

A MULTI-COMPONENT APPROACH TO REDUCING SELF-INJURY IN THE NATURAL ENVIRONMENT

By

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Abstract

Past research has demonstrated that a variety of medical/pharmacological and behavioral strategies may be effective at reducing self-injury for adults with intellectual and developmental disabilities. Unfortunately, the effectiveness of these interventions is rarely evaluated in the natural environment. Also, teachers, who are responsible for the care of these individuals, are often not adequately trained in the use of these procedures. The purpose of the present study was to evaluate treatments for reducing self-injury that combine both behavioral and medical components in the natural environment with a comprehensive staff training package. Three participants (ages 15-48) diagnosed with a profound IDD/autism, who engaged in severe self-injury, participated. A multi-component treatment package was developed for all participants including 1) reinforcing the absence of self-injury and reinforcing communication, 2) blocking self-injury with redirection to appropriate activities, 3) environmental enrichment, and 4) an individualized intervention to address medical and biological influences on self-injury. After the effectiveness of this intervention package was demonstrated, a staff-training package that included feedback and contingent money was evaluated with three of the participants' teachers. The multi-component package was effective at reducing self-injury by 50% for all participants when implemented by the investigators. All teachers were able to consistently implement the intervention plan and produce reductions in self-injury when they received feedback and money regarding their use of the procedures. The multi-component intervention was effective at reducing self-injury and teachers were able to consistently use the intervention in the natural environment. Teachers should receive consistent feedback regarding their use of the procedures so that reductions in self-injury can be maintained in the absence of the investigator.

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A Multi-Component Approach to Reducing Self-Injury in the Natural Environment

Self-injurious behaviors (SIB) are acts directed toward oneself that result in tissue damage (for comprehensive reviews see Rojahn, Schroeder, & Hoch, 2008; Schroeder, Oster-Granite, & Thompson, 2002). SIB occurs most frequently among persons who have severe or profound intellectual and developmental disabilities (IDD) and is manifested in a variety of different topographies (Rojahn, 1994). The most frequent forms of SIB are head banging or hitting, head banging with objects, self-biting, self-scratching, self-pinching, and hair pulling (Rojahn, et al., 2008).

Prevalence estimates of SIB among people with IDD range from 2% - 90% although, on average, a prevalence of 10% is the most frequently cited (Rojahn & Esbensen, 2002). Estimates of whether or not SIB occurs vary depending upon age, IQ, the presence of other medical conditions, place of residence, and a number of other variables. Researchers have estimated that there are approximately 420,000 individuals with intellectual disabilities in the United States who exhibit SIB resulting in serious tissue damage, permanent impairments, and sometimes even death (Rojahn et al., 2008).

The exact causes of self-injury are not well known. Risk factors for developing SIB include having a diagnosis of intellectual disabilities at the severe or profound level, medical problems (e.g., otitis media, seizures, etc.), certain genetic disorders (e.g., Lesch-Nyhan Syndrome), living in restrictive residential settings, and communication deficits (Favell et al., 1982; Schroeder, 1999). Unfortunately, identifying these risk factors (e.g., having a diagnosis of IDD at the severe or profound level) has not led to the development of preventative efforts primarily because it is often not possible to modify these risk factors. For example, once a person is born with a severe or profound IDD, there are very few environmental or medical solutions

presently available to remedy that diagnosis. Similarly, many of the genetic syndromes associated with self-injury currently do not have a cure. Research also suggests that even when medical conditions like otitis media are effectively treated, self-injury may still persist, requiring additional treatments (Carr & McDowell, 1980). Thus, addressing these risk factors may not prevent the development of SIB nor stop self-injury once it has started.

There have been at least 10 different hypotheses as to how self-injury develops in individuals and why it persists (for an extensive review see Rojahn et al., 2008). The variables that originally lead to the development of self-injury may not be what continue to maintain the behavior later on in life. The most common hypotheses are the five reviewed by Carr (1977): (1) self-injury may be maintained by positive reinforcement; (2) self-injury may be maintained by negative reinforcement (e.g., removal of demands); (3) self-injury may be a form of self-stimulation; (4) self-injury may be a product of organic origin (e.g., genetic syndrome or medical conditions); and (5) self-injury may be psychodynamic in nature.

The first two theories suggest that self-injury may be learned behavior maintained by environmental consequences. Behavioral interventions based on these theories have been effective at changing the frequency and severity of self-injury in many cases (Favell et al., 1982; Kahng, Iwata, & Lewin, 2002). For example, differential reinforcement of alternative behaviors (DRA) has been effective in reducing self-injury. DRA involves the withholding of reinforcement is withheld for unwanted behavior and the delivery of reinforcement is delivered contingent on a different class of behavior. DRA procedures have been effective at reducing a number of different problem behaviors, including self-injury (Chowdhury & Benson, 2011; Petscher, Rey, & Bailey, 2009). DRA procedures have limitations, however. For example, Beare, Severson, and Brandt (2004) evaluated the effects of DRA procedures and differential

reinforcement of other behaviors (DRO) procedures at reducing self-injury at a community-work placement with an adult with a profound IDD who engaged in severe self-injury. In the DRA procedure, the participant gained access to a preferred edible when he completed discrete tasks at his work placement. Unfortunately, even though the participant was completing the alternative behavior to gain access to the reinforcer, he continued to engage in self-injury (at similar levels as baseline) during these tasks. In the DRO procedure, the participant not only had to complete the discrete task but also had to do so without engaging in self-injury to gain access to the preferred item. This was effective at reducing self-injury to near zero levels.

Research with some individuals indicated that self-injury might be used as a method to escape from participating in non-preferred activities or transitions to non-preferred activities (e.g., McCord, Thompson, & Iwata, 2001). In these cases, researchers have taught individuals communication responses as a replacement behavior for self-injury. For example, individuals may be taught a communication response (such as exchanging a picture icon) that allows them a structured break from a non-preferred activity (Carr & Durand, 1985; Emerson, 1992). The majority of studies that have taught communicative behavior as a replacement behavior for problem behavior have been effective at reducing the problem behavior (e.g., Mancil, 2006).

Carr's third hypothesis suggests that self-injury may be a form of self-stimulation. Again, behavioral procedures have been used in an attempt to reduce self-injury that may be maintained, for example, by some type of proprioceptive feedback. If self-injury is a form of self-stimulation, in essence, the person is engaged with himself or herself. To decrease the injurious engagement with oneself, one could attempt to increase appropriate engagement with activities or materials in the person's environment to decrease the likelihood that individuals will engage in self-injury. This is often labeled environmental enrichment (EE).

EE procedures usually involve providing noncontingent access to various forms of activities in an attempt to effectively compete with self-injurious behavior or other maladaptive behaviors like stereotypic behavior (Horner, 1980; Vollmer, 1994). Engagement activities may compete with self-injury in two major ways. The first is that the alternative activities may be topographically incompatible with self-injury. Thus, if individuals have both of their hands occupied with an activity (e.g., block manipulation), they may be less likely to engage in self-injurious behavior like face slapping. Second, some types of environmental enrichment procedures have been effective at reducing self-injury when the activities used produce the same type of stimulation hypothesized to maintain self-injury. In general, researchers have reported that EE procedures have been effective in reducing self-injurious behavior (Carey & Hale, 2002; DeLeon, Andres, Rodriguez-Catter, & Neidart, 2000; Healey, Ahearn, Graff, & Libby, 2001; Horner, 1980; Lindberg, Iwata, Roscoe, Worsdell, & Hanley, 2003; O'Reilly, Sigafos, Lancioni, Edrisinha, & Andrews, 2005; Van Camp, Vollmer, & Daniel, 2001). Some of the research, however, indicates that simply providing engagement activities may not produce high rates of engagement. Horner (1980), for example, reported that individuals might need prompting and reinforcement from staff members for continued engagement and reductions in problem behavior.

Even though the literature contains a number of examples of effective procedures in producing reduced rates of self-injury, less than 10% of behavioral interventions have demonstrated long-term effectiveness (i.e., maintenance of effects) or whether or not the people who typically care for the participants (as compared to researchers who implement the procedures in the experiment) can effectively use the interventions (i.e., generalization across people) (Kahng et al., 2002). These behavioral changes may not generalize well and may not be

maintained in the long term without surveillance and continued intervention (Harchik, Sherman, Sheldon, & Strouse, 1992).

Some researchers have taken a biological approach to treating self-injury by attempting to identify the presumed biological mechanisms behind SIB, as suggested in Carr's third and fourth hypotheses (that SIB is a form of self-stimulation and/or is due to genetic syndromes or medical conditions). Psychopharmacological interventions for SIB, especially those guided by research on dopamine, serotonin, and opioid peptide hormones, have shown some promise (e.g., Hellings et al., 2006; Sandman, Barron, & Coleman, 1990). There remain a large number of individuals, however, for whom the results of using psychopharmacological agents are mixed or negative.

Some researchers have suggested that the presence of medical conditions and/or chronic pain may also affect self-injury. Carr and Smith (1995), for example, suggested that the presence of medical conditions may be a setting event for self-injury or may exacerbate self-injury. Some researchers have used medical interventions in an attempt to reduce the frequency of self-injury. Some of these interventions seem to be effective (e.g., Bosh, Van Dyke, Smith, & Poulton, 1997; Hartman, Gilles, McComas, Danov, & Symons, 2008; Peine, Rokneddin, Adams, Blakelock, Jenson, & Osborne, 1995). The majority of these studies, however, are AB case designs and the treatments are highly idiosyncratic. Although many of the interventions have been successful at reducing self-injury for the participant, it is unclear what the exact effects of the treatments are and whether or not similar treatments would be effective for other individuals with self-injury.

Theorists who proposed the psychodynamic theory suggest that self-injury occurs as a way for individuals to develop "body reality" and to distinguish external environments from themselves. The fifth hypothesis has not been empirically tested because the constructs that make

up this hypothesis have not yet been operationalized, making the possibility of studying them almost impossible.

The existing literature contains a number of examples of how self-injury might be reduced for individuals with IDD who engage in self-injury. The major problem, however, is that most of the effective interventions have been used under carefully controlled conditions, implemented by researchers, and used for relatively short amounts of time. Thus, the possible effectiveness of procedures that have been tested in laboratory-like conditions is not known, and it is important that we know how these interventions will work in less-controlled settings like community group homes. A Consensus Development Conference by the National Institute of Child Health and Human Development (NICHD, 1991) estimated that the annual cost of services for people with IDD who injure themselves, harm others, or damage property in the United States exceeds \$3.5 billion dollars per year. Identifying effective treatments for reducing self-injurious behavior will not only reduce costs needed to help provide for these individuals but, more importantly, will increase these individuals' quality of life.

The current literature on self-injury does not appear to offer viable options for teachers who work with individuals who engage in severe self-injury in community-based settings. For example, many interventions may address only one of the maintaining variables for SIB. Additionally, many of these interventions are conducted in tightly controlled analogue settings and for short amounts of time (Kahng et al., 2002). Lastly, teachers who work closely with these individuals often are not taught how to effectively use these interventions. Thus, it is important to identify interventions that will be effective in these individual's natural (as opposed to analogue) environments and once these interventions are developed to teach staff to effectively use them.

Study 1

Schroeder and colleagues (2002) suggest that self-injury is a brain-behavior-environment relationship. SIB may be learned, biologically based, or both, indicating that one treatment may not be sufficient in reducing the occurrence of self-injury. Treatment failures have led researchers to take a closer and more experimental look at both the behavioral and biological antecedents of SIB, which may affect the probability of the development and occurrence of SIB in all of its forms and functions.

Recently researchers have attempted to look at combining a number of procedures to address problem behaviors like SIB. For example, Carr and Blakeley-Smith (2006) evaluated the combined effects of medical and behavioral interventions on the problem behavior of 21 children with IDD whose problem behavior was affected by illness. The authors reported that individuals who received medical intervention alone (e.g., sent to the school nurse, heating pads, aspirin, etc.) had fewer reductions in problem behavior compared to those children who received both medical and behavioral interventions (e.g., increased opportunities for choice, behavioral momentum, staff training).

Although recent research suggests that combining interventions may produce large reductions in self-injury, clinicians and researchers often try to treat this difficult behavior by solely biological means (e.g., psychotropic medication) or with only behavioral interventions. This dichotomy may account for why many treatments do not substantially reduce self-injury or why these treatments do not produce long-lasting reductions in self-injury. As suggested by Favell et al. (1982) and Kahng et al. (2002), the most appropriate treatments for self-injury would incorporate both biological and behavioral components.

Even if comprehensive interventions are evaluated, the effects of these interventions are rarely assessed in these individuals' natural environments. Many studies evaluate the effects of these interventions in tightly controlled analogue settings. Kahng and colleagues (2002) reported that less than 5% of studies evaluating the effects that behavioral intervention had at reducing self-injury were conducted in the participants' natural environments. Although assessing the effects of these interventions in controlled settings is important, interventions that are assessed in laboratory-like environments may not have the same effectiveness in less-controlled settings, such as community group homes. Thus, in order to produce long-lasting and substantial reductions in problem behavior, the effects of these interventions must be evaluated in the natural environment and over a substantial amount of time. Kahng et al. also reported that less than 15% of studies using behavioral interventions to reduce self-injury were evaluated long-term. Finally, it is important not only to assess whether the intervention will maintain its effectiveness over time, but also to determine if it is feasible for teachers and staff to implement the intervention throughout the entire day given their other responsibilities.

Over the last 40 years, researchers have made a number of recommendations regarding the development of treatment plans for reducing self-injury. Some of these recommendations include:

- 1) Staff should teach and reinforce behaviors that provide the individual with more desirable and appropriate methods of receiving reinforcement (e.g., communication training) (Favell et al. 1982; Gorman-Smith & Matson, 1985; Kahng et al. 2002).
- 2) Staff should provide environmental conditions that are associated with low levels of self-injury (environmental and social enrichment) and develop leisure skills (Johnson & Baumeister, 1978; Favell et al. 1982; Kahng et al. 2002).

- 3) Methods should be developed that produce the generalization of the treatment effects to all situations and over time (Favell et al. 1982).
- 4) Researchers should design and implement well-controlled research on the combined use of behavioral and biological interventions, and any intervention should include an attempt to analyze biological and environmental factors that may have caused and/or maintain SIB (Favell et al. 1982; Kahng et al. 2002).

Based on these recommendations, the purpose of the present study was to assess the effects of a multi-component intervention implemented by a researcher in the natural environment. We reinforced both the absence of self-injury and the occurrence of appropriate alternative behaviors. We used environmental enrichment procedures to create environmental conditions that fostered low levels of self-injurious behavior. We also continued to implement the interventions over a significant period of time. Lastly, we evaluated interventions that attempted to address both biological and environmental influences on self-injury.

Methods

Participants

We recruited adolescents and adults with IDD and/or autism who engaged in chronic, refractory self-injury. Chronic self-injury was defined as self-injury that occurred at least once day, across most days of the week, persisted for at least one year, produced some type of tissue damage, and was not currently being effectively treated. We recruited participants from a local not-for-profit organization that serves adults with IDD and the local medical school's child development center in the mid-western United States. All participants were also enrolled in a larger observational study designed to determine sequential relations between non-verbal pain-related behavior and self-injury (Courtemanche, Schroeder, Sheldon, Sherman, & Fowler, 2011).

At the beginning of the study, Bobby was 28 years old. He was diagnosed with autism, a profound intellectual disability, Attention Deficit Hyperactivity Disorder, and a seizure disorder. Bobby used a number of different manual signs to communicate including signs for “drink,” “food,” “swing,” “please,” “more,” “bathroom,” “all-done,” and “goodbye.” Although Bobby was able to effectively communicate, he engaged in a number of different topographies of self-injurious behavior including head hitting (hand to head/face), face hitting, head banging (head to wall), and body hitting. Bobby’s self-injury was very severe and occurred throughout the entire day. On average, he engaged in about 15 instances of self-injury per min and as many as 1000 instances of self-injury in an hour. According to anecdotal reports from his mother, Bobby began engaging in these behaviors around the time he began attending public school. He wore a padded helmet in an attempt to reduce the effects of his self-injury. Bobby’s face was covered with raised callouses, cauliflower ear, and he had detached both retinas due to his chronic head hitting and banging. Recently, Bobby lost his sight due to his self-injury.

In addition to self-injury, Bobby engaged in high rates of stereotypy in the form of twirling, hand flapping and waving, and loud vocalizations. His current residence was a community group home that served one additional consumer. Previously, Bobby had lived at home with his family prior to placement in a group home at the age of 22. He was also taking both typical (i.e., Haldol) and atypical (i.e., Seroquel) antipsychotics in an attempt to reduce his self-injury.

Jack was 46 years old at the beginning of the study and was diagnosed with a profound intellectual disability, a seizure disorder, and an anxiety disorder. Jack had no formal communication but would use body positioning and would grab teachers’ hands and lead them to the item or activity that he wanted. Jack’s self-injurious behavior included head hitting (hand to

head/face), head banging (head to window or door), body hitting, and biting his hands and arms. Jack also had a cauliflower ear that he frequently targeted. He engaged in these behaviors at a low rate (approximately 2 instances per min) while in his home, but he engaged in higher rates (approximately 5 instances per min) of self-injury while riding in the group home van. Jack's self-injury not only had a long-term impact on his health, but it also reduced the amount of time he could spend in the community because staff members were reluctant to take him in the van.

Jack also engaged in stereotypy in the form of repetitive toy manipulation and rubbing glass with his fingers. Prior to moving to his current residence, Jack lived in a state institution from the ages of 4-37. He moved to his current community group home at 38 years old where he lived with three additional consumers. Jack took behavior control medication (loxapine) in an attempt to reduce his self-injury.

