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RESEARCH ARTICLE

Minimizing Escalation by Treating Dangerous Problem Behavior Within an Enhanced Choice Model

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Abstract

To address dangerous problem behavior exhibited by children while explicitly avoiding physical management procedures, we systematically replicated and extended the skill-based treatment procedures described by Hanley, Jin, Vanselow, and Hanratty (2014) by incorporating an enhanced choice model with three children in an outpatient clinic and two in a specialized public school. In this model, several tactics were simultaneously added to the skill-based treatment package to minimize escalation to dangerous behavior, the most notable of which involved offering children multiple choice-making opportunities, including the ongoing options to (a) participate in treatment involving differential reinforcement, (b) "hang out" with noncontingent access to putative reinforcers, or (c) leave the therapeutic space altogether. Children overwhelmingly chose to participate in treatment, which resulted in the elimination of problem behavior and the acquisition and maintenance of adaptive skills during lengthy, challenging periods of nonreinforcement. Implications for the safe implementation of socially valid treatments for problem behavior are discussed.

Keywords Dangerous problem behavior · Enhanced choice model · Extinction without physical guidance · Practical functional assessment · Skill-based treatment

Hanley et al. (2014) described a distinct set of assessment and treatment procedures for addressing and improving severe problem behavior exhibited by children. The procedures consisted of (a) a *practical functional assessment* process, which included an open-ended interview and an interview-informed synthesized contingency analysis (IISCA); (b) a

Research Highlights
• Although problem behavior occurred at consistently high rates for all children during baseline, it was eliminated in treatment, and all children cooperated with nearly 100% of adult expectations shown to evoke problem behavior in baseline—a process and outcome deemed highly satisfactory by caregivers.
• It is possible to achieve socially meaningful outcomes with children who exhibit dangerous problem behavior without any physical management.
• By committing to open-contingency-class analyses, by offering choices to clients, and by committing to a hands-off treatment model, practitioners attempting to treat dangerous problem behavior can do so effectively without evoking any dangerous behavior during any part of the process.

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skill-based treatment developed from the findings of the practical functional assessment process; and (c) an extension of treatment procedures and effects to relevant caregivers in the child's natural environment. The particular set of procedures reported by Hanley et al. (2014) has since been systematically replicated and has contributed to socially meaningful behavior change for many individuals across multiple settings (Beaulieu, Nostrand, Williams, & Herscovitch, 2018; Ferguson et al., Ferguson et al., in press; Hanley et al., 2014; Herman, Healy, & Lydon, 2018; Jessel, Hanley, Ghaemmaghami, & Metras, 2019; Jessel, Ingvarsson, Metras, Kirk, & Whipple, 2018 ; Jessel, Ingvarsson, Metras, Whipple, et al., 2018; Rose & Beaulieu, 2019; Santiago, Hanley, Moore, & Jin, 2016; Strand & Eldevik, 2018; Taylor, Phillips, & Gertzog, 2018). Socially meaningful resolution of many different types of dangerous problem behavior has been shown to be both *possible* (Hanley et al., 2014) and *probable* (Jessel, Ingvarsson, Metras, Kirk, & Whipple, 2018) when the practical functional assessment and skill-based treatment were conducted.

Despite the success of the process and recent attempts to improve its technology and practicality (e.g., Beaulieu et al., 2018; Ghaemmaghami, Hanley, & Jessel, 2016; Ghaemmaghami, Hanley, Jessel, & Landa, 2018), some procedural components of the practical functional assessment and skill-based treatment may not be safe or feasible to replicate under certain conditions, which could limit the generality of its effectiveness, the acceptability of its procedures, and therefore the scope of its application.

First, implementation of any functional analysis of severe problem behavior runs the risk of evoking dangerous behavior. This could be problematic when serving clients whose behavior poses life-threatening risks. Fortunately, researchers have attempted to address this problem by elucidating the link between dangerous topographies of problem behavior and the less dangerous responses with which they co-occur. Over a dozen studies have examined less dangerous "precursor" or "co-occurring" behavior and have consistently found that these responses are sensitive to the same contingencies as more dangerous topographies (Borlase, Vladescu, Kisamore, Reeve, & Fetzer, 2017; Borrero & Borrero, 2008; DeRosa, Roane, Doyle, & McCarthy, 2013; Dracobly & Smith, 2012; Fritz, Iwata, Hammond, & Bloom, 2013; Harding et al., 2001; Herscovitch, Roscoe, Libby, Bourret, & Ahearn, 2009; Hoffmann, Sellers, Halversen, & Bloom, 2018; Lalli, Casey, & Kates, 1995; Langdon, Carr, & Owen-DeSchryver, 2008; Lieving, Hagopian, Long, & O'Connor, 2004; Magee & Ellis, 2000; Richman, Wacker, Asmus, Casey, & Andelman, 1999; Schmidt, Kranak, Goetzel, Kaur, & Rooker, 2020; Smith & Churchill, 2002; Warner et al., 2020). This almost-universal finding suggests that (a) inferences about the function of dangerous behavior can be made by analyzing less dangerous behavior and (b) functional analyses of dangerous problem behavior can be conducted successfully without ever needing to evoke the dangerous topography. Dracobly and Smith (2012), Hoffmann et al. (2018), and Najdowski, Wallace, Ellsworth, MacAleese, and Cleveland (2008) extended the implications of this notion when they eliminated functionally equivalent dangerous *and* nondangerous problem behavior with a function-based treatment informed by the results of functional analyses of precursor behavior. Although early applications of the IISCA may not have targeted nondangerous topographies in the contingency class (e.g., Hanley et al., 2014), recent applications have done so explicitly (e.g., Slaton, Hanley, & Raftery, 2017; Warner et al., 2020).

Second, skill-based treatment involves manipulating a synthesized reinforcement contingency—shown to influence problem behavior via an IISCA—to systematically and progressively teach social skills such as communication, toleration, and cooperation with adult instruction. Skill-based treatment is predicated on differential reinforcement *with extinction*, wherein the emission of targeted social skills results in the delivery of all synthesized reinforcers identified in the IISCA, whereas problem behavior results in extinction. Including extinction in differential reinforcement arrangements has been shown to be efficacious (Iwata, Pace, Kalsher, Cowdery, & Cataldo, 1990; Lalli et al., 1995; Tiger, Hanley, & Bruzek, 2008; Vollmer & Iwata, 1992) and sometimes necessary (Hagopian, Fisher, Sullivan, Acquisto, & LeBlanc, 1998; Shirley, Iwata, Kahng, Mazaleski, & Lerman, 1997; Worsdell, Iwata, Hanley, Thompson, & Kahng, 2000; Zarcone, Iwata, Mazaleski, & Smith, 1994) in the treatment of dangerous problem behavior. All successful, socially validated applications of skill-based treatment involved programmed extinction of problem behavior.

Although efficacious and sometimes necessary, the extinction component of treatments for problem behavior can produce undesirable collateral effects. When a client's problem behavior is placed on extinction, this experience can produce response bursting (i.e., immediate increases in the frequency and intensity of problem behavior; Lerman & Iwata, 1995; Lerman, Iwata, & Wallace, 1999) or induce other forms of dangerous problem behavior (e.g., aggression; Goh & Iwata, 1994; Lieving et al., 2004). Even if temporary, undesirable collateral effects of extinction procedures may not be tenable in practice, especially when working with large clients or in settings that lack adequate support to manage extended episodes of escalation.

