Positives): x1.5 [7 days] (b) Deceleration Target (Negatives): x1.3 [7 days] (c) 1-Min Timing: 1.2 [7 days]
Outliers	(a) Acceleration Target (Positives): None (b) Deceleration Target: Highlier, Day 37 (18) (c) 1-Min Timing: None
AIM	÷1.1 [7 days]

Leslie

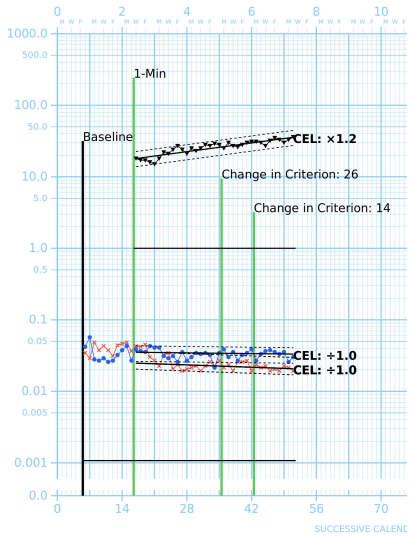
SCC Single Phase Analysis: **Phase 3**



Single Phase Analysis: Change in Criterion- Deceleration to 14 Negatives Phase Length- 8 Days	
Measures	Participant Data
Frequency Range	(a) Acceleration Target (Positives): 25- 35 (b) Deceleration Target (Negatives): 18- 22 (c) 1-Min Timing: 30- 36
Celeration	(a) Acceleration Target (Positives): ÷1.1 (b) Deceleration Target (Negatives): x1.0 (c) 1-Min Timing: x1.1
Bounce	(a) Acceleration Target (Positives): x1.4 [8 days] (b) Deceleration Target (Negatives): x1.2 [8 days] (c) 1-Min Timing: x1.2 [8 days]
Outliers	(a) Acceleration Target (Positives): None (b) Deceleration Target: None (c) 1-Min Timing: None
AIM	÷1.1 [8 days]

Leslie

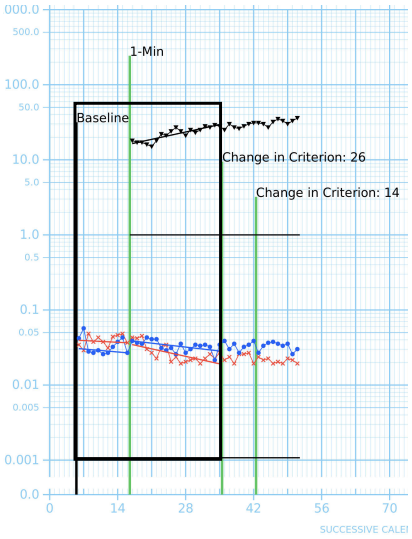
SCC Single Phase Analysis: Total **1-Min**



Single Phase Analysis: 1-Min. Timing Phase Length- 35 Days	
Measures	Participant Data
Frequency Range	(a) Acceleration Target (Positives): 20- 40 (b) Deceleration Target (Negatives): 18- 42 (c) 1-Min Timing: 15-36
Celeration	(a) Acceleration Target (Positives): x1.0 (b) Deceleration Target (Negatives): x1.0 (c) 1-Min Timing: x1.2
Bounce	(a) Acceleration Target (Positives): x1.6 [35 days] (b) Deceleration Target (Negatives): x1.8 [35 days] (c) 1-Min Timing: x1.5
Outliers	(a) Acceleration Target (Positives): None (b) Deceleration Target: None (c) 1-Min Timing: None
AIM	x1.0 [35 days]

Leslie

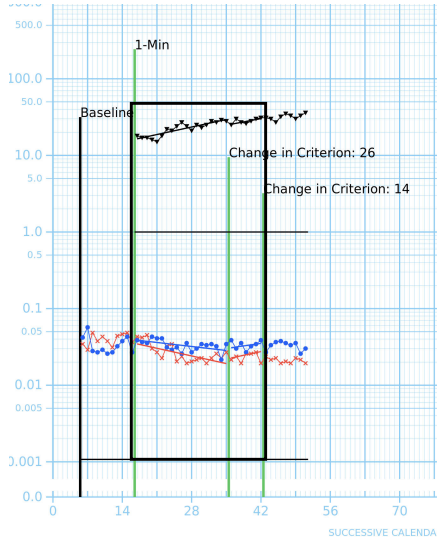
SCC Multiple Phase Analysis: **Baseline to Phase 1**