Steve was 14 years old when beginning the study and was diagnosed with autism. Steve could effectively communicate with gestures and was fluent with a modified picture exchange communication system. Steve's topographies of self-injury included head hitting (hand to head/face), head banging (head to wall or floor), body hitting, and banging his wrists and hands on objects. On average, Steve engaged in these behaviors about three times per min. Steve had callouses on his arms and wrists, along with a number of different bruises in various stages of healing. Steve would also frequently hit these bruises on objects and would ask teachers to push on these bruises. He had also caused large lacerations on his head due to head hitting and banging.

Steve also engaged in stereotypy including hand flapping, jumping, rocking, and loud humming and vocalizations. He lived at home with his family and attended public school. Steve

was not taking any medication aimed at reducing his self-injury. He was taking melatonin to help with his sleep disturbances.

Setting

All sessions took place in the community group home for Bobby, the group home and group home van for Jack, or a public school classroom for Steve. Bobby was staffed one-to-one and Jack was staffed two-to-one (one staff per two consumers). The public school classroom was a special education classroom that served up to 10 additional students. The classroom had one lead teacher and four paraprofessionals.

Data Collection

All data were collected in vivo and from videotapes of sessions. Each session lasted anywhere from 30 to 60 min. Sessions were conducted during times when individuals were likely to engage in self-injury. For Bobby and Steve, this included anytime throughout the day. Jack was likely to engage in self-injury in the morning 30 min prior to his morning van ride and while riding in the van.

Dependent Variables

The main dependent variable was the rate of self-injury per session. We specifically defined each topography of self-injury separately for each participant, but, typically, an instance of self-injury was scored when a participant hit himself or an object and the contact was audible or a mark was produced on the participant's body (see Appendix A for operational definitions).

Inter-observer Agreement

We conducted inter-observer agreement (IOA) on at least 20% of sessions. Reliability was collected live during teaching sessions or from videos of teaching sessions. If reliability was collected live during teaching sessions, a second independent observer collected data at the same

time as the primary investigator. The primary investigator did not interact with the second observer nor did the second observer interact with the participants. If reliability was scored from videotapes of teaching sessions, the second observer independently scored data from the videotapes. In all cases, the secondary observer's data were compared to the data collected by the primary investigator. The primary investigator recorded the number of instances of SIB during each teaching session. The total number of instances of self-injury for each session were compared, and the reliability calculation for self-injury was the smaller frequency number recorded by one observer during a session divided by the larger frequency (or equal) number recorded by the other observer during that same session. We then multiplied that number by 100 to get a percent agreement for each session. IOA for self-injury for all participants averaged 93.6% (range per session 89.6-96.8%).

IOA was also collected on the primary investigator's behavior for 20% of sessions. IOA on the primary investigator's behavior was scored from videotapes. Both the primary investigator and a secondary observer scored the behavior of the primary investigator. A point-by-point comparison was conducted for each behavioral skill step in the intervention plan. The number of agreements divided by the number of agreements plus disagreements, multiplied by 100 was used to calculate IOA for researcher behavior. IOA on researcher behavior averaged 98.7% (range per session 97.0-100%) (see Appendix B for the behavioral steps of the intervention plan for each participant).

Design

The design for the current study was a concurrent multiple-baseline design across participants.

Procedures

Pre-Intervention Assessments

Functional Assessment through Indirect Assessment and Direct Observation. We were unable to receive human rights committee approval to do an experimental functional analysis (Iwata, Dorsey, Slifer, Bauman, & Richman, 1982). Rather, we did a number of direct and indirect assessments to identify environmental variables that might be maintaining each individual's self-injury. The first assessment was the *Questions about Behavioral Function (QABF)* questionnaire (Matson, Bamburg, Cherry, & Paclawaskyj, 1999) (see Appendix C). This questionnaire has 25 items and asks caregivers to rate each item with a frequency measure of "never," "rarely," "some," and "often." Examples of items include "engages in behavior to get attention" and "engages in behavior more frequently when ill." The instrument categorizes behavior into five different functions including access to attention, escape, tangible, non-social, and/or physical. Staff members, who provided direct care for the participants, were asked to fill out a questionnaire for each participant. We also reviewed each participant's behavior-support plan, which outlined the possible functions, precursor behaviors and antecedent and consequent events that might affect self-injury.

We also informally interviewed staff members or teachers who worked closely with each of the participants. We asked the staff or teachers about what the participants' self-injury looked like and the times of day when self-injury was likely to occur. We asked them about what they thought was maintaining the behavior and about their typical responses to the participants' self-injury. Lastly, we asked staff members to list the participants' preferred foods, items, and activities.

We also used the *Behavior Problems Inventory (BPI)* questionnaire (Rojahn, Lott, Esbensen, & Smalls, 2001) (see Appendix D). The *BPI* is a 52-item questionnaire regarding

self-injurious behavior, stereotypy, and aggressive and destructive behavior for individuals diagnosed with an IDD. Each topography of problem behavior on the questionnaire is rated on a frequency scale (e.g., once a minute) and a severity scale (i.e., mild, moderate, or severe). We asked staff to fill out this questionnaire for each participant. Each participant received a score using the BPI, allowing us to make comparisons across participants.

In addition to the questionnaires and interviews, we also did a number of direct observations. Observations took place in the natural environments during the times staff indicated that the participants were likely to engage in self-injury. We observed each participant for approximately 1 hr on five different occasions over the course of at least four weeks. We videotaped each observation but did not interact with the participants during these observations. Using these videos, we attempted to identify antecedents and consequences for each instance or bout of self-injury. We also looked at the videos during times when the participants were not engaging in self-injury to identify environmental events that may interfere with self-injury (e.g., staff attention, meals, etc.).

Lastly, we used the *Non-communicating Children's Pain Checklist (NCCPC-R)* (Breau, McGrath, Camfield, & Finley, 2002) (see Appendix E). The *NCCPC-R* has 7 categories of nonverbal pain-related behavior: vocal, social, facial, activity, physiological, body/limb and eating/sleeping behavior. We scored five direct-observation videotapes of each participant to assess the frequency of non-verbal pain-related behaviors. This checklist was used to identify if participants appeared to be experiencing pain-related behavior during times they engaged in self-injury or if pain-related behavior occurred at a higher rates on days when self-injury also occurred at a high rate.

Medical Information. We received parent/guardian approval to access each of the participant's medical history including access to any reports or recommendations made by each participant's physicians over the last five years. We also attended bi-monthly clinical reviews where each participant's behavioral and medical concerns were reviewed with outside reviewers, behavioral analysts, and nurses. This information was used to determine if any internal/biological events might be affecting each participant's self-injury.

For each participant, there were no apparent medical conditions that were correlated with self-injury. Bobby's current major medical concern involved large cataracts that had developed in both eyes due to his detached retinas. Jack's current medical concerns included anxiety attacks and high blood pressure. Steve's current medical concerns included eczema and his family and physicians were exploring the possibility of a seizure disorder.

Preference Assessments. We conducted a paired-stimulus preference assessment (Fisher et al., 1992) to identify preferred edible items. We asked staff to identify at least five food items for each participant. Each food item was presented eight times over two different days. Food items that were chosen most frequently were considered the most preferred.

We also conducted an engagement preference assessment to identify possible items with which participants would appropriately engage. Through direct observations and staff interviews, we identified at least five potential engagement item/activities for each participant. Each participant was given one item/activity at a time. They were prompted to use the item/activity once. The participant was given three min to engage with the item/activity. Using a 10-s partial interval recoding system, we recorded the number of intervals that the participant engaged with the item/activity. Engagement was defined as any time the participant was facing the item/activity and was actively manipulating the item/activity. At the end of the three min, the

item/activity was removed. Participants had the opportunity to engage with each item/activity for three min, across three different opportunities, presented to them over two different days.

Baseline. We used the video recordings collected from the five direct observations from the pre-intervention assessments (described above) as baseline data. We also collected additional baseline sessions for each participant. During the baseline condition, we did not interact with the participants nor did we provide any consequences for self-injury. Staff members were instructed to continue to implement the participant's behavior support plans as they were currently written.

Multi-Component Intervention. Although the interventions were somewhat individualized for each participant, all interventions contained the same components. The behavioral components included:

- Reinforcing the absence of self-injury (DRO)
- Reinforcing communicative behavior (DRA)
- Blocking self-injury with redirection to appropriate activities.
- Providing participants with engaging and appropriate activities (environmental enrichment)

Each participant also had a treatment aimed at addressing biological/internal conditions that may have exacerbated their self-injury. Interventions were used in the participants' natural environments and no changes were made to the participants' daily schedules while the intervention was being implemented.

Phase 1. The researcher observed the participant (i.e., the researcher could see the individual and was close enough to block and redirect self-injury if necessary) on a variable-time schedule averaging once every two minutes. During this observation, if the participant was not engaged in self-injury, he received social praise (10 s) and/or was given a preferred item or

edible (identified from preference assessment) (i.e., reinforcing the absence of self-injury). If the participant was engaged in self-injury, the participant received no social praise or preferred item, attempts at self-injury were blocked, and participant was offered an alternative activity or a prompt to remain on task (i.e., blocking and redirection). The researcher also reinforced all communication attempts made by the participant on a fixed-ratio of one (i.e., reinforcing alternative behaviors).

Phase 2. Phase 2 also included all components from Phase 1. In addition to the Phase 1 components, we also provided the participant with noncontingent and continuous access to engagement activities that were identified in the previous preference assessments (i.e., environmental enrichment). The participant also received behavior-specific praise (10 s) and/or preferred edibles contingent on appropriate engagement on a schedule of one praise statement in a 10 min period.

We also incorporated an intervention to attempt to address any biological/non-environmental influences on self-injury. Again, after reviewing each participant's medical history, there were no identifiable medical conditions that seemed to be directly affecting each participant's self-injury. After conducting our direct observations of all participants, however, each participant appeared to display pain-related behaviors in conjunction with their self-injurious behavior during baseline. The first goal was to identify any non-verbal and/or verbal behaviors that indicated to others that the participant was feeling pain, was distressed, or uncomfortable. These were taken from the results of the NCCPC-R. Operational definitions of each participant's behavior were developed. We then responded when the participants exhibited what appeared to be pain-related behaviors by providing, if appropriate, either medication (e.g., a prescribed pain medication such as hydrocodone) or non-drug interventions (e.g., allowing

participants to leave a non-preferred situations such as waiting in a parking lot). Because it was unclear what the internal variable was that was actually affecting self-injury, crisis management plans were developed for each participant. The purpose of this component was to address non-environmental aspects (e.g., biological, stress, discomfort) of the participants' self-injury and to reduce the pain or distress that might be a setting event or consequence of self-injury (for an example see Carr, Smith, Giacin, Whelan, & Pancari, 2003). These interventions are described below and were used on an "as needed basis" (PRN) and were only implemented when the participant was displaying the agreed upon behavioral criteria.

After working and observing Bobby for several weeks, we found that eye redness was correlated with increased rates of self-injurious behavior. Additional medical assessments were conducted for Bobby during Phases 1 and 2, and his ophthalmologists hypothesized that Bobby's eye redness was a sign of inflammation in the eye, which may have been painful for Bobby. Based on these additional assessments, behavioral criteria for a crisis management plan were developed that indicated that Bobby was experiencing pain in his eyes. These were as follows: when Bobby's eyes were red, he engaged in loud crying, his head banging was non-redirectable for over an hour, and he refused to eat his meals or comply with any other requests. When it appeared that Bobby was not experiencing pain, the rate of his self-injury was significantly lower and there were differences in the topographies of self-injury. When Bobby did not appear to be experiencing pain (i.e., not displaying the above behavioral criteria), he spent very little time head banging on the wall, frequently smiled and laughed, sought out teachers' attention, swung on his swing. When Bobby appeared to be experiencing pain, he was given one dose of hydrocodone, a prescription pain medication. If, after two doses of hydrocodone, separated by at

least four hours, the behaviors indicating that Bobby was in pain did not subside, the doctor or nursing staff was called.

For Jack, behavioral criteria for a crisis management plan were developed to address what staff labeled as “anxiety.” These were as follows: when Jack engaged in high rates of biting his hands and arms, banged his head on the van window, had enlarged eyes, and made loud vocalizations. When Jack was not “anxious” his behavior and self-injury were significantly different. When Jack was not “anxious,” his self-injury occurred less often, he never engaged in biting, and he was more likely to engage with people and activities. When Jack appeared to be anxious, he was to be told what event was next in his schedule, a teacher sat next to him on the van to block his attempts at head banging, and the errand or task was completed as quickly as possible.

For Steve, behavioral criteria for a crisis management plan were developed to address self-injurious outbursts that, according to teachers, could have been affected by a flaring of Steve’s eczema or headaches. These were as follows: when Steve engaged in high rates of head hitting and banging, had labored breathing, was crying, and did not respond to any instructions. When Steve was not displaying these behavioral criteria, his self-injury occurred at a much lower rate, rarely included head hitting and banging, and he was much more likely to engage with people and activities in his environment. When Steve displayed the behavioral criteria, he was to be redirected to a “safe room” (i.e., a padded time-out room without a door). While in the safe room, attempts at SIB were blocked with a mat. Once Steve was calm for 5 minutes without self-injury, he was given access to cold wash clothes, ice packs were placed on his head, and lotion was put on his arms and legs. He was able to request preferred items and was able to leave the safe room.

Results

Table 1 summarizes the results from the *QABF* and our direct observations. On the *QABF*, Bobby's staff indicated that his self-injury occurred in all conditions (Attention, Escape, Non-Social, Physical, Tangible) with high severity scores in all categories. Jack's staff reported that self-injury occurred in all conditions (Attention, Escape, Non-Social, Physical, Tangible), but the highest severity scores were in the Escape and Non-social conditions. Lastly, Steve's staff reported that his self-injury occurred in all conditions (Attention, Escape, Non-Social, Physical, Tangible), but the highest severity scores were in the Escape and Non-social categories. Our direct observations of the participants supported the results from the *QABF*. Based on the results of the *QABF* and our direct observations, we concluded that each participant's self-injury might have been influenced by a number of different environmental variables and possibly some internal variables.

Table 2 summarizes the participants' characteristics and scores regarding self-injurious, aggressive, and stereotypic behavior. All participants received high score on the BPI in the self-injurious behavior category. A score of 7 or higher on the *NCCPC-R* indicates that the individuals are experiencing pain; all of the participants had an average score of 7 or higher prior to any intervention. Bobby's average score was an 8; Jack's score on the *NCCPC-R* was a 9.2; and Steve scored an average of 9.6.

Figure 1 displays the results from paired-stimulus preference assessment, which was used to identify preferred food items that were used to reinforce the absence of self-injury and other appropriate behavior. The food items are located on the x-axis. The percentage of times each food item was chosen (i.e., number of times a food item was chosen divided by the number of times presented) is on the y-axis. The results of the preference assessment for Jack indicated that

his preferred food items included marshmallows, fruit snacks, and cookies. Steve's preferred food items included pretzels, cookies, and chocolate candies. We attempted to implement this assessment with Bobby. Unfortunately, he was unable to successfully and reliably make choices because of his inability to see the choices. Instead, we simply assessed preference prior to starting any session for Bobby. We did this by offering Bobby a number of different food items, one at a time. If Bobby willingly accepted and ate the food item, we used that food item during that session. If Bobby threw the food item on the floor, it was not used. We attempted to identify at least two different foods or drink items to use per session.

Figure 2 shows the results from engagement preference assessments, which were used to identify potential engagement items/activities for each participant. The engagement item/activities are located on the x-axis. The percent of 10-s intervals that the participant was engaged (i.e., number of intervals that in the participant was engaged divided by the total number of intervals) is on the y-axis. Bobby's preferred engagement items/activities included swinging on a park swing inside his garage and outside, being sung children's songs, and playing hand games. Jack's preferred engagement items/activities while in his home included toy cars, whiffle balls and squishy balls, and a See & Say. Jack's preferred engagement activities on the van included the exercise bands and whiffle balls. Steve's preferred engagement activities were the iPad, computer, rocking chair, and coupon books.

Figure 3 summarizes the results of the effects of the multi-component intervention. Along the x-axis is the date of each session. The y-axis denotes the rate of self-injury per session (i.e., the total frequency of self-injury divided by the number of min in each session). Bobby had high, stable rates of SIB during baseline with a mean rate of 14.7 instances of self-injury per min. After implementing the first phase of the intervention (i.e., reinforcing absence of SIB,

reinforcing appropriate alternative behavior, blocking and redirection), SIB continued to occur at high, variable rates with a mean rate of 12.25 instances per min. After implementing Phase 2 of the intervention (including all components from Phase 1, plus engagement activities and the crisis management plan (PRN intervention)), there were substantial reductions in SIB compared to baseline with a mean rate of 2.6 instances per minute. The PRN intervention only had to be administered 4 times (indicated by the asterisks). Even on days when the PRN was delivered, SIB still occurred at rates similar to baseline. The mean rate of self-injury per min on days when the PRN was delivered was 14.3 instances per min. Large spikes in the rate of SIB were correlated with eye redness. The ophthalmologist also confirmed that Bobby's eyes were irritated and inflamed due to foreign material and scratches on days when he received the PRN. The mean rate of self-injury per min, excluding the days when the PRN was delivered, was 1.23 instances per min. Reductions in SIB were also maintained over a significant amount of time, approximately one year.

Jack had variable rates of self-injury during baseline at home and while riding in the van. At home, the mean rate of self-injury was 2.1 instances per minute. When Jack was riding in the van, the mean rate of self-injury was 5.13 instances per minute. After implementing the first phase of the intervention, self-injury decreased to about half of the rate during baseline. At home, self-injury decreased to a mean rate of 0.42 instances per minute. While riding in the van, self-injury decreased to a mean rate 2.24 instances per minute. After implementing Phase 2 (including all components from Phase 1, plus engagement activities and the crisis management plan (PRN)), there were substantial reductions in the rate of self-injury compared to baseline. At home, self-injury decreased to a mean rate of 0.01 instances per minute and self-injury decreased to a mean rate of 0.49 while riding in the van. The PRN intervention never had to be

implemented in Phase 2. Jack never displayed the behavioral criteria for the administration of the crisis management plan, once the engagement activities were introduced. Similar to Bobby, reductions in SIB maintained over a significant amount of time, approximately 9 months.