Another element of extinction procedures that may pose problems in certain contexts pertains to programming extinction for behavior sensitive to escape. Extinction of behavior that characteristically produces escape from aversive events requires that the behavior no longer terminates the aversive stimulation (Lattal, St. Peter, & Escobar, 2013). When applied to problem behavior in practice, this is commonly achieved by continuing to present task demands in the presence of problem behavior or contextually inappropriate behavior (e.g.,

noncooperation) and by escalating prompts until the client cooperates with the demand (Iwata et al., 1990). In many cases, prompts escalate until physical guidance of the client is necessary to achieve cooperation (Iwata et al., 1990; Zarcone, Iwata, Hughes, & Vollmer, 1993; Zarcone, Iwata, Smith, Mazaleski, & Lerman, 1994). When such procedures are not implemented with high integrity, which may occur when problem behavior is erratic, unpredictable, and difficult to manage, it can lead to adverse treatment effects (St. Peter Pipkin, Vollmer, & Sloman, 2010; Wilder, Atwell, & Wine, 2006). Thus, although shown to be efficacious in many cases, extinction procedures are intrusive, may be considered inappropriate for certain clients (e.g., adults, large individuals, clients with sophisticated language), and have been discouraged and even prohibited in certain settings (LaVigna & Donnellan, 1986). Furthermore, the intrusive nature of physical management procedures may be considered a potential violation of client autonomy, which, when coupled with the undesirable collateral effects of extinction procedures (e.g., induced emotional responding), could inhibit both the development of a positive therapeutic relationship between the client and analyst and the overall acceptability of such procedures.

Escape extinction with physical guidance was included in all published applications of skill-based treatment in which escape was part of the synthesized contingency (42 out of 55 applications, or 76% of cases). Because skill-based treatment is a multifaceted intervention approach that typically involves synthesizing positive and negative reinforcement contingencies, it remains unclear the extent to which escape extinction with physical guidance was necessary to achieve the desired behavioral outcomes. Evidence for its efficacy and necessity has, however, been shown elsewhere with respect to isolated reinforcement contingencies (e.g., attention only, escape only), thus supporting its inclusion in function-based treatment packages (e.g., Hagopian et al., 1998).

It is worth noting that many researchers have investigated differential reinforcement procedures that do not include escape extinction or physical guidance. This most commonly involves arranging concurrent operants wherein one alternative response produces reinforcement that is greater, along some dimension, than that which is still produced by problem behavior (see Trump, Ayres, Quinland, & Zabala, 2020, for a review of the literature examining differential reinforcement without extinction). However, the majority of these studies avoided extinction by manipulating parameters of a single, isolated reinforcer to differentially reinforce a single, alternative response (e.g., providing a greater duration of escape for a communicative response than for problem behavior; Athens & Vollmer, 2010). That the majority of contingencies identified in published skill-based treatment studies synthesized both positive and negative reinforcement to teach a complex repertoire of social skills suggests there is some possible latitude with respect to manipulating parameters of extinction within a differential reinforcement arrangement. For example, it may be possible to eliminate problem behavior and teach communication, toleration, and cooperation skills with a synthesized contingency by withholding only positive reinforcers, and not negative reinforcers, when problem behavior occurs (e.g., Hoch, McComas, Thompson, & Paone, 2002; Piazza et al., 1997).

Thus far in the practical functional assessment and skill-based treatment literature, no attempt has been made to modify treatment procedures to mitigate the collateral effects of extinction and the intrusiveness of potential physical management. Given the possibility that such procedures can produce deleterious effects, and that this may discourage or altogether preclude the adoption of these procedures in certain practice settings, an investigation into a modified treatment approach seems timely and warranted. Therefore, in the present study, we examined the possibility of achieving the main effects of the skill-based treatment reported by Hanley et al. (2014) while minimizing the negative collateral effects associated with certain extinction procedures. More specifically, for children who were reported to be highly resistant to any type of physical management or guidance, we examined the possibility of conducting the entire practical functional assessment and skill-based treatment process while avoiding any physical management of children, and while offering them the ongoing option to participate in their treatment or not. To investigate this, we systematically replicated the skill-based treatment described in Hanley et al. (2014) within an *enhanced choice model.* In Study 1, we implemented the model in an outpatient clinic with three children. In Study 2, we (a) replicated the model in a specialized public school with two children; (b) extended procedures across relevant people, contexts, and time periods; and (c) recruited social validity measures from classroom teachers.

Study 1: Application of the Enhanced Choice Model in an Outpatient Clinic

Method

Participants and Setting

Study 1 was conducted at a university outpatient clinic. Participants could be enrolled in this study if their referrals to the clinic included reports of (a) *dangerous* problem behavior that posed imminent harm to individuals or property in the participants' surrounding environment and (b) escalation in the intensity and danger of problem behavior when physical management was attempted. Three children were referred to the clinic by their pediatricians due to severe and worsening problem behavior in their home or school. Clinic personnel involved in the assessment and treatment process included licensed Board Certified Behavior Analysts (BCBAs; www.

bacb.org) and undergraduate research assistants. Although assessment and treatment of dangerous problem behavior were primary functions of the clinic, personnel were not certified to implement any physical management procedures. Prior to the onset of the current study, the clinic traditionally did not serve families of children who had significant histories with physical restraint procedures; parents were asked to manage problem behavior as they typically would if behavior escalated to a point at which restraint may be warranted. The caregiver interview and all assessment and treatment sessions were conducted by the BCBA (referred to as the "analyst" in Study 1).

A summary of child characteristics can be found in Table 1. Jeffrey was a White 9-year-old boy who communicated vocally and fluently and was diagnosed with generalized anxiety disorder and attention-deficit/hyperactivity disorder. Jeffrey attended a general education classroom in a public school. Jeffrey's parents reported that, although Jeffrey could display age-typical academic and social skills, episodes of problem behavior frequently interrupted his capacity to demonstrate such skills in relevant academic and social contexts. Jeffrey's academic performance appeared to suffer because he resisted help from teachers and caregivers, rendering academic contexts particularly challenging. He was relatively larger and stronger than many of his peers and got into arguments and occasional physical altercations with peers and teachers whenever they tried to tell him what to do or when they did not listen to him. In addition to engaging in physical aggression in the home and school, Jeffrey was reported to elope to dangerous locations when episodes escalated (e.g., into the school parking lot, up a tree). Jeffrey had thus required police intervention at his school on several occasions, which usually resulted in the further escalation of Jeffrey's problem behavior.

Allie was a White 4-year-old girl who communicated vocally at a developmentally appropriate level and was diagnosed with autism spectrum disorder. Allie had a limited but idiosyncratic repertoire of preferred activities and manners of playing and required frequent interaction and undivided attention from caregivers. As such, Allie's mother described her as being "in charge" at home because she would engage in severe problem behavior whenever things did not go exactly "her way," including when family members would touch her, her toys, and any other preferred items. Allie reportedly engaged in aggression toward her siblings in the home and would regularly engage in hour-long tantrums even in the middle of the night.

Jackson was a White 4-year-old boy who communicated vocally at a developmentally appropriate level with no formal diagnosis. Similar to Allie, Jackson also had a limited but idiosyncratic repertoire of preferred activities and manners of playing and required frequent interaction and undivided attention from caregivers. Jackson reportedly directed much of his physical aggression toward his younger sister and also regularly engaged in extended tantrums in the home. Jackson's parents described his problem behavior as "a hair-trigger reaction to not getting his way."

All analysis and treatment sessions were conducted in a small room (4 m × 3 m) at the clinic, equipped with a video camera, a one-way observation mirror, two child-sized tables, two to three chairs, and play and academic materials as nominated in each participant's caregiver interview. In addition, a small family waiting room (4 m × 3 m) adjacent to the treatment room, equipped with two comfortable chairs and an adult-sized table, was a space wherein participants could "hang out" if they chose to. Parents were asked to be at the clinic during all sessions and either watched from behind an observation mirror or participated in the session.