Multiple Phase Analysis: Baseline to Phase 1	
Measures	Participant Data
Frequency Multipliers (Jumps)	(a) Acceleration Target (Positives) Baseline to Phase 1: x1.4 (b) Deceleration Target (Negatives) Baseline to Phase 1: x1.2
Celeration Multipliers (Turns)	(a) Acceleration Target (Positives) Baseline to Phase 1: x1.0 (b) Deceleration Target (Negatives) Baseline to Phase 1: ÷1.2
Bounce Changes	(a) Acceleration Target (Positives) Baseline to Phase 1: x1.8 to x1.6 (b) Deceleration Target Baseline to Phase 1: x1.8 to x1.8
AIM	○ Baseline: x1.2 [19 days] ○ Phase 1: ÷1.1 [7 days]

Leslie

SCC Multiple Phase Analysis: **Phase 1 to Phase 2**



Multiple Phase Analysis: Phase 1 to Phase 2 (First Criterion Phase to Second)	
Measures	Participant Data
Frequency Multipliers (Jumps)	(a) Acceleration Target (Positives) Phase 1 to Phase 2: x1.1 (b) Deceleration Target (Negatives) Phase 1 to Phase 2: ÷1.3
Celeration Multipliers (Turns)	(a) Acceleration Target (Positives) Phase 1 to Phase 2: x1.3 (b) Deceleration Target (Negatives) Phase 1 to Phase 2: x1.7
Bounce Changes	(a) Acceleration Target (Positives) Phase 1 to Phase 2: x1.6 [19 days] to x1.5 [7 days] (b) Deceleration Target Phase 1 to Phase 2: x1.8 [19 days] to x1.3 [7 days]
AIM	○ Phase 1: x1.2 [19 days] ○ Phase 2: ÷1.1 [7 days]

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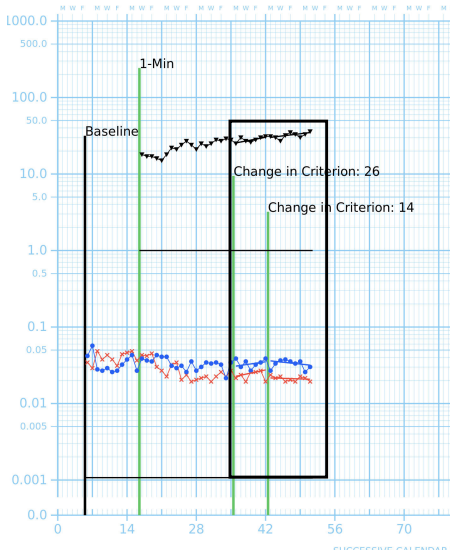
SCC Multiple Phase Analysis: **Phase 2 to Phase 3**



Multiple Phase Analysis: Phase 2 to Phase 3 (Second Criterion Phase to Third)	
Measures	Participant Data
Frequency Multipliers (Jumps)	(a) Acceleration Target (Positives) Phase 2 to Phase 3: ÷1.4 (b) Deceleration Target (Negatives) Phase 2 to Phase 3: x1.2
Celeration Multipliers (Turns)	(a) Acceleration Target (Positives) Phase 2 to Phase 3: ÷1.3 (b) Deceleration Target (Negatives) Phase 2 to Phase 3: ÷1.4
Bounce Changes	(a) Acceleration Target (Positives) Phase 2 to Phase 3: x1.5 [7 days] to x1.4 [8 days] (b) Deceleration Target Phase 2 to Phase 3: x1.3 [7 days] to x1.2 [8 days]
AIM	○ Phase 2: ÷1.1 [7 days] ○ Phase 3: ÷1.1 [8 days]

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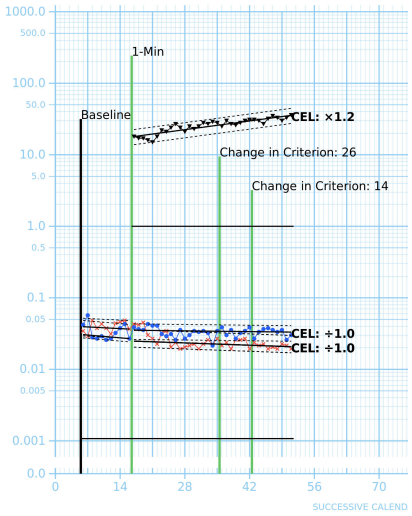
SCC Multiple Phase Analysis: **Baseline to Total 1-Min**



Multiple Phase Analysis: Baseline to 1-Min.	
Measures	Participant Data
Frequency Multipliers (Jumps)	(a) Acceleration Target (Positives) Baseline to 1-min: x1.4 (b) Deceleration Target (Negatives) Baseline to 1-min: x1.2
Celeration Multipliers (Turns)	(a) Acceleration Target (Positives) Baseline to 1-min: ÷1.1 (b) Deceleration Target (Negatives) Baseline to 1-min: ÷1.1
Bounce Changes	(a) Acceleration Target (Positives) Baseline to 1-min: x1.8 to x1.6 (b) Deceleration Target Baseline to 1-min: x1.8 to x1.8
AIM	○ Baseline: x1.0 [11 days] ○ 1-Min: x1.0 [35 days]

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