Steve also had variable rates of self-injury during baseline with a mean rate of 3.14 instances per minute. After implementing the Phase 1, unlike the first two participants, there were substantial reductions in the rate of self-injury compared to baseline. During this phase, the mean rate of self-injury was 0.22 instances per minute. Phase 2 was not implemented with this participant because self-injury occurred at very low rates and remained low in Phase 1, not requiring the introduction of Phase 2. After the introduction of Phase 1, Steve never displayed the behavioral criteria required for the PRN (crisis management plan). Reductions in self-injury were recorded for approximately 6 months.

Discussion

The multi-component intervention, used in the present study, was effective at reducing self-injury compared to baseline rates for all three participants. Reductions in self-injury were not noted until the intervention was introduced and implemented consistently for each participant. The intervention was successful in the natural environment. During the sessions, the participant's daily schedule was followed as closely as possible. Additionally, the intervention was effective for a substantial amount of time. We followed and worked these participants for approximately one year.

This study attempted to develop interventions that addressed brain-behavior-environment influences on the self-injurious behavior. The people who participated in this study had long histories of engaging in very severe self-injurious behavior that had caused a number of permanent impairments. Anecdotally, many of the teachers that worked with these individuals

had reported a number of different treatment failures. Watching these people engage in serious self-injurious behavior, with no effective intervention, may have produced a learned helplessness in many of the teachers. Based on the results of the current study, clearly, these individuals needed an intensive and multi-component intervention that addressed many possible influences on self-injury.

All participants, however, did not need all components of the intensive intervention. Steve only needed Phase 1, while Jack only needed Phase 1 plus the engagement component, whereas Bobby needed all the components for substantial reductions in self-injury. These individual differences suggest that interventions for reducing self-injury in the natural environment may need to be individualized for each consumer. Because self-injury can be affected by a number of different environment and internal variables, it is unlikely that a generic intervention package will be successful for all individuals. Some individuals may need more intensive intervention. It is likely that all three of our participant's self-injury was both socially and biologically mediated, as is the case for many severe, refractory, self-injury cases. These individuals need a much more detailed and complex intervention than individuals whose self-injury may only be socially mediated.

In order to effectively treat this difficult behavior, a number of steps must be taken. The first is to do a number of assessments prior to developing interventions. The assessments should include direct assessments, and if possible, experimental functional analyses, of environmental events that may be influencing self-injury. Medical assessments and, if possible, genetic testing should also be conducted to identify any possible biological influences on self-injury. Conducting a number of assessments is likely to increase the likelihood that the initial interventions that are developed will be effective. The results of these assessments should guide

treatment teams in developing individualized interventions that may require a number of different components.

The results of the first study suggest that, in addition to changing teacher behavior by providing reinforcement for the absence of self-injury, as well as for appropriate behavior, the environment may need to be changed to promote appropriate engagement. The environmental enrichment component may have played a crucial role in the reduction of self-injury for the first two participants. Once engagement activities were made available to Bobby and Jack, their self-injury substantially decreased. The engagement activities may have functioned in two different ways. The first is that appropriate engagement may have been incompatible with self-injury. For example, swinging on the swing in the garage was incompatible with banging his head on the wall in the kitchen for Bobby. Unfortunately, the participants did continue to engage in some topographies of self-injury while they were using the engagement activities. For example, Bobby still engaged in some head hitting while swinging on the swing. The second way is that some of the engagement activities may have provided the same type of sensory feedback as the self-injury. All participants engaged in high rates of self-stimulatory behavior suggesting that they may have been sensitive to the proprioceptive feedback they may have received from certain engagement activities.

We never had to implement the environmental enrichment component for Steve. We hypothesize that Steve's environment was already highly engaging prior to starting the study. Steve attended public school each day and had access to activities he enjoyed such as riding his bike, using the computer, and sitting in the rocking chair. The public school environment was substantially different, in terms of the availability of engagement activities, from the both of group home environments where both Bobby and Jack were living.

An additional consideration involves the scores from the *NCCPC-R*. All of the participants received scores indicating that they were in pain during the baseline observation sessions. All participants had a crisis management procedure developed to decrease the frequency and duration of the non-verbal pain-related behaviors displayed in conjunction with self-injury. Bobby was the only participant for which this component was necessary. Additionally, Bobby was the only participant in which we could identify a clear correlate of the pain (i.e., eye irritation and leaking cataracts). It is unclear if the participants were actually experiencing pain during baseline or what the exhibition of these behaviors may indicate. There has been some preliminary research on investigating whether pain is a cause or a consequence of self-injury (Courtemanche et al., 2011). So far, the results are inconclusive. Perhaps the data reported here suggest that pain-related behaviors might be a consequence of self-injury, because, for two of the individuals, the presence of pain-related behaviors decreased when self-injury decreased.

Although it is not exactly clear how pain-related behaviors play a role in self-injury, using the *NCCPC-R* was helpful in determining times when a more intensive intervention may be necessary for certain individuals. For example, observing these non-verbal pain-related behaviors made it easier to identify times when Bobby might be experiencing pain, making the distribution of PRN medication more likely to be delivered at appropriate times. Future studies should continue to evaluate how to effectively identify if individuals are in fact experiencing pain in relation to self-injury. Although it is unclear if self-injury produces pain or pain may produce self-injury, but appropriate interventions need to be identified to improve these individuals' quality of life.

Unfortunately, as seen with Bobby, even when the intervention was implemented consistently and with high integrity, self-injury may still occur at high rates on certain days. During these times, additional assessments should be conducted to identify if high rates of self-injury are correlated with illness, allergies, infection, or other factors that may exacerbate self-injury (Carr & Smith, 1995).

The current study was effective at reducing self-injury in the natural environment for a substantial amount of time for three participants who engaged in severe and chronic self-injury. The largest limitation of the current study is that the intervention was researcher mediated and teachers who work with these individuals on a daily basis were not taught how to use these interventions. Because these individuals needed such intensive intervention, it is important that detailed staff training and continued follow-up be implemented.

Study 2

Reducing self-injury that has been in existence for several years is difficult, especially when one does not know what is maintaining the self-injury. We developed procedures that were effective in reducing self-injury in the natural environment for three individuals with IDD. To maintain low levels of self-injury, teachers and staff need to learn to implement these procedures. Researchers have been successful at teaching teachers a number of different skills including helping adults with IDD with self-help skills (e.g., Ducharme & Feldman, 1992; Ivancic, Reid, Iwata, Faw, & Page, 1981; Kissel, Whitman, & Reid, 1983), prompting and reinforcing appropriate behavior in group homes, the community, and special education classrooms (e.g., Barnes, Dunning, Rehfeldt, 2011; DiGennaro, Martens, & McIntyre, 2005; Golden & Reese, 1996; Halle, Baer, & Spradlin, 1981; Parsons, Rollyson, & Reid, 2004), conducting functional analyses (e.g., Iwata et al., 2000), collecting accurate data in group homes

(e.g., Mozingo, Smith, Riordan, Reiss, & Bailey, 2006), and decreasing a number of different problem behaviors (e.g., Carr & Carlson, 1993; Allen, McDonald, Dunn, & Doyal, 1997; Feldman, Condillac, Tough, Hunt, & Griffiths, 2002).

Teaching staff how to implement behavior plans for reducing problem behaviors, like self-injurious behavior, is extremely important for both teachers and consumers. These maladaptive behaviors not only interfere with learning on the behalf of the consumer, but these behaviors may also have an effect on the interactions between staff and consumers. Researchers have reported that self-injurious behavior may evoke a number of different feelings in staff members including sadness and despair (Hasting & Remington, 1993). As a result, individuals who engage self-injury may receive poorer services, be excluded from activities, and be at more risk of abuse (Hastings & Remington, 1993; Oliver, Murphy, & Corbett, 1987). Additionally, working with individuals who engage in self-injury may produce staff burnout and eventually staff turnover. When behavior plans, designed to reduce these unwanted behaviors, are not implemented correctly or consistently, treatment attempts may become ineffective (Reid & Parsons, 2002). Once an effective intervention has been developed to reduce problem behavior, a necessary step is to train staff how to successfully implement the intervention consistently and with high integrity. Kahng et al. (2002) reported that less than 5% of studies demonstrating effective behavioral interventions to reduce self-injury were taught to teachers. Clearly, additional research on teaching staff how to use these interventions to reduce serious problem behaviors, like self-injury, is warranted.

If training teachers how to implement behavior support plans is to be effective, the training needs to be knowledge- (knowing the plan) and performance-based (performing the plan correctly) (Reid & Parsons, 2002). Thus, the plan must be broken down into component steps

and practice to a criterion in “real life” situations. Knowledge- and performance-based staff training requires that the trainer provide staff with both a written and verbal description of the behavior support plan and rationales as to why each skill step in the plan is important. The trainer should also demonstrate the skill steps that the teachers need to perform. The demonstration of the skill steps should be under similar conditions as to when and where the teachers would be using the behavior support plan in their everyday work (Harchik, Sherman, Hopkins, Strouse, Sheldon, 1989; Reid & Parsons, 2002).

After watching the demonstration of the skill steps, teachers must practice the skill steps of the intervention plan in both role-play situations and with the actual consumers. Practicing the behavioral skill steps during role-play situations reduces the potential of negative effects on the consumer and allows teachers to make mistakes while they are learning to implement the skill steps. Once teachers have displayed proficiency in role-play situations, only a brief amount of additional training may be needed for staff to perform the skills with the actual consumers (Reid & Parsons, 2002). Teachers should continue to practice the intervention plan until they have become proficient in its use.

Teachers should also receive feedback regarding their implementation of the intervention plan. Feedback may be a crucial component when teaching teachers how to implement procedures (Harchik et al., 1989). This may be especially true when the feedback not only identifies the skill steps that the teacher implemented correctly, but the feedback also specifies to the teacher how to respond differently in the future if they implemented skill steps incorrectly (Roscoe, Fisher, Glover, Volkert, 2006).

Some research has suggested that feedback may be more effective when it is used in conjunction with additional potential reinforcers (Balcazar, Hopkins, & Suarez, 1986; Alvero,

Bucklin, & Austin, 2001). Researchers have produced large changes in staff behavior when monetary incentives were incorporated with feedback (Katz, Johnson, & Gelfand, 1972; Pomerleau, Bobrove, & Smith, 1973; Pommer & Streedbeck, 1974). Bucklin and Dickinson (2001) reported that feedback with contingent money was more effective than feedback with noncontingent money. Contingent money alone, however, may not improve a teacher's implementation of procedures (Roscoe et al., 2006). Only using contingent money may not provide teachers with information regarding skills steps that may need improvement. Feedback may enhance the effects of contingent money (Bucklin, McGee, & Dickinson, 2003), especially if the feedback specifies exact ways for the teachers to improve their performance.

Contingent money may act as a positive reinforcer making it more likely that teachers will continue to implement the behavior support plan in the future. Teachers have also reported that time is a commodity that they value. A survey of teachers indicated that interventions that take less time are more preferred by teachers (Witt, Martens, & Elliot, 1984). Negative reinforcement contingencies rather than positive have been used to maintain teachers use of procedures. After initial teaching-training procedures, Ward, Johnson, and Konukman (1998) made teachers practice, 10 times, skills that were incorrectly implemented. Similarly, DiGennaro and colleagues (2005) required that teachers practiced missed skill steps three times. For both of these studies, the teachers could avoid the meetings and practice if they correctly implemented the procedures.

Teachers and staff should be taught to successfully and consistently implement intervention plans in the presence of the researcher/observer. It is critical, however, that staff implement these procedures when a researcher/observer is not physically present. It may be the case that staff may implement procedures when they know that someone is watching them (i.e.,

staff reactivity) (Kazdin, 1979) but not at other times. Mazingo and colleagues (2006) reported that the presence of a researcher, even when the researcher did not provide feedback, was enough to maintain teachers' use of a data collection procedure. In an attempt to reduce staff reactivity, Ivancic and colleagues (1981) tried to use covert observations to monitor teacher behavior through unannounced visits, but the researchers reported that they had a difficult time collecting the information required to evaluate the staff's performance. For example, if the teachers were working on self-help skills in the bathroom, it would be difficult for an observer to inconspicuously monitor staff's behavior. Additionally, in this study, although the staff were unaware of when the researcher would arrive at the home, the researchers were still present in the home, possibly affecting the staff's performance and changing staff behavior within seconds of the arrival of the researcher/observer.

Many researchers also advocate that continual feedback is necessary to maintain behaviors that teachers have been taught. For example, Harchik et al. (1992) used a consultation-training package to teach staff to use a token reinforcement system to reinforce appropriate engagement in activities with adults with IDD. The researchers reported that the teachers stopped implementing the procedure when they were no longer receiving feedback from the researchers regarding their use of the procedures. Once the researchers again began to provide feedback over the teachers' performance, the teachers resumed using the procedures. The results of this study suggest that ongoing feedback was needed for staff to continue to consistently use the procedures.

Although researchers report that teachers need ongoing feedback and support, it is unclear how often this feedback and support should be provided. Harchik and colleagues (1989) suggest that teachers should be observed and receive feedback at least once a week. They report

that even with experienced staff, periodic observations and feedback are necessary to maintain adequate performance. Some researchers have been able to fade the frequency that teachers receive feedback over time. Maintenance of teacher behavior has been achieved with structured feedback and reinforcement thinning schedules (DiGennaro et al., 2005; DiGennaro, Martens, & Kleinmann, 2007).

We addressed three issues in the second study. The first was to teach teachers who work in community group homes and a public school setting how to implement procedures to reduce severe self-injury in the natural environment using a multi-component treatment approach (based on the results of Study 1) with a staff-training package that included feedback and contingent money. The second was to assess whether teachers continued to implement the behavior support plan after the researcher was no longer present in the environment observing their performance. The third purpose was to assess whether teachers continued to implement the behavior support plan in the researcher's absence and were not receiving feedback and money as frequently.

Methods

Participants

We recruited one teacher who worked closely with each of the three consumers from Study 1.

Dyad 1. Our first dyad was Steve and his teacher. At the beginning of the study, the teacher was 42 years old. She had worked in her current position with Steve for 10 months. Prior to her current school placement, she had worked for 12 years in the public school system as a paraprofessional with both general and special education students. She had a high school diploma and had taken two college courses. Prior to her work with Steve, she had never worked with anyone who engaged in severe self-injury.

Dyad 2. Our second dyad was Bobby and his teacher. At the beginning of the study, the teacher was 48 years old. She had worked in her current position as a teacher with Bobby for one year. Prior to this job, she had four years of experience working in community group homes that served adults with mild IDD. She had a high school diploma. Prior to her work with Bobby, she had never worked with any individuals who engaged in severe self-injury.

Dyad 3. Our third dyad was Jack and his teacher. At the beginning of the study, the teacher was 54 years old. She had worked in her current position with Jack for three years, but had over 10 years of experience working with adults with IDD living in the community. She had a bachelor's degree in both sociology and psychology. Prior to her work with Jack, she had never worked with any individuals who engaged in severe self-injury.

Setting

The settings for this study were the same as in Study 1. For Steve, the setting was his public school classroom. For Bobby, the setting was his community group home. For Jack, we taught teachers how to implement the intervention while Jack was riding in the group home van. We only focused on Jack's self-injury when he was riding in the van because his self-injury occurred most frequently and was most severe in this setting.

Data Collection

We collected two types of observation videos. All videos were 10 min in length. The first type of videos were collected during observations of teacher and consumer behavior when the researcher was present in the school, home, or van. These observations were collected during scheduled appointments with teachers during times when self-injury was likely to occur. These observations were used to assess how the teachers were implementing the intervention plan when

the researcher was present, and the frequency of self-injury engaged in by each of the participants.

The second type of observation videos were videos that were collected when the researcher was not present in the school, home, or van. These videos were collected from either security cameras installed in the home and van or during unannounced visits by research assistants in the school. Videos were collected during times when self-injury was likely to occur and were used to assess how frequently self-injury occurred and whether the teachers were implementing the intervention plan when the researcher was not in the school, home, or van observing their performance. For Bobby, we viewed footage from security cameras that were installed in his home. The security cameras were part of a HomeLink Support Technologies system (Strouse, in prep). Because Bobby was likely to engage in self-injury throughout the day, we randomly determined which times the interactions between Bobby and his teacher were viewed. If Bobby and his teacher were not visible on the video during the randomly selected time (e.g., teacher was not scheduled to work, Bobby was on a community outing, etc.), the next time in the random sequence was chosen. For Jack, we viewed footage from a security camera that was installed in his group home van.

We were unable to install security cameras in Steve's classroom because of confidentiality issues with his classmates and other teachers. For Steve, we collected videos during unannounced visits made by research assistants. Steve's teacher was unaware of the time or day that the research assistant would arrive at the classroom. Research assistants recorded the interactions between Steve and his teacher for the first ten minutes of each unannounced visit.

Dependent Measures

Teacher Behavior. All consumers had a behavior support plan developed for them based on the results of Study 1 (see Appendix B for the behavioral skills steps of each participant's behavior support plans). Steve's plan had 24 steps; Bobby's plan had 19 steps; Jack's plan had 22 steps. For each behavioral skill step in the behavior support plan, teachers could receive a score of "2," "1," or "0." If the teacher implemented a step of the intervention correctly for the entire 10 min observation, she would receive a score of "2." If the teacher attempted any step in the plan, but she did not complete the step correctly or consistently throughout the entire observation, the teacher would receive a score of "1" for that step. If the teacher omitted a step of behavior plan, the teacher received a score of "0" for that step. A teacher could also receive a score of "not applicable" for certain steps based on whether or not that step of the plan needed to be implemented. For example, if a consumer did not request any preferred items during the observation, steps related to reinforcing communication would be scored as "not applicable."