Measurement and Response Definitions

Data on target responses and relevant environmental events were collected on laptop computers by trained observers. Targeted topographies of dangerous and nondangerous problem behavior for each child can be found along the *y*-axis of the graphs in the right column of Figure 1. For all participants, target dangerous problem behavior included aggression (e.g., hitting, kicking, shoving, grabbing, biting, scratching) and disruption (e.g., banging surfaces, throwing objects, tipping or kicking furniture). For Jeffrey and Allie, target dangerous problem behavior also included elopement, which was defined as crossing the threshold of a room without adult

Table 1 Participant Characteristics

Name	Age (years)	Diagnosis	Language level	Referred for
Jeffrey	9	ADHD; generalized anxiety disorder	Developmentally appropriate	Aggression, elopement, meltdowns
Allie	4	Autism spectrum disorder	Developmentally appropriate	Aggression, disruption, elopement, meltdowns
Jackson	4	None	Developmentally appropriate	Aggression, disruption, meltdowns

Note. ADHD = attention-deficit/hyperactivity disorder.

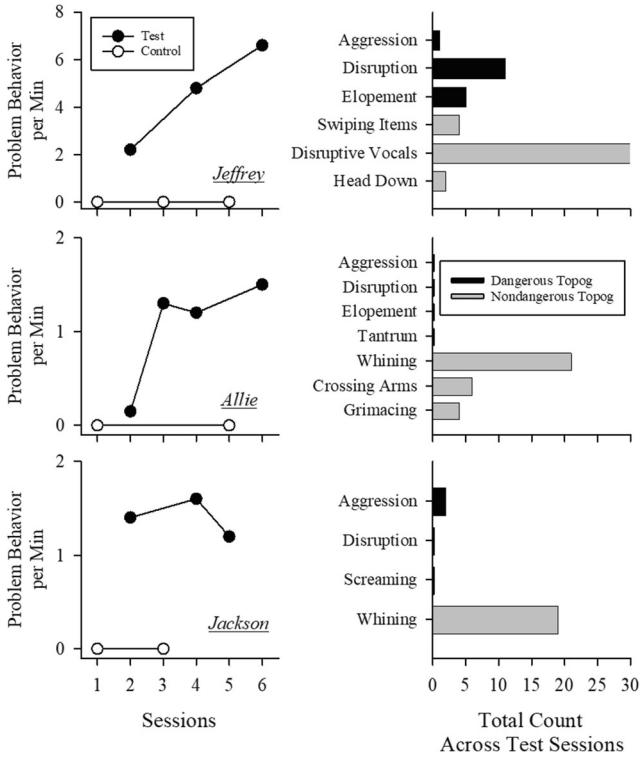

Fig. 1 Results of Interview-Informed Synthesized Contingency Analyses for Jeffrey (Top Panel), Allie (Middle Panel), and Jackson (Bottom Panel). *Note.* The column on the left displays problem behavior aggregated into a single measure per session. The column on the right displays counts of occurrences of individual topographies of problem behavior (*y*-axis labels) that are denoted as either dangerous (black bars) or nondangerous (gray bars). Topog = topography.

permission. Jeffrey's nondangerous topographies of problem behavior included swiping items, disruptive vocals (e.g., arguing and cursing above conversational volume), and putting his head down in his arms or on the table. Allie's nondangerous topographies included whining, crossing her arms, and facial grimacing. Jackson's nondangerous topographies included screaming and whining. Child-specific target functional communication responses (FCRs) and tolerance responses are listed in Table 2, all of which were scored as independent only if they occurred absent or at least 5 s removed from an analyst prompt. Rates of participants' dangerous and nondangerous problem behavior; simple, intermediate (Jackson only), and complex FCRs; and tolerance responses were calculated by recording the number of independent responses emitted and dividing by the number of minutes elapsed per session.

Percentage engagement in contextually appropriate behavior (CAB; a measure of the extent to which children cooperated with adult instruction during periods of nonreinforcement) was calculated by dividing the number of independent CAB observed by the number of CAB expectations presented per session, and multiplying that quotient by 100. CAB expectations were those that were presented by the analyst upon termination of reinforcement or a denial cue. Instructions posed by the analyst were considered CAB expectations (e.g., instructions to put items away, demands to complete academic work, suggestions to find something different to play with). CAB was scored if the child cooperated with the specific expectation in place in the absence of problem behavior or noncooperation lasting longer than 10 s (e.g., putting toys away in 5 s, engaging with academic work without problem behavior).

Total session duration was recorded in seconds, along with the duration of each session for which the participant experienced reinforcement. A measure of the duration in which the participant experienced the programmed establishing

Table 2 IISCA Outcomes, Target Communicative Responses, and Terminal CAB Requirements in Treatment

Name	Synthesized contingency identified	SimpleFCR	Intermediate FCR	ComplexFCR	Tolerance response	Terminal CAB expectation in treatment
Jeffrey	Escape from writing tasks to iPad, Game Boy, table games, complimentary attention, and mand compliance	*My way please.*	—	*Excuse me . . . May I have my way please?*	*That's cool with me* or *I'm cool with that.*	Average of 5 min of writing paragraphs on an analyst-directed topic, with proofreading and editing, while analyst diverted attention to a phone
Allie	Escape from cleaning, sharing, or playing alone to animal and imaginary play toys, interactive role-play, and mand compliance	*My way please.*	—	*Excuse me . . . My way please?*	*OK* after taking a breath	Average of 5 min of sharing, turn taking, playing alone with less preferred toys, and cleaning up play area
Jackson	Escape from cleaning, sharing, and adult-directed play to balls, table games, interactive sports play, and mand compliance	*More time.*	*Can I have more time?*	*Excuse me . . . Can I please have more time?*	*OK* with two thumbs up	Average of 3–5 min of sharing toys, tolerating adult-directed play, and cleaning up play area

Note. IISCA = interview-informed synthesized contingency analysis; FCR = functional communication response; CAB = contextually appropriate behavior; — = not applicable. Font in italics indicates that which was spoken by the child.

operation (EO; a period of nonreinforcement) was calculated by subtracting the duration in reinforcement from the total duration of each session.

Time stamps were recorded on choices made by the child to either (a) engage the practice context, (b) enter the hangout space, or (c) leave the clinic for the day. These data were collected on paper data sheets; data collectors started a timer when the analyst greeted the child's family upon entering the clinic, and noted the time at which each choice was made. Although children could vocally communicate their choice to practice, hang out, or leave, the time at which "hang out" was chosen was only recorded when they entered the hangout room. The choice to leave was scored when the child vocally indicated that they wanted to leave the clinic for the day. All other activities (e.g., participating in practice sessions, picking toys, going to the bathroom) were scored as "practice" because they were typical of the traditional clinic process. The amount of time that elapsed from the start of the visit to the time when the child made a particular choice was divided by the total duration of the visit to derive a proportion measure. Individual visit durations were generally 60 min long.

Interobserver agreement (IOA) was calculated for an average of 27% of sessions for all children across analysis and treatment phases (range 26%–30%) by having a trained second observer simultaneously but independently collect data on all dependent measures. Each session was partitioned into 10-s intervals, and agreement for each rate-measured target response (e.g., problem behavior, FCRs), as well as time in reinforcement, was calculated by dividing the number of agreements per interval by the number of agreements plus disagreements per interval and multiplying by 100. One hundred percent agreement was scored if both observers scored zero for any measure in a given interval. The IOA for the choice data per visit (i.e., duration spent in either practice, hangout, or out of clinic) was calculated by dividing the shorter duration of a given choice by the longer duration for each visit and multiplying by 100. For all dependent measures, mean IOA was 98% (range 83%–100%) for Jeffrey, 97% (range 84%–100%) for Allie, and 98% (range 86%–100%) for Jackson.