For each observation, whether in the presence or absence of the researcher, the percentage of intervention steps performed correctly by the teacher was calculated. The total amount of points earned by the teacher was divided by the total number of applicable steps of the plan (multiplied by two). This number was then multiplied by 100 to get a percentage of steps the teacher implemented correctly.

Consumer Behavior. For each 10 min observation, whether in the presence or the absence of the researcher, we recorded the frequency of self-injury that the consumer engaged in while the teachers were implementing the behavior support plan.

Inter-observer Agreement. We assessed inter-observer agreement (IOA) on at least 20% of sessions. Reliability was collected from videos of all observations both in the researcher's presence and absence. A second observer independently scored data from the videotapes. In all

cases, the secondary observer's data was compared to the data collected by the primary investigator.

For each teacher's use of the behavior support plan developed for the consumer with whom they worked, a point-by-point comparison was conducted for each behavioral skill step in the relevant consumer's intervention plan. The number of agreements was divided by the number of agreements plus disagreements and multiplied by 100. The overall IOA on teacher behavior was 97.2% (range across sessions 95.3-100%).

The primary investigator also recorded the number of instances of SIB during each observation. A second observer recorded the number of instances of SIB for at least 20% of the sessions. The total number of instances of self-injury recorded by the primary investigator for each session was compared with the total number of instances of self-injury recorded by the second observer, and the reliability calculation for self-injury was the smaller frequency number recorded by one observer during a session divided by the larger frequency (or equal) number recorded by the other observer during that same session. We then multiplied that number by 100 to get a percent agreement for each session. The total IOA for self-injury was 95.9% (range across sessions 86.7-98.1%).

IOA was also calculated on the primary investigator's integrity in following the teaching protocol steps. For Phase 1, IOA was calculated as to whether the primary investigator followed the teaching protocol for the role-play scenarios (see Appendix F for the teaching protocol steps for role-play scenarios). IOA for researcher behavior in Phase 1 was 100%. For Phase 2, IOA was calculated as to whether the primary investigator followed the teaching protocol while she was present in the home observing the teacher and consumer (see Appendix G for teaching protocol steps for Phase 2). IOA for researcher behavior in Phase 2 was 100%. For Phases 3

and 4, IOA was calculated as to whether the primary investigator followed the teaching protocol for the observations in the researcher's absence (see Appendix H for the teaching protocol steps for Phases 3 and 4). IOA for researcher behavior in Phases 3 and 4 was 100%.

Design

We used a multiple baseline design to for teacher and consumer behavior in both the researcher's presence and absence.

Procedures

Baseline. During observations of teachers, they were told, "Act like we are not observing you and do what you would normally do." Teachers were given no information regarding the steps of the new behavior support plan. Teachers received no feedback or money for correct implementation of intervention procedures. We provided no consequences for self-injurious behavior.

Debit Cards. After each observation (except during baseline), teachers had the opportunity to earn differing dollar amounts (\$2.00, \$5.00, or \$10.00) based on their implementation of the behavior support plan. Each teacher was assigned a reusable MasterCard debit card. We used Greenphire, LLC to manage our payments to teachers. Greenphire, LLC is a company that provides payment solutions for organizations conducting clinical trials. The ClinCard system is a product of Greenphire that provides secure web-based data collection services combined with research participant payment. Through the ClinCard system, we were able to remotely and securely deposit money onto each teacher's debit card.

Phase 1-Written Instructions, Modeling, Role-playing, and Feedback + Contingent Money. During Phase 1, a one-on-one meeting was scheduled with the teacher in the school or home. During this meeting, the teacher was given a written description of the new behavior

support plan. We verbally described each step in the plan and provided rationales as to why each step was important. After the initial description of the steps in the plan, we asked the teacher to complete a written quiz over the material within 24 hr (or the following work day). If the teacher scored 90% or higher on the quiz, \$5.00 was deposited onto her debit card. If the teacher did not score 90% or higher on the quiz, she was required to retake the quiz until she earned a score of 90% or higher. Once the teacher reached this criterion, we deposited \$2.00 onto her debit card. Teachers were only required to pass the quiz once (see Appendix I for written quizzes).

After passing the quiz, all subsequent teaching sessions were conducted in the following manner. The primary investigator reviewed the written description of the behavior support plan and then modeled the steps of the intervention plan with the teacher acting as the consumer. After modeling, the teacher was asked to identify the skill steps of the behavior support plan that the primary investigator modeled correctly and incorrectly. If any steps of the behavior support plan were modeled incorrectly, the primary investigator remodeled the whole intervention plan and modeled all skill steps of the intervention correctly.

After the researcher modeled the steps in the behavior support plan, the teacher practiced the steps of the intervention in a role-play situation with the researcher acting as the consumer. After completing the role-play, the researcher gave verbal feedback to the teacher over the steps she performed correctly and the steps she may have missed or performed incorrectly. The amount of money the teacher earned was based on this first performance. If the teacher performed 100% of the behavioral skill steps correctly with a “2” rating for each step during the first role-play, we deposited \$5.00 onto her debit card and she was not required to practice the intervention steps again that session. If the teacher did not perform the steps correctly at 100%,

she continued to practice the behavior support plan in the role-play situation until the 100% criterion was met. Once the criterion was met, the teacher received only \$2.00.

After the teacher met the criterion for that session, we discussed how the teacher would use these skills in her daily work. Teachers had to perform 100% of the behavioral skill steps correctly with a “2” rating on each skill step during the first role-play of the session for three consecutive sessions, across three days, in order to move to the next phase.

Phase 2-Naturalistic Observations-Researcher Present. In Phase 2, we continued to schedule one-on-one meetings with each teacher. During these meetings, rather than practicing the behavioral skill steps in a role-play situation, the teacher performed the skill steps directly with the consumer while the researcher observed her performance. The researcher provided feedback (praise and corrective feedback) to the teacher throughout the observation over steps of the intervention that she was performing well or steps she was missing or performing incorrectly.

At the end of the 10 min observation, if the teacher completed 90% of the intervention steps correctly (with a score of “2” rating on the majority of the skills steps), the session ended and we deposited \$5.00 onto her debit card. If the teacher did not meet the 90% criterion, she was required to practice the intervention steps in a role-play situation with the researcher until she had correctly implemented 100% of the steps of the intervention plan three consecutive times. After meeting these criteria, we deposited only \$2.00 onto the teacher’s debit card. Teachers had to reach successful implementation of the intervention steps at 90% correct during the first observation, for three consecutive observations, across three days. Additionally, the consumer with whom the teacher was working had to have a 50% reduction (as compared to baseline) in self-injurious behavior during each of the three consecutive observations before moving to Phase 3.

Phase 3-Generalization-Researcher Absent. During this phase, we used the same procedures from Phase 2, except feedback and money were now delivered contingent on each teacher's use of the behavior support plan in the absence of the primary investigator. Data were collected from the security videos (for Bobby, Jack, and their teachers) and videos collected by research assistants (for Steve and his teacher) during unannounced visits. After viewing the teacher's performance from the videos, if the teacher met the criterion of 90% correct implementation of the intervention steps (with a score of "2" rating on the majority of the skills steps) in the absence of the researcher, she was notified via both phone and email, within 24 hours of the observation, with behavior-specific praise over the intervention steps that she performed correctly with a "2" rating and corrective feedback over the skill steps for which she earned a rating of "1" or "0" (both written and verbal feedback). The teacher was not required to role-play any parts of the intervention with the primary investigator and \$10.00 was deposited onto her debit card. If the teacher did not meet the 90% criterion, she was notified via phone and email, within 24 hours of the observation, with behavior specific praise over the intervention steps that she performed correctly. The teacher was also given suggestions for improvement over the areas of the behavior support plan that she had missed or performed incorrectly. During the phone call, the researcher set up a meeting time with the teacher to practice the intervention steps in a role-play situation with the researcher, either the same day that feedback was given or the next "work" day for that teacher. The researcher practiced the intervention steps in a role-play situation with the teacher until she correctly implemented 100% of the skill steps with a "2" rating for three consecutive role-plays (within the same session). Once this was completed, we deposited \$2.00 onto her debit card. Teachers had to reach successful implementation of the intervention steps at 90% correct for three consecutive observations in the researcher's absence,

across three days, with a 50% reduction (as compared to baseline) in their consumer's SIB before moving to Phase 4.

Phase 4-Structured Fading. In Phase 4, we evaluated whether teachers continued to use the intervention plan when they received less frequent feedback and money for correct implementation of the plan. During this phase, all procedures for conducting observations and delivering feedback and money were the same as Phase 3. We continued to monitor both teacher and consumer behavior through the security cameras and videos collected during the unannounced visits by the research assistants. The frequency that feedback and money were delivered, however, was decreased.

Prior to starting Phase 4, we reviewed how often the teachers received feedback during Phases 2 and 3. We then took average the number of workdays that teachers were receiving feedback and doubled that number. For example, if a teacher, on average, received feedback every two days in Phases 2 and 3, during Phase 4, she received feedback every four days.

Social Validity

We collected two different types of social validity data. The first type was from our three teachers who participated in the teacher training. A social validity survey was distributed to each teacher with whom we worked. Each survey contained ten questions that asked teachers to evaluate the acceptability of the teaching procedures and the outcomes of the study (see Appendix J for social validity survey for teachers).

The second type of social validity data we collected was from outside reviewers who did not know the purpose of the study. The purpose of this assessment was to assess what professionals who work with individuals with IDD thought of the overall effects of the study. We did this by taking random, 2 min clips, from a random sample of the videos collected in the

researcher's absence from both baseline conditions and post-teaching. We only used videos of Steve and his teacher and Bobby and his teacher because these were the only dyads for which we had teacher consent to show their videos to individuals not associated with the research project.

There were a total of 8, 2 min video clips, for a total of 16 min of video. Video clips were presented in a random order to 9 reviewers. We asked each reviewer to answer five questions anonymously for each video clip. Questions were related to teacher-consumer interactions, how the teachers attempted to reduce self-injury, and whether the frequency of self-injury occurred at acceptable levels (see Appendix K for the questions that were asked of the outside reviewers).

Results

Figure 4 displays both teacher and consumer behavior while the researcher was present in the school, home, or van to conduct observations. The x-axis represents the number of observations. The left y-axis represents the percentage of intervention steps correctly implemented by the teacher (closed circles). The right y-axis represents the frequency of SIB that the consumer engaged in while the teacher was being observed (open squares).

For Steve, during baseline, his teacher implemented less than 50% of the behavioral skills steps in his behavior support plan. During these baseline observations, Steve engaged in self-injury at a mean rate of 1.3 instances per minute. During Phase 1, Steve's teacher met the mastery criterion of three consecutive role-plays at 100% correct implementation of the skill steps. In Phase 2, Steve's teacher met the mastery criterion of three consecutive observations at 90% correct implementation of the skill steps when working directly with the consumer. During this phase, Steve's self-injury decreased to a mean rate of 0.37 instances per minute.

During baseline, Bobby's teacher implemented less than 50% of the behavioral skill steps in his behavior support plan. During these baseline observations, Bobby engaged in self-injury

at a mean rate of 17.4 instances per minute. During Phase 1, his teacher met the mastery criterion of three consecutive role-plays at 100% correct implementation. Following the role-play practice, during Phase 2, Bobby's teacher met the mastery criterion of three consecutive observations at 90% correct implementation of the skill steps with the consumer. During Phase 2, Bobby's self-injury decreased to a mean rate of 4.57 instances per minute.

During baseline, Jack's teacher implemented less than 30% of the behavioral skill steps in his behavior support plan while Jack was riding in the van. During these observations, Jack engaged in self-injury at a mean rate of 5.5 instances per minute. During Phase 1, Jack's teacher met the mastery criterion of three consecutive role-plays at 100% implementation of the behavior support plan. Following this phase, Jack's teacher met the criterion of three consecutive observations at 90% correct implementation of the behavior support plan. During Phase 2, Jack engaged in self-injury at a mean rate of 1.6 instances per minute.

Figure 5 displays both teacher and consumer behavior while the researcher was not present in the school, home, or van but was collected using videos from the security cameras and the videos collected during unannounced visits by research assistants. The x-axis represents the number of observations collected in the researcher's absence. The left y-axis represents the percentage of intervention steps correctly implemented by the teacher (closed circles) in the researcher's absence. The right y-axis represents the frequency of SIB that occurred while the teacher was implementing the intervention (open squares).

During baseline, on average, Steve's teacher implemented approximately 50% of the intervention steps when the researcher was absent. During these observations, Steve engaged in an average rate of 0.7 instances of self-injury per minute. Once Steve's teacher began receiving feedback and contingent money regarding her use of the behavior support plan in the

researcher's absence, she began correctly implementing the plan at 90% or higher and she met the criterion of three consecutive sessions at 90% correct implementation of the skill steps. During this time, Steve's self-injurious behavior was reduced to an average rate of 0.17 instances per minute. Steve's teacher was able to continue to implement the behavior support plan with at least 90% correct implementation of the skill steps even when the frequency that she received feedback and money was reduced to every 4 days.

During baseline, on average, Bobby's teacher implemented less than 35% of the skill steps in Bobby's behavior support plan when the researcher was not present in the home. During these observations, Bobby engaged in an average rate of 14.1 instances of self-injury per minute. Once Bobby's teacher was receiving feedback and contingent money regarding her implementation of the behavioral skill steps for Bobby's behavior support plan, she met the mastery criterion of 90% correct implementation of the skill steps in the behavior support plan for three consecutive observations when the researcher was absent. During this time, Bobby's self-injurious behavior reduced to a mean rate of 7.2 instances per minute. Bobby's teacher was able to continue to implement Bobby's behavior support plan even when the frequency that she received feedback and money was faded to every 5 days.

During baseline, Jack's teacher, on average, implemented less than 10% of the behavioral skill steps in Jack's behavior support plan while he was riding in the van and when the researcher was absent. During these observations, Jack engaged in self-injury at a mean rate of 3.1 instances per minute. Once Jack's teacher began receiving feedback and contingent money regarding her use of Jack's behavior support plan, she met the criterion of three consecutive observations at 90% correct implementation of the skill steps in the behavior support plan. During this time, Jack's mean rate of self-injurious behavior was 0.63 instances per minute.

Jack's teacher was able to continue to implement Jack's behavior support plan even when the frequency that she received feedback and money was reduced to every other day.

Correlational Analyses

We calculated the relationship between each teacher's integrity to the behavior support plan and the frequency of each consumer's self-injurious behavior to determine if high integrity to the behavior support plan was associated with decreases in self-injurious behavior. There were statistically significant correlations between adherence to the behavior support plan and decreases in self-injurious behavior for Bobby and his teacher ($r=-0.5$, $p<0.01$) and Jack and his teacher ($r=-0.56$, $p<0.01$). A statistically significant correlation was not found for Steve and his teacher ($r=-0.27$).

Social Validity

Social Validity from Teachers. Table 3 displays the results of the social validity surveys that were given to the three teachers who participated in the study. All teachers agree that they liked the teaching procedures, including the feedback and money. Teachers also reported that they felt confident implementing the new behavior support plans and that the plans were effective at reducing self-injury for the consumers with whom they were working.

Social Validity from Outside Reviewers. Figure 6 displays the results of the social validity assessments from the outside reviewers. On average, after viewing random clips of both baseline and post-treatment videos, the outside reviewers reported that the frequency that teachers provided and prompted engagement was higher after teaching compared to baseline. They also, on average, reported that the frequency and quality of teacher-consumer interactions improved post teaching. Lastly, on average, the outside reviewers reported that the methods that

the teachers used to reduce self-injury were more acceptable and that self-injury occurred less frequently after teaching.

Discussion

The staff-training package that included feedback and contingent money was successful in producing consistent implementation of multi-step behavior support plans for reducing self-injury in the natural environment in both the presence and absence of the researcher. Additionally, with consistent implementation of the behavior support plans, teachers were able to achieve reductions in the frequency of self-injury for the consumer with whom they were working. Teachers also continued to implement the behavior support plans in the absence of the researcher even when they received less frequent feedback and money.

The use of feedback and contingent money appear to be essential components of the staff-training package. Based on our results, simply providing teachers with a written description of the behavior support plan and having them practice the skills steps of the plan with the researcher and the consumer did not change the teachers' use of the behavior support plan once the researcher was not in the school, home, or van observing them. Although performance of the intervention steps may have slightly increased for some teachers during this time, the skill steps of the behavior plan were not consistently implemented until feedback and money were contingent on the teachers' use of the skills steps in the researcher's absence. We did not observe lasting and substantial reductions in self-injurious behavior until the behavior support plans were consistently implemented by the teachers.

The results of the present study support previous research that teachers need frequent feedback, as well as additional incentives like money, for continued and consistent implementation of behavior support plans or other teaching plans (e.g., Harchik et al., 1992).

Additionally, we were able to covertly observe teacher behavior without being present in the environment. The results in the current study suggest that teachers do not implement plans when an observer is not present and observing them. These results also suggest that teachers need on-going feedback and perhaps contingent money to promote long-term use of the behavior support plans during all times of the day when there is not someone present observing them. This may be especially true for behavior-support plans that have multiple components and may be difficult for teachers to implement.

One of the limitations of the present study is that it is unclear if the feedback, contingent money, and negative reinforcement procedures were all necessary components of the staff-training package to achieve the desired change in the teachers' behavior. As previous research indicates, the written and verbal feedback that teachers received most likely played a large role in the improvement in teacher performance noted in this study. As suggested by Roscoe and colleagues (2006), our feedback specified steps that the teacher was completing correctly, as well as specifying areas for improvement and how to improve in those areas.

Anecdotally, our teachers verbally reported to the primary investigator that the money was not important to them. We included contingent money as part of our training package to increase the likelihood that our staff-training package was going to be effective and that our teachers would learn the behavior support plans as quickly as possible. The consumers with whom the teachers were working engaged in severe and high rates of self-injurious behavior. We wanted the teachers to be able to address this difficult behavior as quickly and effectively as possible. Although we are not sure if the inclusion of the contingent money was an important part of the staff-training package, one of the teachers indicated that she was able to earn more money by taking the quiz and completing a role-play in thirty minutes, than she could earn in a

whole hour at her current salary. Also, the cooperating institution where both Bobby and Jack lived had begun giving monetary incentives for teachers with high levels of compliance for certain objectives or procedures. Using a staff-training procedure that combines both feedback and contingent money could easily become an institutionalized procedure for this organization.

We are also unsure if the negative reinforcement contingency included in our staff-training package was necessary. Only one of our teachers actually contacted this contingency, perhaps suggesting that it may not be an essential part of the training procedures and the positive reinforcement contingency (i.e., money) was a more important component to the training package. Negative reinforcement procedures, like ones used by DiGennaro and colleagues (2005), have been successful at improving teachers' use of procedures. These types of contingencies may be especially useful when providing additional incentives, like money, are not an option.

An additional limitation of the current study involves some of the difficulties we encountered using the security cameras to monitor teacher behavior. The security cameras were installed in the homes/van for security and safety reasons. Many of the camera and microphone placements throughout the home were not conducive for research purposes. We had to install additional cameras and microphones so that the majority of teacher-consumer interactions could be observed and heard. Using this type of observation system could be very costly up front for researchers and may be viewed as intrusive. Future researchers should continue to evaluate how these types of technologies can be used to train teachers and monitor their behavior. Although there could be high initial costs, using this type of technology could save money later on by giving clinicians the ability to monitor behavior from long distances. This may be especially beneficial when training teachers who provide services in rural areas.

An additional consideration of the present study was the length of the observation window for which we observed teachers. We only observed teachers for 10 min during each observation. Teachers reported to the primary investigator that they did not feel that the 10 min observation gave the researcher enough information about the circumstances that were occurring immediately before the observation. For example, during one observation of Steve and his teacher, the teacher had performed the skill steps at 90% correct, but Steve's self-injury still occurred at a high frequency. By simply watching the 10 min clip, we were unaware that Steve was incontinent 5 min before the video was taken, likely affecting the frequency of Steve's self-injury. In clinical settings, it is likely that observations of teacher behavior would be longer than 10 min and might range anywhere from 30-60 min. Longer observations may provide a clearer picture of the relationship between a teacher's performance and its effects on consumer behavior. Using technologies like the security cameras may provide opportunities to view what happened immediately preceding the observation, as opposed to the unannounced visits, where this was not possible.

The current study extends the previous literature in several ways. This study extends the current literature on the generalization of treatment effects across teachers for procedures designed to reduce self-injury in the natural environment (e.g., school and homes). All of our teachers were successfully able to implement the procedures and produce substantial reductions in self-injury in the participants' natural environments. The current study also assessed the effects of a combined feedback and contingent money procedure to teach teachers how to implement behavior support plans with individuals with IDD. Feedback and contingent money were part of an effective training package for teachers that produced rapid acquisition of the behavior support plans. The current study was one of the first to use security cameras to covertly

monitor teacher's behavior when a researcher was not present in the environment. Using this technology allowed us to monitor teacher behavior when we were not physically present in the consumer's environment. Using the security cameras also allowed us to demonstrate that even when teachers are proficient in using a behavior support plan, they may not consistently implement the plan during all times of the day unless they receive feedback regarding their use of the plan in the absence of an observer. Lastly, the current study demonstrated that teachers will continue to consistently implement behavior support plans when they are only receiving feedback approximately once per week.

General Discussion

The three consumers that we worked with in these studies were severe, chronic self-injury cases where the self-injury occurred at high rates and high intensities. Based on the results of Study 1, we were able to substantially reduce the rate of self-injurious behavior for all three participants. In order to achieve these results, we not only had to change the frequency and the quality of teacher-consumer interactions, but we also had to change the environment so that there were several engaging activities available to the consumers during most times of the day.

We were also able to teach teachers how to effectively use these interventions. Teachers learned to how implement the intervention plans relatively quickly, suggesting that the teachers were already capable of implementing the plans but may have lacked the motivation to do so prior to starting the study. Once teachers received feedback and contingent money regarding their use of the plan, all of the teachers consistently implemented the intervention plan and produced large reductions in self-injury during all times of the day even when an observer was not present in the home observing them. We were also able to fade the frequency that teachers received feedback and money to approximately once a week. Future research should continue to

evaluate how much the feedback/reinforcement schedule can be thinned before teachers stop consistently implementing the intervention. Based on the results of the current studies, we recommend that staff and teachers be observed and receive feedback on an intermittent and variable schedule.

Bobby, Jack, and Steve are likely to need constant monitoring and follow-up for the majority of their lives. Research has suggested that without consistent and intensive intervention, many individuals who engage in severe self-injurious behavior will continue to engage in this behavior (Schroeder et al., 1982; Schroeder, Schroeder, Smith, & Dalldorf, 1978). For example, Taylor, Oliver, and Murphy (2011) followed 49 individuals who engaged in severe self-injury over an 18-year period. They reported that only eight of these individuals stopped engaging in self-injury at the 18-year follow-up. Additionally, while most individuals continued to engage in same topographies of self-injurious behavior, almost 30% of the sample began engaging in new topographies of self-injurious behavior. The authors also discussed how many of these individuals' living environments had changed during the 18 years providing evidence as to how resilient and persistent self-injurious behavior can be even when faced with large environmental changes.

The chronicity of self-injurious behavior may be attributed to a number of different factors. The first may be that these individuals do not have access to intensive interventions. The second factor may be that the intensive interventions are not well sustained. Staff-turnover, lack of fidelity to the intervention plan, and the consistency that the plan is implemented can all affect how often individuals engage in self-injury. Because turnover among staff who work with people with IDD is high, new staff members must be trained until they can consistently implement the intervention plans to produce reductions in self-injury. Not only will new staff

need constant monitoring and feedback, but also staff who have been working with these individuals for several months or years need on-going feedback regarding their use of the intervention plan.

In order to effectively treat self-injurious behavior, interventions need to be intensive with long-term monitoring. The applied research on treating self-injurious behavior is filled with effective interventions for reducing self-injurious behavior, but studies like Taylor et al. (2011) demonstrate that many individuals who engage in chronic self-injury continue to engage in this behavior for the majority of their lives. Kahng et al. (2002) reported that less than 15% of effective behavioral interventions for reducing self-injury were assessed for long term effects. Others have suggested that elimination of self-injury may be age-related and that interventions that are used later on in life may be less effective because the self-injurious behavior is already well established (Berkson, Tupa, & Sherman, 2001).

Individuals who engage in self-injury need early intervention, intensive intervention, and long-term follow-up with constant staff training and feedback. Recently, researchers have shifted their focus to early identification and early intervention for infants and young children with self-injurious behavior (for a review see Schroeder & Courtemanche, 2012). For example, Richman and Lindauer (2005) reported that self-injurious behavior in young children could be prevented with functional communication training. These children may still need continued monitoring to assess if self-injury may resurge later in on life.

Unfortunately, some may argue that long-term monitoring may be costly in terms of time and money, especially when many not-for-profit organizations that serve individuals with IDD are facing budget cuts almost every year. Although long-term monitoring may be costly up front for organizations, it may reduce future costs that these individuals may accrue due to out-

of-home placements, medical expenses, property damage, etc. Clearly, individuals who engage in severe and chronic self-injury are in desperate need of this type of intensive follow-up not only to decrease the frequency of self-injury and the potential of producing permanent impairments but also to increase the overall quality of these individuals' lives.

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Table 1. Summary of results from QABF and Direct Observations

Participant	QABF	Direct Observations and Interviews
Bobby	Staff reported that SIB occurs in all conditions (Attention, Escape, Non-Social, Physical, Tangible) with high severity scores in all categories.	<ul style="list-style-type: none"> -SIB serves lots of functions: “help me”, “leave me alone”, “give me that”, “pay attention to me” -Attention (singing, hand games) from staff seems to interfere with SIB -Food/meals seems to interfere with SIB -Swinging incompatible with SIB. This seems to be the only activity he will independently engage in. He has no engagement activities at the home. -The two activities he will initiate himself are swinging and head banging -Irritation in his eyes (pain and redness) seems to increase SIB, especially head banging (usually paired with crying) -Blocking head banging only escalates SIB
Jack	Staff reported SIB in all conditions (Attention, Escape, Non-Social, Physical, Tangible), but had the highest severity scores in Escape and Non-social	<p>VAN</p> <ul style="list-style-type: none"> -Appears to enjoy riding in van, but also engages in SIB on the van -Prefers highway driving to driving around town -Does not like driving to the Day Center even if he is not getting out of the van -Changes in “typical” van routine may cause “anxiety” because he is unaware of where he is going and frequency and severity of SIB increases -Watching the van leave without him is an antecedent to SIB (bangs head on side of house or front door) <p>HOME</p> <ul style="list-style-type: none"> -Attention from male teachers appears to be preferred over female -Attention seems to interfere with SIB -Demands, such as daily life skills (shaving), may be an antecedent to SIB -Has no real engagement activities in the home (does play with one toy car) -Staff rarely engage or interact with Jack while in the home -Likes to spend time outside -Likes cookies, water, and other snacks
Steve	Staff reported SIB in all conditions (Attention, Escape,	-1-on-1 attention from teachers seems to maintain on-task behavior

Non-Social, Physical,
Tangible), but had the highest
severity scores in Escape and
Non-social

- Will engage in SIB to gain access to teacher attention
- Will engage in SIB to escape work demands. This occurs frequently
- Will engage in SIB to gain access to preferred items (e.g., time-out room, computer, trampoline, books)
- Flare-ups with eczema may be a setting event for SIB (will put legs up on table to ask staff for lotion)
- Loud noises and lots of people seem to be an antecedent for SIB (wears headphones)
- Rarely seeks out teachers if he needs something

Table 2. Participant Characteristics and Scores regarding Self-injurious, Aggressive, and Stereotypic Behavior

Participant	Topographies	BPI Score	Average NCCPC-R score
Bobby	-Head hitting -Head banging -Body hitting -Face hitting	SIB-99 Stereotyped Behavior-148 Aggressive/Destructive Behavior-60	8
Jack	-Head hitting -Head banging -Body hitting -Biting	SIB-168 Stereotyped Behavior-255 Aggressive/Destructive Behavior-63	9.6
Steve	-Head hitting -Head banging -Body hitting -Object hitting	SIB-126 Stereotyped Behavior-84 Aggressive/Destructive Behavior-0	9.2

Table 3. Social Validity Scores from Teachers.

1. The methods (i.e., written instructions, modeling, & role-playing) improved my implementation of the behavior support plan to reduce self-injury.	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree
Number of Responses					3
2. I liked the methods (i.e., written instructions, modeling, & role-playing) used to teach me the behavior support plan to reduce self-injury.	Greatly disliked	Disliked	Neutral	Liked	Liked a great deal
Number of Responses					3
3. The verbal/written feedback improved my teaching performance.	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree
Number of Responses					3
4. I liked the verbal/written feedback that was provided to me over my teaching performance.	Greatly disliked	Disliked	Neutral	Liked	Liked a great deal
Number of Responses					3
5. Earning the money on my gift card improved my teaching performance.	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree
Number of Responses			1	1	1
6. I liked earning money on my gift card when my teaching performance was at or above a certain criterion.	Greatly disliked	Disliked	Neutral	Liked	Liked a great deal
Number of Responses			1		2

7. After working with the researcher, I felt very capable implementing the behavior support plan when she was not present.

	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree
Number of Responses					3

8. My use of the behavior support plan was effective at reducing self-injury.

	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree
Number of Responses					3

9. When I knew an observer was in my home/classroom watching me teach, I felt:

	Very Uncomfortable	Uncomfortable	Neutral	Comfortable	Very comfortable
Number of Responses				1	2

10. When I knew an observer was watching me from the HomeLink videos, I felt:

	Very Uncomfortable	Uncomfortable	Neutral	Comfortable	Very comfortable	Not Applicable
Number of Responses				1	1	1

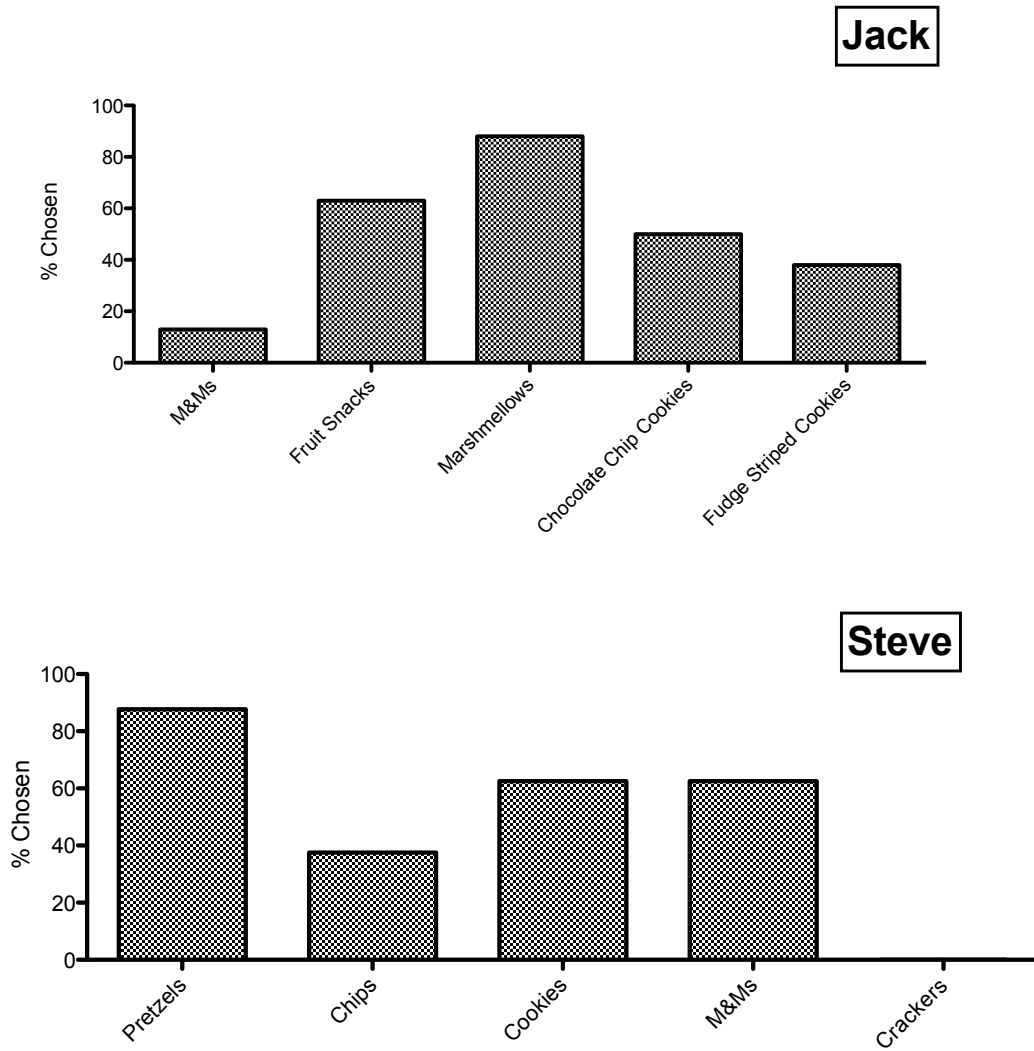


Figure 1. Results of the paired-stimulus preference assessment for Jack and Steve

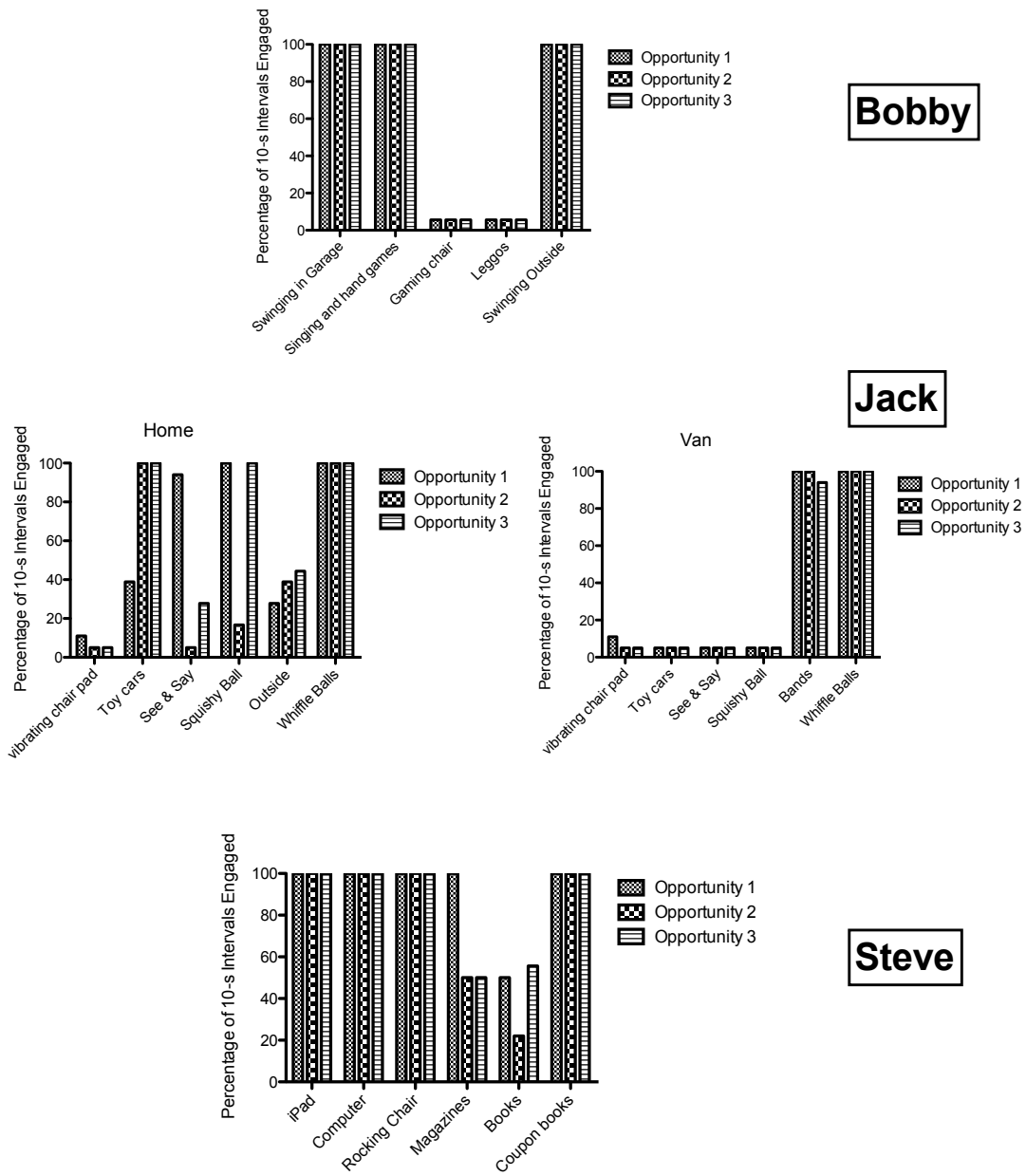


Figure 2. Results of engagement preference assessments.