Experimental Design

The independent variable was the synthesized reinforcement contingency identified via the practical functional assessment process. Effects of the reinforcement contingency on problem behavior were assessed in a multielement design in the IISCA. In treatment, the synthesized reinforcement contingency was progressively applied, along with prompting, to multiple alternative responses, including FCRs, tolerance responses, and CABs. Treatment evaluation involved a multiple-baseline design across responses with features unique to a changing-criterion design. Functional control was demonstrated when problem behavior and target alternative responses were observed *only if* they were included in the reinforcement contingency. Levels of problem behavior and alternative responses changed, in predictable directions, in correspondence with changes to the reinforcement contingency. In addition, a reversal design was used to evaluate control over problem behavior and the simple FCR for Allie. A contingency reversal for problem behavior was not conducted with Jeffrey and Jackson because (a) it is not necessary in order to demonstrate control in a multiple-baseline design, especially if there are at least three different phases across which an independent variable is evaluated (Kazdin, 2011; Kratochwill et al., 2010); (b) several other treatment-oriented studies have demonstrated the effects of a reinforcement contingency on multiple topographies of prosocial responses in the absence of a reversal (Ghaemmaghami et al., 2018; Jessel, Ingvarsson, Metras, Kirk, & Whipple, 2018 ; Rose & Beaulieu, 2019); and (c) a primary aim of the current study was to minimize the occurrence of problem behavior during the process.

Procedures

Practical Functional Assessment Process Each child's clinic process began with a practical functional assessment (Hanley et al., 2014; Slaton et al., 2017). An open-ended interview (Hanley, 2012) was conducted by the analyst with one or more parents, the results of which informed the design of a subsequent IISCA. General procedures for the IISCA closely emulated what was described in Hanley et al. (2014), with the addition of enhanced choice model procedures (described in what follows) for Allie and Jackson.

Across interviews for all three children, parents reported that dangerous and nondangerous topographies of problem behavior were likely to be evoked when certain demands were presented, when access to certain tangibles was terminated, when attention was diverted or withheld, and when adults did not comply with unique child requests. Furthermore, all parents reported that their typical strategy for de-escalating episodes of problem behavior involved relenting on those demands, providing tangible items, delivering some attention, and complying with requests. Each child's IISCA therefore involved evaluating a synthesized contingency of escape to tangibles, attention, and mand compliance across rapidly alternating, 5-min test (contingency present) and control (contingency absent) sessions. The specific topographies of dangerous and nondangerous problem behavior that were eligible for reinforcement in the IISCA, as identified via the interview, can be found along the *y*-axis of the graphs in the right column of Fig. 1. Specific features of the contingencies tested in each child's analysis are described in Table 2.

Skill-Based Treatment Procedures in treatment emulated what was described in Hanley et al. (2014), in which FCRs, tolerance responses, and CABs were vocally prompted (via a

most-to-least prompting hierarchy) and differentially reinforced with the synthesized reinforcers identified in the IISCA, and problem behavior was placed on extinction (details of extinction procedures are described in what follows). FCRs, tolerance responses, and CABs were taught across successive treatment phases: functional communication training (FCT), tolerance response training, and CAB chaining (analogous to delay-tolerance training in Hanley et al., 2014) respectively.

FCT involved gradual shaping to a terminal, complex FCR by first teaching a simple FCR, then an intermediate (for Jackson only) FCR (Ghaemmaghami et al., 2018). The analyst began each session by programming reinforcement for the child, which involved the provision of tangibles, attention, and mand compliance with no demands presented (see Table 2 for personalized descriptions of reinforcers for each child). Then, the analyst interrupted reinforcement with the imposition of an EO, prompted the target response(s), and differentially reinforced its occurrence (with programmed extinction for problem behavior; details of which are described in what follows). At the beginning of each phase, target response prompts were delivered immediately following the imposition of the EO and were faded in a most-to-least manner as children began to independently emit target responses; however, vocal and gestural prompts were re-presented every 5–10 s if children engaged in any problem behavior or contextually inappropriate behavior. As complex FCRs and tolerance responses were acquired, each continued to be reinforced on an intermittent, unpredictable schedule, such that FCRs were immediately reinforced during 40% of randomly determined trials, but tolerance responses were required to produce reinforcement during the other 60% of trials. In the CAB-chaining phase, CAB expectations were gradually increased in both overall amount and difficulty until a predetermined, terminal goal was met (see terminal CAB expectations in Table 2). Intermittent and unpredictable reinforcement of each social skill continued during CAB chaining, such that 20% of trials in each session involved reinforcement of the complex FCR, 20% of trials involved reinforcement of the tolerance response following a denial of the FCR, and the remaining 60% of trials involved at least one CAB expectation following the emission of a tolerance response, the order of which was randomly determined.

Sessions were 5 min during FCT phases (note that Jeffrey's FCT sessions were 10 min in duration). Following FCT, sessions were defined by trials, instead of a fixed duration, to accommodate the increasing expectations of the child during EO periods. Sessions in tolerance response training and CAB chaining were five trials each, with a trial defined as the presentation of the putative EO until the point at which reinforcement was delivered or after 30 min had elapsed (the latter never occurred). Session duration varied between 4 and 35 min. Criteria to progress across phases were two consecutive sessions with zero problem behavior and consistent emission of target skills during EO periods. Skill-based treatment was considered complete when two visits elapsed without any choices made to hang out or leave the clinic, and when two consecutive sessions occurred with zero problem behavior and consistent emission of target skills during EO periods.

To avoid physical management of children and in an effort to minimize the escalation of problem behavior, typical skill-based treatment procedures were modified in four ways.

First, extinction procedures were adjusted with respect to problem behavior and contextually inappropriate behavior. While positive reinforcers were withheld (e.g., tangibles, attention, the opportunity to have requests granted), the escape extinction component did not include any physical guidance. Instead, vocal and gestural prompts were re-presented every 5–10 s if children engaged in problem behavior or contextually inappropriate behavior (Piazza, Moes, & Fisher, 1996).

Second, whereas presession instruction in Hanley et al. (2014) consisted of behavior skills training in which the target response was taught, modeled, rehearsed, and critiqued, in the current model, analysts provided additional details of that which was to occur in the practice context and only conducted the rehearsal and feedback portion if the child recruited the practice opportunity. Prior to beginning the first session of each visit, analysts would (a) discuss progress made during the prior visit and (b) describe the current training step, including the most challenging EO that would be programmed and the specific responses required of the child to produce reinforcement. These procedures were repeated between any sessions in which changes in response requirements or in the presentation of the EO occurred. Furthermore, the analyst, child, and parent would review participant performance at the culmination of the day's visit. This was an opportunity for (a) the analyst and caregiver to provide specific praise about performance in various situations, (b) the child to discuss and evaluate their own performance, (c) the analyst to foreshadow what was to occur during the next visit, and (d) the child to ask questions or make requests relevant to the treatment process. Speaking loosely, these procedures were included to build rapport and increase transparency between the analyst, child, and parent(s). Although expectations were made clear prior to entering the practice context, this did not affect the intermittency and unpredictability with which reinforcement was delivered within the session. In other words, although each child was informed about the most challenging EO to expect in the practice session, they were not told when to expect it; probabilistic reinforcement was still scheduled for each social skill.