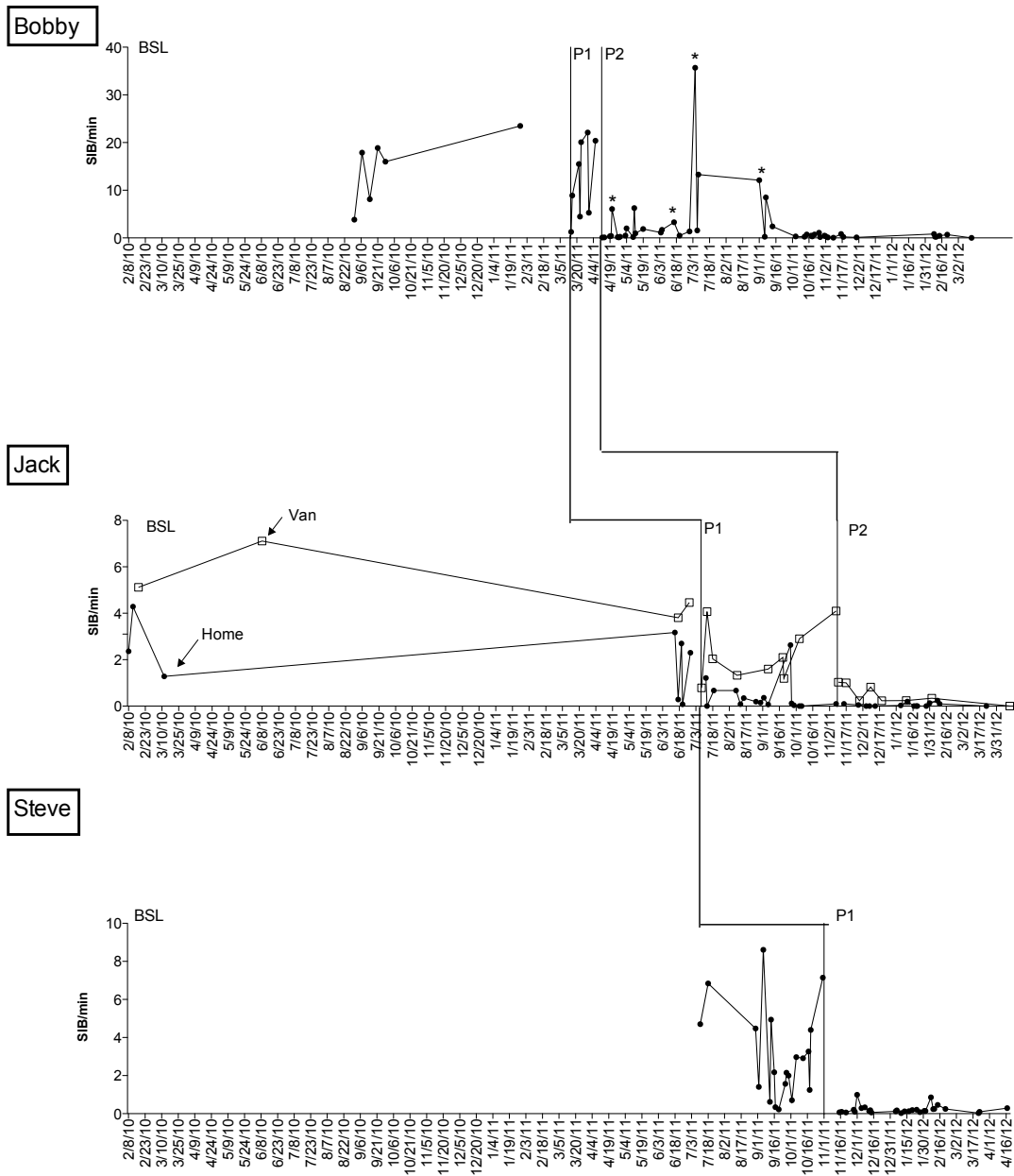


Figure 3. Results of the multi-component intervention

Researcher Present

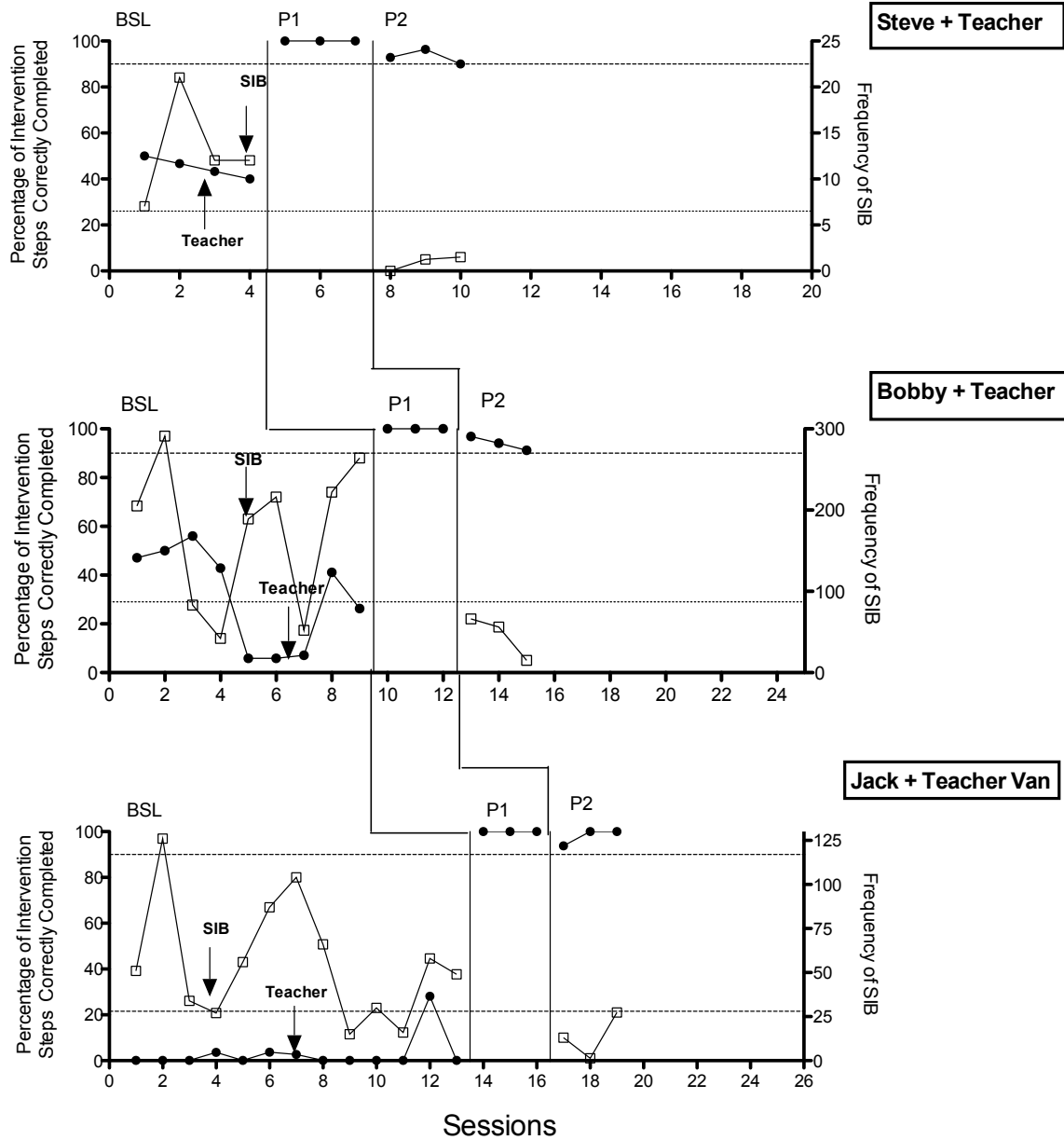


Figure 4. Teacher and consumer behavior while the researcher was present

Researcher Absent

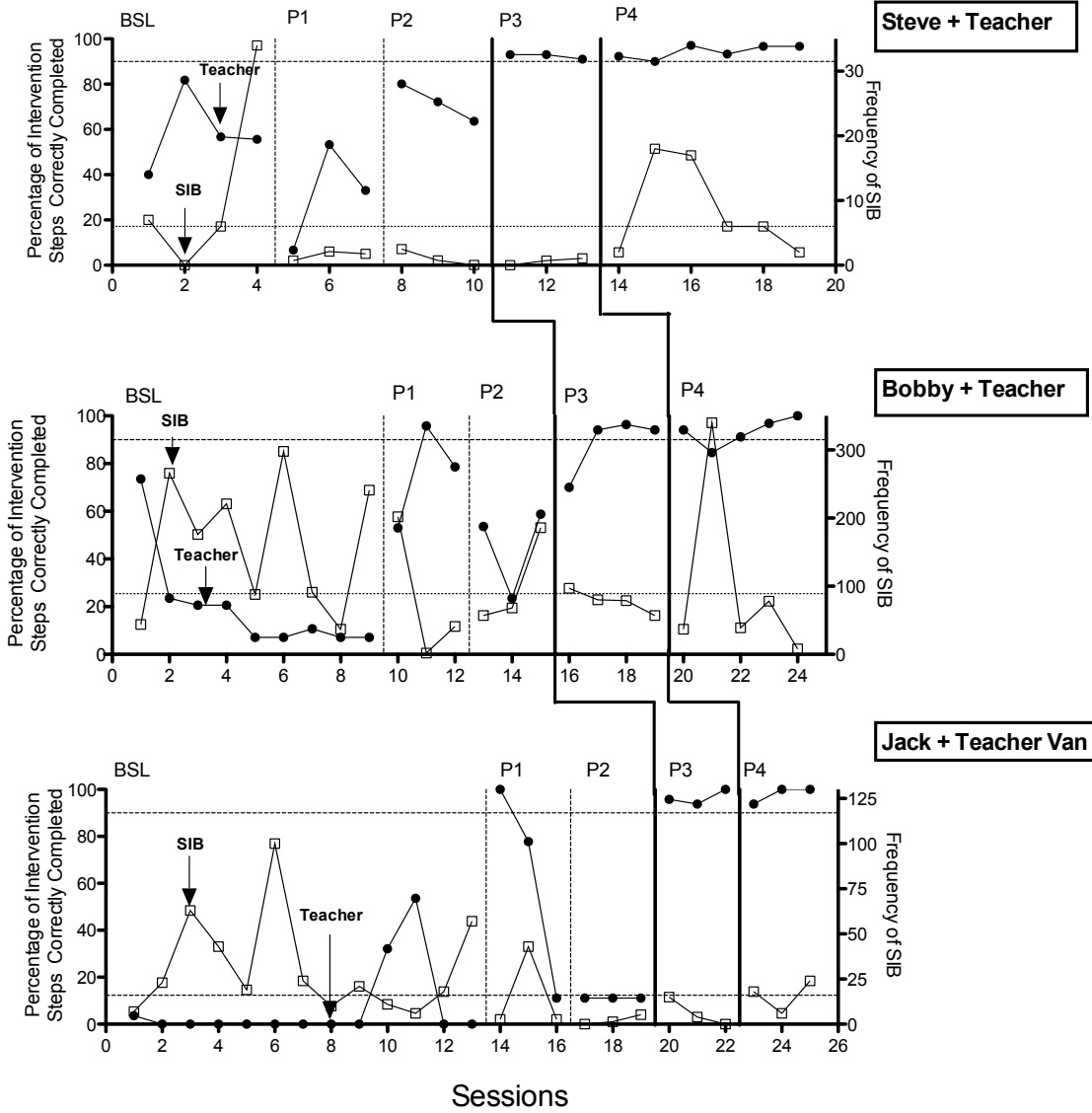


Figure 5. Teacher and consumer behavior while the researcher was absent

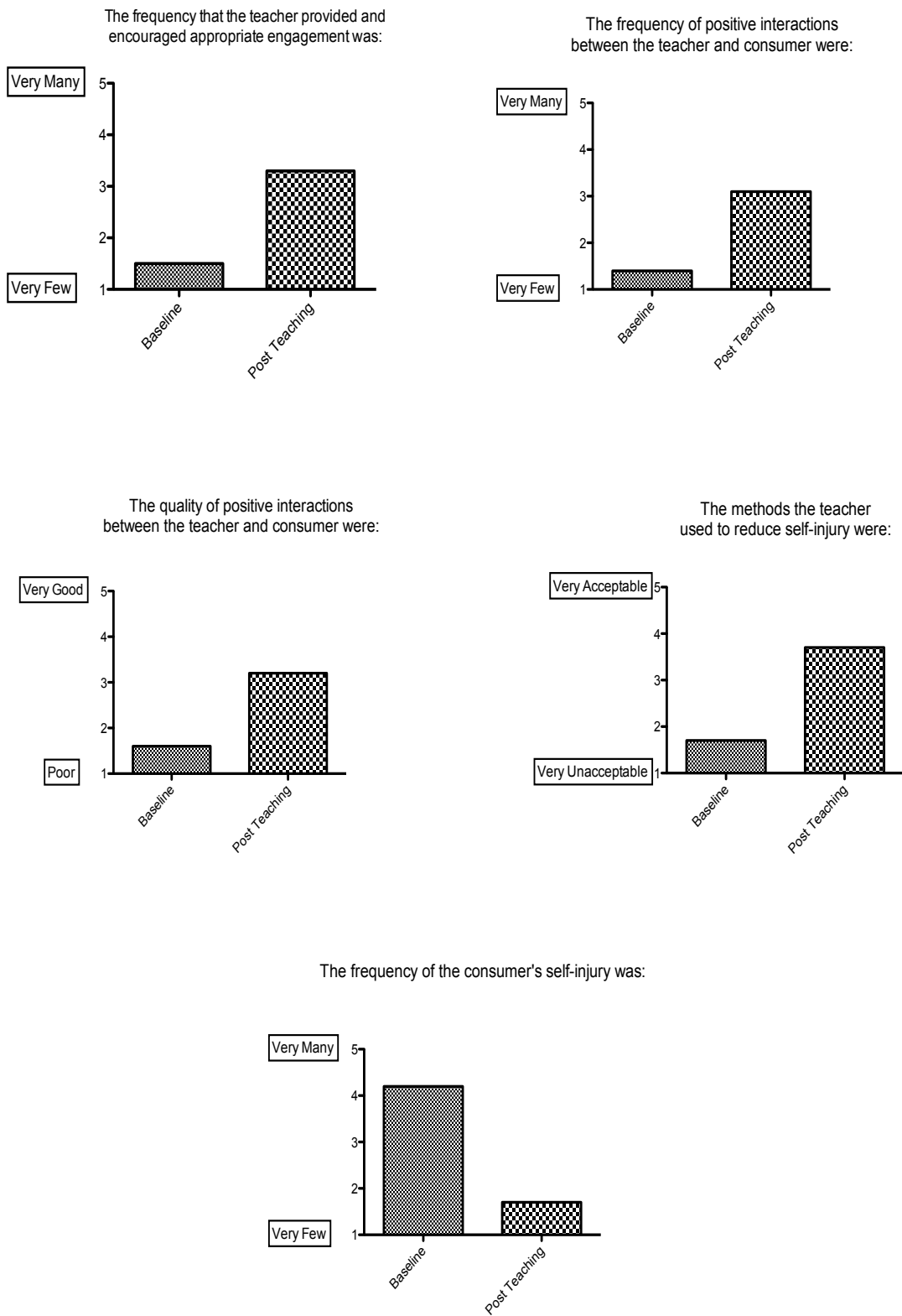


Figure 6. Results of social validity assessment from outside reviewers

Appendix A-Operational Definitions of Self-injurious Behavior

Bobby-Operational Definitions of Self-Injurious Behavior

- Head Banging – fore/side/back of head hitting the wall (while rocking) or floor (with or without helmet) with enough force to produce a sound or red mark.
- Head Hitting – any contact with a closed fist or open palm to head/face/ears with enough force to produce a sound or red mark.
- Body hitting – open or closed fist making contact with any part of the body, except the head or face, with enough force to produce a sound or red mark.

Jack-Operational Definitions of Self-Injurious Behavior

- Head Hitting – any closed fist or open palm making contact head/face/ears with enough force to produce a sound or red mark.
- Head Banging – fore/side/back of head making contact with window of van or door with enough force to produce a sound or red mark.
- Body hitting – open or closed fist coming in contact with any part of the body, except the head or face, with enough force to produce a sound or red mark.
- Biting-any time Jack puts his hand or arm in his mouth and bites down while grimacing his face and using his other hand to slap the hand/arm that is in his mouth.

Steve-Operational Definitions of Self-Injurious Behavior

- Head Hitting – any closed fist or open palm making contact with head/face/ears with enough force to produce a sound or red mark.
- Body hitting – open or closed hand coming in contact with any part of the body, except the head or face, with enough force to produce a sound or red mark.
- Head Banging – fore/side/ back of head on wall or floor with enough force to produce a sound or red mark.
- Object hitting- open or closed fist coming in contact with an object (e.g., wall, desk, floor) with enough force to produce a sound or red mark.

Appendix B-Behavioral Skill Steps of Behavior Support Plans for Each Participant

Teacher Behavior Checklist

Bobby

- ____ 1. Make **engagement activities available (swing)** to Bobby at all times.
Make sure that these materials are accessible to Bobby. Make sure that Bobby knows that the swing is available and the garage door is never locked. This will allow Bobby to access the swing whenever he chooses.
- ____ 2. Provide **descriptive praise** for appropriate engagement at least **once every 10 minutes** in the absence of SIB.
Make sure that you label the behavior that Bobby is doing that you like and provide praise (“you are doing great swinging”).
- ____ 2a. Face Bobby
- ____ 2b. Have a positive facial expression
- ____ 2c. Have a positive, enthusiastic voice tone
- ____ 3. At least **once every two minutes, look** to see if Bobby is engaged in SIB.
- ____ 3a. If Bobby is not engaged in SIB, provide **positive attention** (“you are doing great!”) and/or things he likes (for example, signing, playing hand games)
- ____ 3ai. Face Bobby
- ____ 3aii. Have a positive facial expression
- ____ 3aiii. Have a positive, enthusiastic voice tone
- ____ 3b. If Bobby is engaged in SIB, do not have any positive interactions (tickling, smiling, laughing) with Bobby during this time.
- ____ 3bi. Block (with forearm or pillow) attempts at SIB, and
- ____ 3bii. Offer Bobby **an alternative activity** or a **prompt to remain on task**
- ____ 3biii. **Refrain from having any negative interactions** (“don’t hit yourself”)
4. If Bobby asks for a preferred item or activity:
- ____ 4a. Acknowledge the request. (e.g., “You would like a drink”)
- ____ 4b. If possible, retrieve the requested item or have Bobby help you with this
- ____ 4c. Fulfill requests within **2 minutes** of the initial response.
5. If Bobby has high rates of head banging, his eyes are red, he is crying, and is noncompliant
- ____ 5a. Administer **PRN**
- ____ 5b. If behavior does not improve after two doses of PRN, make appointment with **ophthalmologist or call nursing.**

Teacher Behavior Checklist

Jack

- _____ 1. Make **engagement activities available (e.g., toy cars, whiffle balls, exercise bands, etc.)** to Jack at all times.

Make sure that these materials are accessible to Jack. Placing them on the couch next to him or out in the living will help ensure that Jack will engage with these items. These items should not be placed in the toy box in the living room.

- _____ 2. Provide **descriptive praise** for appropriate engagement **at least once every 10 minutes** in the absence of SIB.

Make sure that you label the behavior that Jack is doing that you like and provide praise (“you are doing great playing with your cars”).

_____ 2a. Face Jack

_____ 2b. Have a positive facial expression

_____ 2c. Have a positive, enthusiastic voice tone

- _____ 3. At least once every **two minutes, look** to see if Jack is engaged in SIB.

_____ 3a. If Jack is not engaged in SIB, provide **positive attention** (“you are doing great!”) and/or things he likes (for example, food, back rubs, and head rubs)

_____ 3ai. Face Jack

_____ 3aii. Have a positive facial expression

_____ 3aiii. Have a positive, enthusiastic voice tone

_____ 3b. If Jack is engaged in SIB, do not have any positive interactions (tickling, smiling, laughing, back rubs) with Jack during this time.

_____ 3bi. Block (with forearm) attempts at SIB, and

_____ 3bii. Offer Jack **an alternative activity** or a **prompt to remain on task**

_____ 3biii. **Refrain from having any negative interactions** (“don’t hit yourself”)

4. If Jack asks for a preferred item or activity:

_____ 4a. Acknowledge the request. (e.g., “You would like a drink”)

_____ 4b. If possible, retrieve the requested item or have Jack help you with this

_____ 4c. Fulfill requests within **2 minutes** of the initial response.

5. If Jack has widened eyes, labored breathing, and high rates of SIB while riding on the van

_____ 5a. **Remind** him that he is not getting off the van

_____ 5b. Tell him what **activity is next in his schedule**

_____ 5c. **Block** attempts at self-injury

_____ 5d. **No verbal statements** about the SIB

_____ 5e. **Complete the errand** as soon as possible

Teacher Behavior Checklist

Steve

- _____ 1. Make **engagement activities available (e.g., books, iPad, rocking chair etc.)** to Steve at all times.
Make sure that these materials are accessible to Steve in the classroom.
- _____ 2. Provide **descriptive praise** for appropriate engagement at least once every 10 minutes in the absence of SIB.
Make sure that you label the behavior that Steve is doing that you like and provide praise (“you are doing great reading your book”).
- _____ 2a. Face Steve
- _____ 2b. Have a positive facial expression
- _____ 2c. Have a positive, enthusiastic voice tone
- _____ 3. At least once **every two minutes, look** to see if Steve is engaged in SIB.
- _____ 3a. If Steve is not engaged in SIB, provide **positive attention** (“you are doing great!”) and/or things he likes (for example food, tickles, lotion)
- _____ 3ai. Face Steve
- _____ 3aii. Have a positive facial expression
- _____ 3aiii. Have a positive, enthusiastic voice tone
- _____ 3b. If Steve is engaged in SIB, do not have any positive interactions (e.g., tickling, smiling, laughing) with Steve during this time.
- _____ 3bi. Block (with forearm) attempts at SIB, and
- _____ 3bii. Offer Steve **an alternative activity** or a **prompt to remain on task**
- _____ 3biii. **Refrain from having any negative interactions** (“don’t hit yourself”)
- _____ 4. Make Steve’s PECs book available to him at all times
If Steve asks for a preferred item or activity:
- _____ 4a. Acknowledge the request. (e.g., “You would like a drink”)
- _____ 4b. If possible, retrieve the requested item or have Steve help you with this
- _____ 4c. Fulfill requests within **2 minutes** of the initial response.
5. If Steve has high rates of SIB, labored breathing, crying, and noncompliance:
- _____ 5a. **Redirect** him to his “safe room”
- _____ 5b. **Block** SIB attempts with a mat (DO NOT use your hands or arms)
- _____ 5c. **Refrain from having positive interactions**
- _____ 5d. **Refrain from having negative interactions**
- _____ 5e. Make **PECs book** available
- _____ 5f. Can leave “safe room” when SIB is absent for **5 minutes**

Questions
About
Behavioral
Function

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QUESTIONS ABOUT BEHAVIORAL FUNCTION (QABF)

Client's name and residence: _____

Name of person completing QABF: _____ Date: _____

Target Behavior: _____

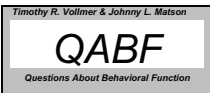
Rate how often the CLIENT demonstrates the behaviors in situations where they might occur.

Be sure to rate how often each behavior occurs, not what you think a good answer would be.

X	0	1	2	3
Does Not Apply	Never	Rarely	Some	Often

- _____ 1. Engages in the behavior to get attention.
- _____ 2. Engages in the behavior to escape work or learning situations.
- _____ 3. Engages in the behavior as a form of "self-stimulation".
- _____ 4. Engages in the behavior because he/she is in pain.
- _____ 5. Engages in the behavior to get access to items such as preferred toys, food, or beverages.
- _____ 6. Engages in the behavior because he/she likes to be reprimanded.
- _____ 7. Engages in the behavior when asked to do something (get dressed, brush teeth, work, etc.)
- _____ 8. Engages in the behavior even if he/she thinks no one is in the room.
- _____ 9. Engages in the behavior more frequently when he/she is ill.
- _____ 10. Engages in the behavior when you take something away from him/her.
- _____ 11. Engages in the behavior to draw attention to him/herself.
- _____ 12. Engages in the behavior when he/she does not want to do something.
- _____ 13. Engages in the behavior because there is nothing else to do.
- _____ 14. Engages in the behavior when there is something bothering him/her physically.
- _____ 15. Engages in the behavior when you have something he/she wants.
- _____ 16. Engages in the behavior to try to get a reaction from you.
- _____ 17. Engages in the behavior to try to get people to leave him/her alone.
- _____ 18. Engages in the behavior in a highly repetitive manner, ignoring his/her surroundings.
- _____ 19. Engages in the behavior because he/she is physically uncomfortable.
- _____ 20. Engages in the behavior when a peer has something he/she wants.
- _____ 21. Does he/she seem to be saying "come see me" or "look at me" when engaging in the behavior?
- _____ 22. Does he/she seem to be saying "leave me alone" or "stop asking me to do this" when engaging in the behavior ?
- _____ 23. Does he/she seem to enjoy the behavior, even if no one is around?
- _____ 24. Does the behavior seem to indicate t to you tha t he/she is not feeling well?
- _____ 25. Does he/she seem to be saying "give me that (toy item, food, item)" when engaging in the behavior?

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Name: _____ Today's Date: _____
 ID Number: _____ Informant: _____
 Age: _____ Gender: _____ Race: _____
 MR Level: _____

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	8		8		8		8		8
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	2		2		2		2		2
	1		1		1		1		1
0	0	0	0	0	0	0	0	0	0
Attention	Severity / Attention	Escape	Severity / Escape	Non-Social	Severity / Non-Soc.	Physical	Severity / Physical	Tangible	Severity / Tangible
___ 1. Attention	___ 1. Attention	___ 2. Escape	___ 2. Escape	___ 3. Self stimulation	___ 3. Self stimulation	___ 4. In pain	___ 4. In pain	___ 5. Access to items	___ 5. Access to items
___ 6. Reprimand	___ 6. Reprimand	___ 7. Do Something	___ 7. Do Something	___ 8. Thinks alone	___ 8. Thinks alone	___ 9. When ill	___ 9. When ill	___ 10. Take away	___ 10. Take away
___ 11. Draws	___ 11. Draws	___ 12. Not do	___ 12. Not do	___ 13. Nothing to do	___ 13. Nothing to do	___ 14. Physical problem	___ 14. Physical problem	___ 15. You have	___ 15. You have
___ 16. Reaction	___ 16. Reaction	___ 17. Alone	___ 17. Alone	___ 18. Repetitive	___ 18. Repetitive	___ 19. Uncomfortable	___ 19. Uncomfortable	___ 20. Peer has	___ 20. Peer has
___ 21. "Come see"	___ 21. "Come see"	___ 22. "Leave alone"	___ 22. "Leave alone"	___ 23. Enjoy by self	___ 23. Enjoy by self	___ 24. Not feeling well	___ 24. Not feeling well	___ 25. "Give me that"	___ 25. "Give me that"

SCORING: The number of items endorsed for each subscale are totaled and graphed under the corresponding subscale highlighted in black.
 The frequencies for each subscale are totaled and graphed under the corresponding subscale highlighted in gray.
 The graph should display two lines. The first connects subscale endorsements, the second connects frequencies.

Items are listed on the back of this form.

FOR ADDITIONAL TEST KITS/INFORMATION:
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ATTENTION

1. Engages in the behavior to get attention.
6. Engages in the behavior because he/she likes to be reprimanded.
11. Engages in the behavior to draw attention to him/herself.
16. Engages in the behavior to try to get a reaction from you.
21. Does he/she seem to be saying "come see me" or "look at me" when engaging in the behavior?

ESCAPE

2. Engages in the behavior to escape work or learning situations.
7. Engages in the behavior when asked to do something (get dressed, brush teeth, work, etc.).
12. Engages in the behavior when he/she does not want to do something.
17. Engages in the behavior to try to get people to leave him/her alone.
22. Does he/she seem to be saying "leave me alone" or "stop asking me to do this" when engaging in the behavior?

NON-SOCIAL

3. Engages in the behavior as a form of "self-stimulation".
8. Engages in the behavior even if he/she thinks no one is in the room.
13. Engages in the behavior because there is nothing else to do.
18. Engages in the behavior in a highly repetitive manner, ignoring his/her surroundings.
23. Does he/she seem to enjoy the behavior, even if no one is around?

PHYSICAL

4. Engages in the behavior because he/she is in pain.
9. Engages in the behavior more frequently when he/she is ill.
14. Engages in the behavior when there is something bothering him/her physically.
19. Engages in the behavior because he/she is physically uncomfortable.
24. Does the behavior seem to indicate to you that he/she is not feeling well?

TANGIBLE

5. Engages in the behavior to get access to items such as preferred toys, food, or beverages.
10. Engages in the behavior when you take something away from him/her.
15. Engages in the behavior when you have something he/she wants.
20. Engages in the behavior when a peer has something he/she wants.
25. Does he/she seem to be saying "give me that (toy item, food item)" when engaging in the behavior?

Appendix D- Behavior Problems Inventory

BPI-S

The Behavior Problems Inventory for Individuals with Intellectual Disabilities - Short Form

The Target Individual:

ID (please leave blank): _____
 Age: ____ years ____ months; Gender: male female
 Ethnicity/Race: _____
 Intellectual Disability:
 no ID; unknown;
 mild (IQ 56-70); moderate (IQ 41-55); severe (26-40); profound (< 26)

The Respondent

Relationship to the individual: _____
 Time you typically spent with the individual per day: _____
 How long have you known the individual: _____

Instructions

On the following pages you will find broad definitions followed by specific descriptions of three types of behavior problems: self-injurious behaviors (items 1-8), stereotyped behaviors (items 9-20), and aggressive/destructive behaviors (items 21-30). Please indicate which behaviors you have observed in this individual *during the past six months* by circling the number in the appropriate boxes (1) how often a described behavior typically occurs and (2) how serious a problem the behavior is. If the behavior has never been observed during the last six months, or if it poses no problem, check "never" (i.e., number "0"). For each item, please multiply the scores and put the product in the far right column. For subscale total scores, add the product sum.

SELF-INJURIOUS BEHAVIOR													
		Never or no problem	Average frequency of occurrence							Severity of the Problem			
			Fewer than once a month	About once per month	About once per week	About once per day	About once per hour	More than once per hour	Once per minute or more	Mild	Moderate	Severe	
			1	2	3	4	5	6	7	1	3	9	
Self-injurious behavior (SIB) causes damage to the person's own body; i.e., damage has either already occurred, or it must be expected if the behavior remained untreated. SIBs occur repeatedly in the same way over and over again, and they are characteristic for that person.													
2	Head hitting with hand or other body part	0	1	2	3	4	5	6	7	1	3	9	
3	Body hitting (except for the head) with hand or with any other body part	0	1	2	3	4	5	6	7	1	3	9	
4	Self-scratching	0	1	2	3	4	5	6	7	1	3	9	
5	Pica	0	1	2	3	4	5	6	7	1	3	9	
6	Inserting inappropriate objects in nose, ears, anus, etc.	0	1	2	3	4	5	6	7	1	3	9	
7	Hair pulling (tearing out patches of hair)	0	1	2	3	4	5	6	7	1	3	9	
8	Teeth grinding (evidence of ground teeth)	0	1	2	3	4	5	6	7	1	3	9	
Subtotal:													

STEREOTYPED BEHAVIOR

Stereotyped behaviors look unusual, strange, or inappropriate to the average person. They are voluntary acts that occur repeatedly in the same way over and over again, and they are characteristic for that person. However, they do NOT cause physical damage.

	Never	Fewer than once a month	About once per month	About once per week	About once per day	About once per hour	More than once per hour	Once per minute or more	Mild	Moderate	Severe
8	0	1	2	3	4	5	6	7	1	3	9
10	0	1	2	3	4	5	6	7	1	3	9
12	0	1	2	3	4	5	6	7	1	3	9
13	0	1	2	3	4	5	6	7	1	3	9
14	0	1	2	3	4	5	6	7	1	3	9
15	0	1	2	3	4	5	6	7	1	3	9
16	0	1	2	3	4	5	6	7	1	3	9
17	0	1	2	3	4	5	6	7	1	3	9
18	0	1	2	3	4	5	6	7	1	3	9
19	0	1	2	3	4	5	6	7	1	3	9
20	0	1	2	3	4	5	6	7	1	3	9
Subtotal:											

AGGRESSIVE/DESTRUCTIVE BEHAVIOR

Aggressive or destructive behaviors are offensive actions or deliberate overt attacks directed towards other individuals or objects. They occur repeatedly in the same way over and over again, and they are characteristic for that person.