Third, options pertaining to CAB expectations during the CAB-chaining phase were offered to the child *some of the time* (i.e., during approximately 33% of trials in which CAB expectations were in place). Providing opportunities for children to make choices during instruction has

been shown to decrease problem behavior and increase cooperation with instruction (Dunlap et al., 1994; Dunlap, Kern-Dunlap, Clarke, & Robbins, 1991; Powell & Nelson, 1997; Taylor et al., 2018). Whereas in Hanley et al. (2014), adults directed the activities of this entire period, in the current model, the analyst occasionally offered the child some options and control over what they engaged with. Options included what to work on (e.g., reading vs. writing), where to work (e.g., at the desk vs. on the floor), and how the work would be completed (e.g., child writes on their own vs. child dictates and analyst writes for them). These trials were included to increase the likelihood of CAB engagement and to incorporate child feedback during treatment (e.g., Jeffrey sometimes requested to work on challenging math homework even though his IISCA identified writing tasks to be evocative). Choice-making opportunities during CAB chaining were programmed only on some trials because, although research has demonstrated their positive impact on problem behavior and cooperation, terminal treatment goals specified that children cooperate with CAB expectations that were exclusively adult directed.

Fourth, because skill-based treatment was embedded in the enhanced choice model, participants *always* had the opportunity to exit the practice context and either "hang out" or leave the clinic for the day.

Enhanced Choice Model The practical functional assessment and skill-based treatment procedures described previously were embedded in an enhanced choice model, in which children were offered concurrent, continuously available options to (a) enter the "practice" context in which the aforementioned skill-based treatment procedures were implemented, (b) enter a "hangout" context in a different room in which the evocative conditions of the treatment context were never present, or (c) leave the clinic altogether with their parents. During the first visit in which enhanced choice procedures were in place, each child's analyst showed them the various clinic rooms while describing the contingency arrangement (i.e., the "rules" in place in each context). It was conveyed to children that, although the analyst would be presenting evocative events in the practice context and teaching skills under those conditions, they could go "hang out" or "leave" at any point. At the start of every subsequent visit, children were immediately offered these options.

There was no particular response required within the practice context in order to choose to hang out, nor was there any contingency programmed between problem behavior and the availability of the hangout space, meaning that children could select "hang out" by either requesting it or simply going to the other room, irrespective of the occurrence of problem behavior (note that if Jeffrey or Allie was to have exited the practice room during a session without first requesting and being granted permission by an adult, this would have been scored as an instance of elopement, but it would not have precluded them from entering the hangout context). If children chose to hang out, they could bring tangible items with them and they could interact with available adults. Instructions relevant to the skill building in the practice context (i.e., CAB expectations) were never presented in the hangout context, and participants were free to enter and exit the space at any time. In other words, noncontingent synthesized reinforcement, including all of the categorical reinforcers present in the practice context, was arranged in the hangout context. While in the hangout context, the analyst re-presented enhanced choice options approximately every 5 min.

Children additionally had the continuously available option to terminate the day's visit and leave the clinic. Parents agreed to join the analyst in honoring this request at any point during any visit, and neither adult attempted to negotiate with the child once the request was made.

Jeffrey's enrollment in the clinic was originally for participation in another study, and he therefore experienced typical clinic procedures during the IISCA. This involved escape extinction with physical guidance for contextually inappropriate behavior during IISCA test conditions. These procedures led to the unsafe escalation of problem behavior during the analysis, which therefore prompted the development of the enhanced choice model. He did not have options to hang out or leave until skill-based treatment began, at which point he had all three options. Allie's mother drove a long distance to visit the clinic and therefore requested that we omit the option to leave from Allie's enhanced choice model in both the IISCA and skill-based treatment. Jackson experienced the entire enhanced choice model throughout the IISCA and treatment.

Results and Discussion

Practical Functional Assessment Process

Figure 1 depicts the results of the IISCAs for Jeffrey, Allie, and Jackson. In all analyses, problem behavior occurred exclusively in the test condition, demonstrating its sensitivity to a synthesized contingency of escape to tangibles, attention, and mand compliance (see Table 2 for participant-specific contingency descriptions).

The graphs in the right column of Fig. 1 depict counts of occurrences of dangerous and nondangerous topographies of problem behavior across all test sessions. Allie and Jackson engaged almost exclusively in nondangerous problem behavior (second and third panels of the right column of Fig. 1). Jeffrey engaged in some dangerous problem behavior; however, the majority of responses observed and reinforced during Jeffrey's IISCA were nondangerous topographies.

Skill-Based Treatment

Jeffrey's, Allie's, and Jackson's treatment processes are depicted in Figs. 2, 3, and 4, respectively. Problem behavior immediately decreased for all children once the reinforcement contingency was withdrawn. Dangerous problem behavior never occurred during any treatment phase for Jeffrey and Allie; it occurred a total of three times during Jackson's treatment. Nondangerous problem behavior also seldomly occurred throughout any participant's treatment process, and all problem behavior was eliminated by the end of treatment.

Simple, intermediate (Jackson only), and complex FCRs, as well as tolerance responses and CABs, which all occurred at zero or low levels during baseline, emerged only when they were explicitly included in the synthesized contingency, and maintained throughout treatment only if they continued to be reinforced at least intermittently. This can be seen in Figs. 2, 3, and 4, and the responses for which reinforcement was arranged across phases are highlighted with gray shading. These data suggest functional control over targeted social skills by the synthesized contingency. As such, simple and intermediate (Jackson only) FCRs were acquired in their respective training phases and were subsequently extinguished once they were no longer supported by the contingency. By the end of skill-based treatment, all participants were consistently emitting (a) complex FCRs when reinforcement was terminated, (b) tolerance responses when FCRs were denied, and (c) CABs specific to treatment team goals during programmed delays to reinforcement.

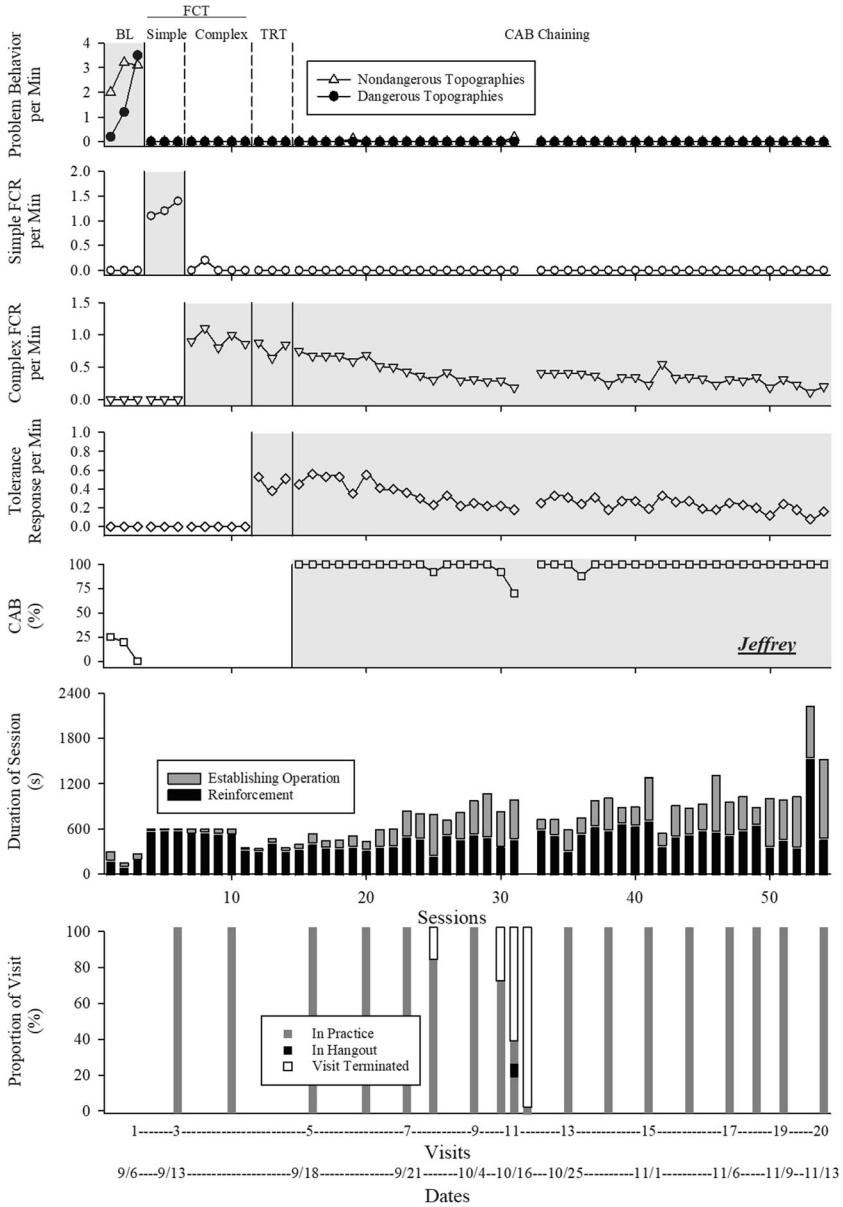

Fig. 2 Enhanced Choice Model Treatment Evaluation for Jeffrey. *Note.* BL = baseline; FCT = functional communication training; TRT = tolerance response training; FCR = functional communication response; CAB = contextually appropriate behavior. Areas shaded in gray represent responses to which the reinforcement contingency was applied during each phase.

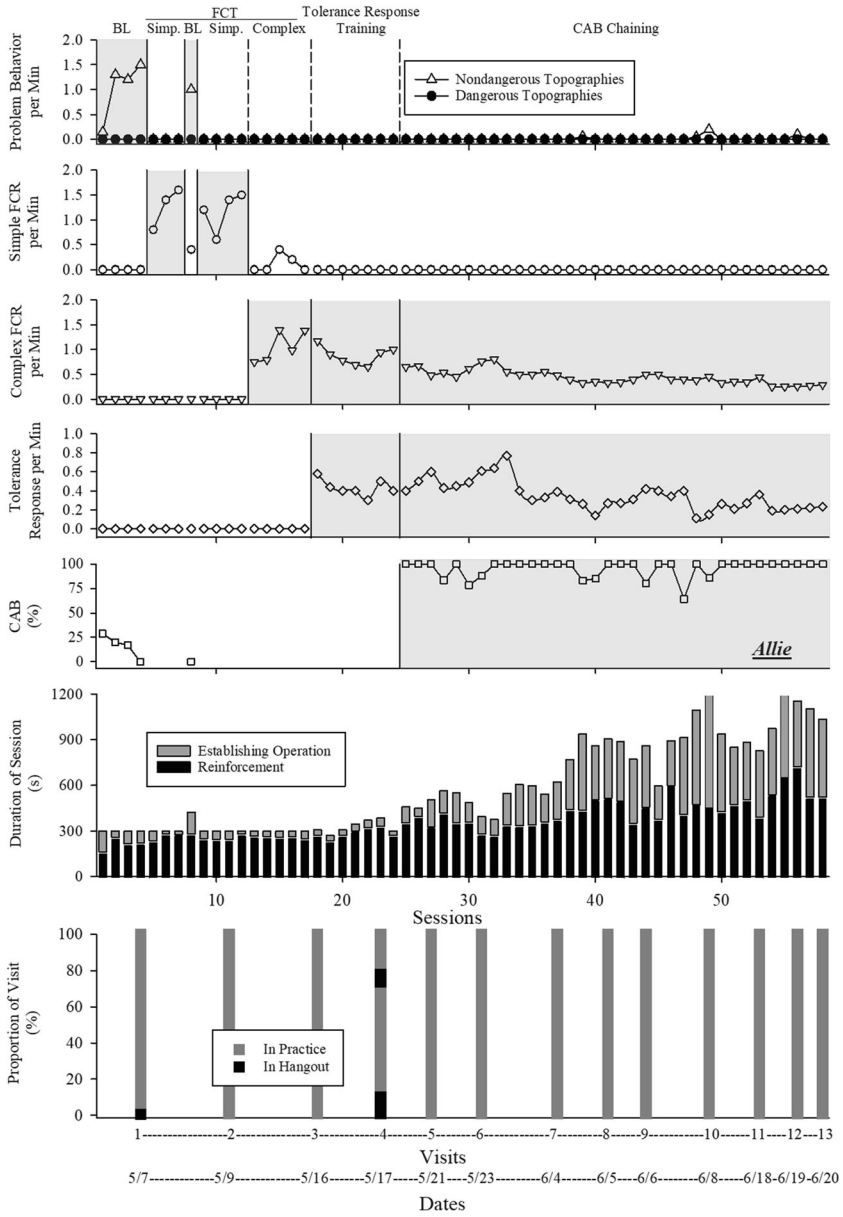

Fig. 3 Enhanced Choice Model Treatment Evaluation for Allie. *Note.* BL = baseline; FCT = functional communication training; Simp. = simple; FCR = functional communication response; CAB = contextually appropriate behavior. Areas shaded in gray represent responses to which the reinforcement contingency was applied during each phase.

A brief contingency reversal was conducted for Allie following initial simple FCT during which problem behavior occurred at a level consistent with baseline performance. Upon the return to simple FCT, problem behavior was again eliminated immediately and replaced with the simple FCR, providing an additional demonstration of functional control over behavior by the synthesized contingency.

Session duration and time spent experiencing the EO gradually increased throughout CAB chaining for all participants. Across the final three treatment sessions, the average proportion of the session in reinforcement was 50%, 54%, and 51% for Jeffrey, Allie, and Jackson, respectively.

Enhanced Choice Model

The bottom panels of Figs. 2, 3, and 4 depict choices made to either practice, hang out, or leave throughout each visit. Each bar represents a visit to the clinic in which enhanced choice procedures were in place. Each bar in this panel aligns vertically with the performance data of the final session of that day's visit. The graph is meant to be interpreted as a sort of time lapse, wherein the bottom of each bar represents the start of each visit, and participant experience in either practice, hanging out, or neither (i.e., visit termination) is tracked from the bottom to the top.

Jeffrey's participation in the IISCA and skill-based treatment process was completed in 20 clinic visits