	Never	Fewer than once a month	About once per month	About once per week	About once per day	About once per hour	More than once per hour	Once per minute or more	Mild	Moderate	Severe
21	0	1	2	3	4	5	6	7	1	3	9
22	0	1	2	3	4	5	6	7	1	3	9
23	0	1	2	3	4	5	6	7	1	3	9
24	0	1	2	3	4	5	6	7	1	3	9
25	0	1	2	3	4	5	6	7	1	3	9
26	0	1	2	3	4	5	6	7	1	3	9
27	0	1	2	3	4	5	6	7	1	3	9
28	0	1	2	3	4	5	6	7	1	3	9
29	0	1	2	3	4	5	6	7	1	3	9
30	0	1	2	3	4	5	6	7	1	3	9
Subtotal:											

Appendix E-Non-communicating Children's Pain Checklist

Non-communicating Children's Pain Checklist – Revised (NCCPC-R)

NAME: _____	UNIT/FILE #: _____	DATE: _____ (dd/mm.yy)
OBSERVER: _____	START TIME: _____ AM/PM	STOP TIME: _____ AM/PM

How often has this child shown these behaviours in the last 2 hours? Please circle a number for each item. If an item does not apply to this child (for example, this child does not eat solid food or cannot reach with his/her hands), then indicate "not applicable" for that item.

0 = NOT AT ALL 1 = JUST A LITTLE 2 = FAIRLY OFTEN 3 = VERY OFTEN NA = NOT APPLICABLE

I. Vocal

1. Moaning, whining, whimpering (fairly soft).....	0	1	2	3	NA
2. Crying (moderately loud).....	0	1	2	3	NA
3. Screaming/yelling (very loud).....	0	1	2	3	NA
4. A specific sound or word for pain (e.g., a word, cry or type of laugh).....	0	1	2	3	NA

II. Social

5. Not cooperating, cranky, irritable, unhappy.....	0	1	2	3	NA
6. Less interaction with others, withdrawn.....	0	1	2	3	NA
7. Seeking comfort or physical closeness.....	0	1	2	3	NA
8. Being difficult to distract, not able to satisfy or pacify.....	0	1	2	3	NA

III. Facial

9. A furrowed brow.....	0	1	2	3	NA
10. A change in eyes, including: squinting of eyes, eyes opened wide, eyes frowning.....	0	1	2	3	NA
11. Turning down of mouth, not smiling.....	0	1	2	3	NA
12. Lips puckering up, tight, pouting, or quivering.....	0	1	2	3	NA
13. Clenching or grinding teeth, chewing or thrusting tongue out.....	0	1	2	3	NA

IV. Activity

14. Not moving, less active, quiet.....	0	1	2	3	NA
15. Jumping around, agitated, fidgety.....	0	1	2	3	NA

V. Body and Limbs

16. Floppy.....	0	1	2	3	NA
17. Stiff, spastic, tense, rigid.....	0	1	2	3	NA
18. Gesturing to or touching part of the body that hurts.....	0	1	2	3	NA
19. Protecting, favoring or guarding part of the body that hurts.....	0	1	2	3	NA
20. Flinching or moving the body part away, being sensitive to touch.....	0	1	2	3	NA
21. Moving the body in a specific way to show pain (e.g. head back, arms down, curls up, etc.).....	0	1	2	3	NA

VI. Physiological

22. Shivering.....	0	1	2	3	NA
23. Change in color, pallor.....	0	1	2	3	NA
24. Sweating, perspiring.....	0	1	2	3	NA
25. Tears.....	0	1	2	3	NA
26. Sharp intake of breath, gasping.....	0	1	2	3	NA
27. Breath holding.....	0	1	2	3	NA

VII. Eating/Sleeping

28. Eating less, not interested in food.....	0	1	2	3	NA
29. Increase in sleep.....	0	1	2	3	NA
30. Decrease in sleep.....	0	1	2	3	NA

SCORE SUMMARY:

Category:	I	II	III	IV	V	VI	VII	TOTAL
Score:								

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USING THE NCCPC-R

The NCCPC-R was designed to be used for children, aged 3 to 18 years, who are unable to speak because of cognitive (mental/intellectual) impairments or disabilities. It can be used *whether or not* a child has physical impairments or disabilities. Descriptions of the types of children used to validate the NCCPC-R can be found in: Breau, L.M., McGrath, P.J., Camfield, C.S. & Finley, G.A. (2002). Psychometric Properties of the Non-communicating Children's Pain Checklist-Revised. *Pain*, 99, 349-357. The NCCPC-R was designed to be used without training by parents and caregivers (carers). It can also be used by other adults who are not familiar with a specific child (do not know them well).

The NCCPC-R may be freely copied for clinical use or use in research funded by not-for-profit agencies. For-profit agencies should contact Lynn Breau: Pediatric Pain Research, IWK Health Centre, 5850 University Avenue, Halifax, Nova Scotia Canada, B3J 3G9 (lbreau@ns.sympatico.ca).

The NCCPC-R was intended for use for short or long-term pain in the child's home or in a long-term residential setting. If suspected *pain after surgery or pain due to procedures conducted in hospital* are the reason for measuring pain, the **Non-communicating Children's Pain Checklist – Postoperative Version** should be used. It can be obtained by contacting Lynn Breau. Information regarding the NCCPC-PV can be found in: Breau, L.M., Finley, G.A., McGrath, P.J. & Camfield, C.S. (2002). Validation of the Non-Communicating Children's Pain Checklist - Postoperative Version. *Anesthesiology*, 96 (3), 528-535.

ADMINISTRATION:

To complete the NCCPC-R, base your observations on the child's behavior over the past **two hours**. *It is not necessary to watch the child continuously for this period*. However, it is recommended that the observer be in the child's presence for the majority of this time (e.g.; be in the same room with the child). Although shorter observation periods may be used, the cut-off scores described below may not apply.

Eating/Sleeping Subscale: Items on the Eating/Sleeping subscale may not occur during the two-hour observation. In this case, the rating should be based on the child's behavior over the day of the observation.

All other subscales: At the end of the observation time, indicate how frequently (how often) each item was seen or heard. This should not be based on the child's typical behavior or in relation to what he or she usually does. A guide for deciding the frequency of items is below:

0	=	Not present at all during the observation period. (Note if the item is not present because the child is not capable of performing that act, it should be scored as "NA").
1	=	Seen or heard rarely (hardly at all), but is present.
2	=	Seen or heard a number of times, but not continuous (not all the time).
3	=	Seen or heard often, almost continuous (almost all the time); anyone would easily notice this if they saw the child for a few moments during the observation time.
NA	=	Not applicable. This child is not capable of performing this action.

SCORING:

1. Add up the scores for each subscale and enter below that subscale number in the Score Summary at the bottom of the sheet. Items marked "NA" are scored as "0" (zero).
2. Add up all subscale scores for Total Score.
3. Check whether the child's score is greater than the cut-off score.

CUT-OFF SCORE:

Based on the scores of 71 children aged 3 to 18 (Breau, McGrath, Camfield & Finley, 2002), a **Total Score of 7 or more** indicates a child has pain. This was accurate in the study group 84% of the time. A Total Score of 6 or less indicates a child does not have pain. This was correct in the study group 77% of the time.

USE OF CUT-OFF SCORES:

As with all observational pain tools, caution should be taken in using cut-off scores because they may not be 100% accurate. They should not be used as the only basis for deciding whether a child should be treated for pain. In some cases children may have lower scores when pain is present. For more detailed instructions for use of the NCCPC-R in such situations, please refer to the full manual, available from Lynn Breau: Pediatric Pain Research, IWK Health Centre, 5850 University Avenue, Halifax, Nova Scotia Canada, B3J 3G9 (lbreau@ns.sympatico.ca).

Appendix F-Treatment Fidelity Datasheet for Phase I-Role-Play

Teacher:_____

Date of Observation_____

Scorer:_____

- ___ 1. Did the researcher provided teachers with a written description of the plan?
- ___ 2. Did the researcher give a **description** of general behaviors to be targeted?
- ___ 3. Did the researcher provide **rationales**?
- ___ 4. Did the researcher give a detailed **description of steps** of the intervention to be completed?
- ___ 5. Did the researcher **model the** steps of the intervention with teacher or research assistant acting as the consumer?
- ___ 6. Did the researcher **ask teacher for feedback** over the steps that were completed correctly or that may have been completed incorrectly?
- ___ 7. Did the researcher **model all of the steps of the intervention correctly** with the teacher or research assistant acting as the consumer?
- ___ 8. Did the researcher have the teacher **practice** the steps of the intervention with researcher acting as the consumer?
- ___ 9. Did the researcher provide **feedback** to the teacher over the steps she performed correctly and the steps she may have missed or performed incorrectly?
- ___ 10. If the teacher completes 100% of the intervention steps correctly, did the researcher put \$5.00 on her debit card?
- ___ 11a. If the teacher does not perform the steps at 100% correct, did the researcher continue to practice with the teacher until the criterion was met?
- ___ 11b. Did the teacher receive \$2.00 on her debit card?
- ___ 12. Did the researcher discuss how the teacher would use these skills in their daily work?

Key:

Y-Yes

N-No

NA-Not Applicable

Appendix G-Treatment Fidelity Datasheet for Phase 2

Teacher:_____

Date of Observation_____

Scorer:_____

___1. Did the researcher give behavior-specific praise to the teacher throughout and/or at the end at the observation?

___3. Did the researcher give corrective feedback to the teacher throughout and/or at the end at the observation?

___4. Did the researcher specify how much money the teacher earned?

___5. Did the researcher put the specified amount of money on the teacher's debit card?

Y-Yes

N-No

NA-Not Applicable

Appendix H-Treatment Fidelity Datasheet for Phases 3 and 4

Teacher:_____

Date of Observation_____

Scorer:_____

___ 1. Was email sent?

___2. Did the email contain behavior-specific praise over the skill steps?

___3. Did email contain corrective feedback?

___4. Did the email specify how much money the teacher earned?

___5. Did the researcher put the specified amount of money on the teacher's debit card?

Y-Yes

N-No

NA-Not Applicable

Appendix I-Written Quizzes given to Teachers during Phase I

Bobby

1. Make _____ **activities available (swing)** to Bobby at all times.
Make sure that these materials are accessible to Bobby. Make sure that Bobby knows that the swing is available and the garage door is never locked. This will allow Bobby to access the swing whenever he chooses.

2. Provide **descriptive** _____ for appropriate engagement at least **once every _____ minutes** in the absence of SIB.
Make sure that you label the behavior that Bobby is doing that you like and provide praise (“you are doing great swinging”).
 - 2a. Face Bobby
 - 2b. Have a positive facial expression
 - 2c. Have a positive, enthusiastic voice tone

3. At least **once every _____ minutes, look** to see if Bobby is engaged in SIB.
 - 3a. If Bobby is not engaged in SIB, provide **positive** _____ (“you are doing great!”) and/or things he likes (for example, signing, playing hand games)
 - 3ai. Face Bobby
 - 3aii. Have a positive facial expression
 - 3aiii. Have a positive, enthusiastic voice tone

 - 3b. If Bobby is engaged in SIB, do not have any positive interactions (tickling, smiling, laughing) with Bobby during this time.
 - 3bi. _____ (with forearm or pillow) attempts at SIB, and
 - 3bii. Offer Bobby **an alternative** _____ or a _____ **to remain on task**
 - 3biii. **Refrain from having any** _____ **interactions** (“don’t hit yourself”)

4. If Bobby asks for a preferred item or activity:
 - 4a. Acknowledge the request. (e.g., “You would like a drink”)
 - 4b. If possible, retrieve the requested item or have Bobby help you with this
 - 4c. Fulfill requests within _____ **minutes** of the initial response.

5. If Bobby has high rates of head banging, his eyes are red, he is crying, and is noncompliant
 - 5a. Administer _____
 - 5b. If behavior does not improve after two doses of PRN, make appointment with **ophthalmologist or call nursing.**

Jack

1. Make _____ **activities available (e.g., toy cars, recliner, exercise bands, etc.)** to Jack at all times.
Make sure that these materials are accessible to Jack. Placing them on the couch next to him or out in the living will help ensure that Jack will engage with these items. These items should not be placed in the toy box in the living room.
2. Provide **descriptive** _____ for appropriate engagement **at least once every _____ minutes** in the absence of SIB.
Make sure that you label the behavior that Jack is doing that you like and provide praise (“you are doing great playing with your cars”).
 - 2a. Face Jack
 - 2b. Have a positive facial expression
 - 2c. Have a positive, enthusiastic voice tone
3. At least once every _____ **minutes, look** to see if Jack is engaged in SIB.
 - 3a. If Jack is not engaged in SIB, provide **positive** _____ (“you are doing great!”) and/or things he likes (for example, food, back rubs, and head rubs)
 - 3ai. Face Jack
 - 3aii. Have a positive facial expression
 - 3aiii. Have a positive, enthusiastic voice tone
 - 3b. If Jack is engaged in SIB, do not have any positive interactions (tickling, smiling, laughing, back rubs) with Jack during this time.
 - 3bi. _____ (with forearm) attempts at SIB, and
 - 3bii. Offer Jack **an alternative** _____ or a _____ **to remain on task**
 - 3biii. **Refrain from having any** _____ **interactions** (“don’t hit yourself”)
4. If Jack asks for a preferred item or activity:
 - 4a. Acknowledge the request. (e.g., “You would like a drink”)
 - 4b. If possible, retrieve the requested item or have Jack help you with this
 - 4c. Fulfill requests within _____ **minutes** of the initial response.
6. If Jack has widened eyes, labored breathing, and high rates of SIB while riding on the van
 - 5a. **Remind** him that he is not getting off the van
 - 5b. Tell him what **activity is next in his** _____
 - 5c. _____ attempts at self-injury
 - 5d. **No verbal statements** about the SIB
 - 5e. **Complete the** _____ as soon as possible

Steve

1. Make _____ **activities available (e.g., books, iPad, rocking chair etc.)** to Steve at all times.

Make sure that these materials are accessible to Steve in the classroom.

2. Provide **descriptive** _____ for appropriate engagement at least once every _____ minutes in the absence of SIB.

Make sure that you label the behavior that Steve is doing that you like and provide praise ("you are doing great reading your book").

2a. Face Steve

2b. Have a positive facial expression

2c. Have a positive, enthusiastic voice tone

3. At least once **every** _____ **minutes, look** to see if Steve is engaged in SIB.

3a. If Steve is not engaged in SIB, provide **positive** _____ ("you are doing great!") and/or things he likes (for example food, tickles, lotion)

3ai. Face Steve

3aii. Have a positive facial expression

3aiii. Have a positive, enthusiastic voice tone

3b. If Steve is engaged in SIB, do not have any positive interactions (e.g., tickling, smiling, laughing) with Steve during this time.

3bi. _____ (with forearm) attempts at SIB, and

3bii. Offer Steve **an alternative** _____ or a _____ **to remain on task**

3biii. **Refrain from having any** _____ **interactions** ("don't hit yourself")

4. Make Steve's _____ available to him at all times

If Steve asks for a preferred item or activity:

4a. Acknowledge the request. (e.g., "You would like a drink")

4b. If possible, retrieve the requested item or have Steve help you with this

4c. Fulfill requests within _____ **minutes** of the initial response.

5. If Steve has high rates of SIB, labored breathing, crying, and noncompliance:

5a. **Redirect** him to his "safe room"

5b. _____ SIB attempts with a mat (DO NOT use your hands or arms)

5c. **Refrain from having** _____ **interactions**

5d. **Refrain from having** _____ **interactions**

5e. Make **PECs book** available

5f. Can leave "safe room" when SIB is absent for _____ **minutes**

Appendix J-Social Validity Questionnaire for Recipients

1. The methods (i.e., written instructions, modeling, & role-playing) improved my implementation of the behavior support plan to reduce self-injury.

1	2	3	4	5
Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree

2. I liked the methods (i.e., written instructions, modeling, & role-playing) used to teach me the behavior support plan to reduce self-injury.

1	2	3	4	5
Greatly disliked	Disliked	Neutral	Liked	Liked a great deal

3. The verbal/written feedback improved my teaching performance.

1	2	3	4	5
Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree

4. I liked the verbal/written feedback that was provided to me over my teaching performance.

1	2	3	4	5
Greatly disliked	Disliked	Neutral	Liked	Liked a great deal

5. Earning the money on my gift card improved my teaching performance.

1	2	3	4	5
Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree

6. I liked earning money on my gift card when my teaching performance was at or above a certain criterion.

1	2	3	4	5
Greatly disliked	Disliked	Neutral	Liked	Liked a great deal

7. After working with the primary investigator, I felt very capable implementing the behavior support plan when she was not present.

1	2	3	4	5
Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree

8. My use of the behavior support plan was effective at reducing self-injury.

1	2	3	4	5
Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree

9. When I knew an observer was in my home/classroom watching me teach, I felt:

1	2	3	4	5
Very Uncomfortable	Uncomfortable	Neutral	Comfortable	Very comfortable

10. When I knew an observer was watching me from the HomeLink videos, I felt:

1	2	3	4	5	NA
Very Uncomfortable	Uncomfortable	Neutral	Comfortable	Very comfortable	Not Applicable

Comments:

Appendix K-Social Validity Questionnaire for Outside Reviewers

1. The frequency that teachers provided and encouraged appropriate engagement was:

1	2	3	4	5
Very Few	Few	Some	Many	Very Many

2. The frequency of the positive interactions (e.g., descriptive praise) between the teacher and consumer were:

1	2	3	4	5
Very Few	Few	Some	Many	Very Many

3. The quality of the positive interactions (e.g., descriptive praise) between the teacher and consumer were:

1	2	3	4	5
Poor	Fair	Average	Good	Very Good

4. The methods (e.g., providing attention, reinforcing communication, blocking and redirection) the teacher used to reduce the consumer's self-injury were:

1	2	3	4	5
Very unacceptable	Unacceptable	Neutral	Acceptable	Very Acceptable

5. The frequency of the consumer's self-injury was:

1	2	3	4	5
Very Few	Few	Some	Many	Very Many