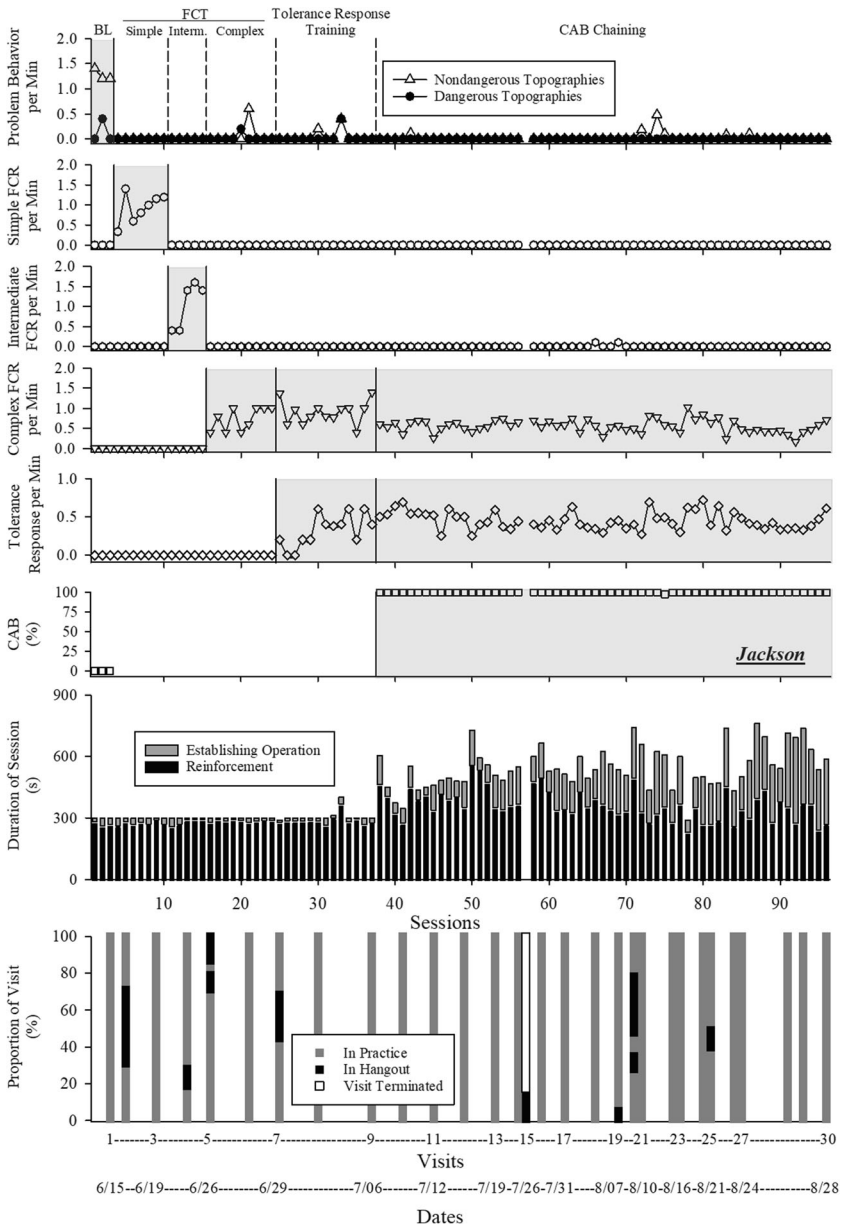

Fig. 4 Enhanced Choice Model Treatment Evaluation for Jackson. *Note.* BL = baseline; FCT = functional communication training; Interm. = intermediate; FCR = functional communication response; CAB = contextually appropriate behavior. Areas shaded in gray represent responses to which the reinforcement contingency was applied during each phase.

across 10 weeks 5 days. Throughout all visits for which Jeffrey experienced the enhanced choice model (i.e., in treatment only), he elected to practice 88% of the time. Jeffrey chose to hang out one time for 3 min and asked to terminate the visit four times total. Allie's participation in the process was completed in 13 clinic visits across 6 weeks 2 days. Throughout all visits for which Allie experienced the enhanced choice model (i.e., IISCA and treatment), she elected to practice 99% of the time. Allie chose to hang out three times for 8 min total. Jackson's participation in the process was completed in 30 clinic visits across 10 weeks 4 days. Throughout all visits for which Jackson experienced the enhanced choice model (i.e., IISCA and treatment), he elected to practice 92% of the time. Jackson chose to hang out 10 times for 115 min total, and asked to terminate the visit one time.

In summary, at the culmination of skill-based treatment embedded within an enhanced choice model, Jeffrey, Allie, and Jackson were emitting target social skills at the exclusion of problem behavior despite lengthy delays to reinforcement in which CAB expectations were in place that were shown to be evocative in baseline. In Study 1, we achieved efficacious outcomes in an outpatient clinic with respect to the problem behavior of three children without any escalation of dangerous behavior or physical management. Furthermore, despite having the continuously available options to consume reinforcers noncontingently or to leave the clinic, all

children chose to experience differential reinforcement in the practice context a majority of the time.

Time constraints and parent availability limited our ability to systematically extend the procedures and effects of skill-based treatment to relevant environments. Furthermore, we did not obtain measures of social validity with respect to the process and outcomes of the enhanced choice model. To address these shortcomings and to evaluate the generality of the process's efficacy, in Study 2 we (a) replicated the process with two children in a specialized public school; (b) extended the process and outcomes across relevant people, contexts, and time periods; and (c) obtained social validity measures from teachers with respect to the practical functional assessment process, the skill-based treatment, and the extension of its procedures and effects back into the classroom.

Study 2: Extension of the Enhanced Choice Model to a Public School

Method

Participants and Setting

Study 2 was conducted at a specialized public school serving children with special needs (Grades K–8). The school administration had contracted BCBAs and research assistants (i.e., graduate students in special education with an emphasis on applied behavior analysis certification) from an external agency to provide assessment and treatment services to certain students with dangerous problem behavior. Participants were selected from a list of students (all of whom met the enrollment criteria specified in Study 1) based on the extent to which their problem behavior interfered with daily classroom activities, the perceived urgency with which intensive support was needed, and the extent to which their classroom teacher was willing to (a) allow their student to be removed from the class periodically to participate in the process and (b) be trained on the procedures so as to implement them in their classroom. Two children were selected and enrolled in Study 2.

A BCBA supervised a research assistant in the implementation of the IISCA and skill-based treatment procedures in both cases. The BCBA did not conduct any IISCA or treatment procedures, but they conducted the caregiver interview. To keep consistent with term usage in Study 1, "analyst" will refer to the research assistant who implemented the IISCA and skill-based treatment, and "BCBA" will refer to the behavior analyst who supervised the process. Furthermore, "classroom teacher" will refer to the participant's lead classroom teacher, and "paraprofessional" will refer to any other caregivers who worked with the participant in their classroom. It is important to note that the BCBAs and analysts contracted to conduct the assessment and treatment process were considered nondistrict personnel, which meant they were strictly prohibited from putting hands on any students in the school. Thus, the enhanced choice model of skill-based treatment was an appropriate treatment option for the circumstances. The BCBA and analyst came to the school for an average of three 1-hr visits per week throughout the assessment, treatment, and extension process.

A summary of child characteristics can be found in Table 3. Peter was a White 8-year-old boy who communicated vocally and was diagnosed with autism spectrum disorder. At the time this study commenced, Peter had just returned to the specialized school from a general education elementary school because his problem behavior necessitated a more resource-intensive learning environment. Peter displayed a limited attending repertoire during academic instruction and often engaged in dangerous problem behavior when he was offered help or redirected back to his school work, which sometimes necessitated removal from the classroom for extended periods of time. Episodes of dangerous problem behavior often involved a combination of destruction of furniture and classroom objects, aggression toward adults, head-directed self-injurious behavior (SIB), and attempted or actual elopement from the classroom or school. Peter's classroom teachers and paraprofessionals were concerned that his behavior was continuing to interfere with his learning such that it appeared less and less likely that he would successfully reintegrate into a general education setting without more intensive support.

Hank was a Black 9-year-old boy who communicated vocally and fluently and was diagnosed with attention-deficit/hyperactivity disorder and emotional disturbance. Hank reportedly seldom cooperated with any academic instruction in the months leading up to his enrollment in this study. Similar to Jeffrey (Study 1), Hank's teachers reported that although he could display age-typical academic and social skills, episodes of problem behavior frequently interrupted his capacity to demonstrate such skills in relevant academic and social contexts. When asked to transition from preferred activities to engage in academic work, Hank often argued with, yelled, and cursed at classroom teachers in a manner that routinely disrupted class proceedings. This often escalated to dangerous aggression toward classroom teachers and paraprofessionals, including attempted stabbing with classroom objects (e.g., pencils). Hank's problem behavior was so disruptive and frequent that at the time this study began, he was earning 10 or more min of playtime following a 5-min period without problem behavior (no work completion was required as part of this contingency). Both participants spent a concerning amount of their school day outside of the classroom due to dangerous problem behavior.

Assessment and treatment sessions were primarily conducted in the school library, a large, multipurpose room (approximately 12 m by 8 m) equipped with 8 to 10 tables, about

Table 3 Participant Characteristics

Name	Age (years)	Diagnosis	Language level	Referred for
Peter	8	Autism spectrum disorder	Developmentally appropriate	SIB, aggression, elopement, disruption
Hank	9	ADHD; emotional disturbance	Developmentally appropriate	Aggression, elopement, noncooperation

Note. ADHD = attention-deficit/hyperactivity disorder; SIB = self-injurious behavior.

20 chairs, large bookshelves along the walls, a small desk with a computer, a chalkboard, a handwashing area, storage bins containing miscellaneous school supplies, and play and academic materials as nominated in each child's caregiver interview. The BCBA was also present for all sessions and brought with them video recording equipment and paper data sheets and pencils for data collection. An additional graduate student was occasionally present in the room as a secondary data collector. If the school library was not available during a scheduled visit, the team conducted sessions in a guidance counselor's office, a smaller room (6 m × 2 m) equipped with two tables, four chairs, a bulletin board, two bookshelves, and a filing cabinet.

Unlike the outpatient clinic model described in Study 1, the treatment team did not have reliable access to a second room to serve as a "hangout" space. Instead, using tape on the floor, they delineated an area of each room with a table and two chairs and used a red equilateral triangle (sides approximately 8 cm in length) made of laminated card stock to signal to the child where they could hang out.

Measurement and Response Definitions

Data on target responses, relevant environmental events, and enhanced choices made were collected on paper data sheets by trained observers. Recorders used one data sheet each per session. Video cameras recorded all sessions but were turned off between sessions to preserve storage space. All target dependent variables recorded in Study 1 were measured and calculated in the same way in Study 2, with the exception of the time-stamp data representing enhanced choices made by the participant. Choice data were added to a more comprehensive data sheet for use in this replication. Due to the constraints the data sheet imposed on data collection (i.e., that data were only recorded during a session), and because time in between sessions was not video recorded, choice data are only reported within sessions.

Targeted topographies of nondangerous problem behavior for each child can be found along the *y*-axis of the graphs in the right column of Fig. 5. Target dangerous problem behavior for Peter included head-directed SIB, aggression, disruption, and elopement. Target dangerous problem behavior for Hank included aggression and elopement. Peter's nondangerous topographies of problem behavior included screaming, hiding under furniture, putting his head down in his arms or on the table, and facial grimacing. Hank's nondangerous topographies included ripping materials, disruptive vocals (e.g., arguing and cursing above a conversational volume), and putting his head down in his arms or on the table. Child-specific target FCRs and tolerance responses are listed in Table 4. CAB engagement was specific to the expectation in place for each child (see Table 4 for terminal CAB expectations in treatment and extension).

IOA was calculated for an average of 61% of sessions for both children across assessment, treatment, and extension phases (range 47%–73%). The IOA for the rate-measured target responses was calculated as a total agreement (this is different from the IOA calculation in Study 1 because data collectors used paper data sheets instead of computer software). The IOA for duration measures was calculated in the same way that the choice measures were calculated in Study 1 (i.e., total duration IOA). For all dependent measures, mean

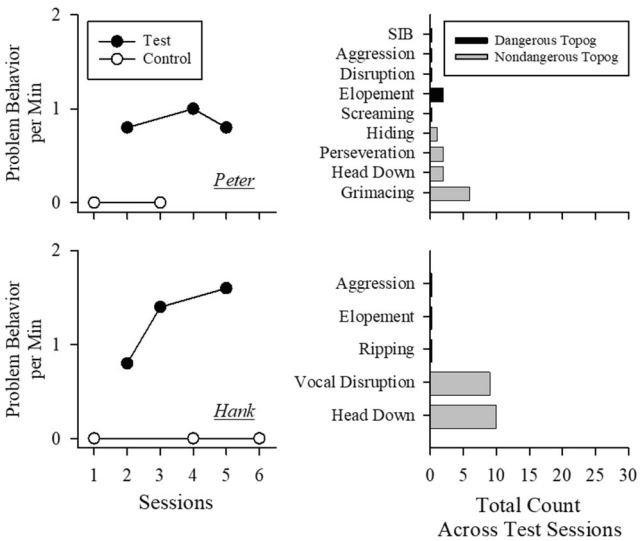

Fig. 5 Results of Interview-Informed Synthesized Contingency Analyses for Peter (Top Panel) and Hank (Bottom Panel). *Note.* SIB = self-injurious behavior. The column on the left displays problem behavior aggregated into a single measure per session. The column on the right displays counts of occurrences of individual topographies of problem behavior (*y*-axis labels) that are denoted as either dangerous (black bars) or nondangerous (gray bars). Topog = topography.

Table 4 IISCA Outcomes, Target Communicative Responses, and Terminal CAB Requirements in Treatment and Extension

Name	Synthesized contingency identified	Simple FCR	Intermediate FCR	Complex FCR	Tolerance response	Terminal CAB expectation in treatment	Terminal CAB expectation in extension
Peter	Escape from math, reading, writing, and spelling tasks to iPad, action figures, books, tag, hide-and-seek, and mand compliance	*My way please.*	*May I please have my way?*	*Excuse me . . . May I please have my way?*	*OK.*	Average of 33 tasks including spelling tests, independent math work, reading passages, and writing sentences	Average of 73 of the same tasks as in treatment
Hank	Escape from reading and writing tasks and "makeup" work to action figures, Play-Doh, books, interactive role-play, and mand compliance	*My way.*	—	*Excuse me . . . May I please have my way?*	*OK.*	Average of 30 tasks including free-writing from a prompt, correcting written errors, sorting words, and completing makeup work	Average of 56 of the same tasks as in treatment

Note. IISCA = interview-informed synthesized contingency analysis; FCR = functional communication response; CAB = contextually appropriate behavior; — = not applicable. Font in italics indicates that which was spoken by the child.

IOA was 95% (range 81%–100%) for Peter and 97% (range 88%–100%) for Hank.

Experimental Design

The design was identical to that of Study 1 for the IISCA and for skill-based treatment. For Hank only, a reversal was conducted following initial simple FCT.

Procedures

Practical Functional Assessment Process The practical functional assessment procedures were identical to those described in Study 1. Interviews were conducted with each child's classroom teacher and a paraprofessional. In both interviews, caregivers described suspected synthesized contingencies of escape to tangibles, attention, and mand compliance, which were evaluated in subsequent IISCAs. The specific features of the contingencies tested in each participant's analysis are described in Table 4. Sessions were 5 min long.

The Enhanced Choice Model of Skill-Based Treatment Procedures for skill-based treatment and the enhanced choice model were mostly identical to those in Study 1 with the only differences being the environmental arrangement of the hangout space (see Participants and Setting for a description) and how the visit started and potentially ended. Skill-based treatment was conducted in a "pullout" manner in the school in which Peter and Hank attended, so visits began when the analyst went to the child's classroom and offered the three enhanced choice options. Choosing to "leave" during treatment meant returning to their classroom's regularly scheduled activities. BCBAs and analysts stayed at the school for the duration of the 60-min scheduled visit, and if either participant chose to return to their classroom during treatment, the analyst would visit their classroom about every 10 min to re-present the three options (children never returned to the skill-based treatment space upon terminating the visit).

Sessions were the duration it took to complete five trials during skill-based treatment and extension to relevant caregivers and contexts (between 3 and 40 min). In the final phase (i.e., treatment extension across relevant time periods in relevant contexts), sessions lasted as long as a designated teaching period in the child's classroom (e.g., math block) until the point at which all students in the class earned free time.

For both Peter and Hank, the enhanced choice model was only programmed during skill-based treatment and extension. During the IISCA, however, both participants could choose to stay in the analysis context or "leave" because the BCBA and analysts did not have permission to block their exit in any way. Both participants remained in the practice context for the duration of their respective IISCAs.

Planning for Treatment Extension The process by which the treatment teams extended the procedures and effects of the enhanced choice model of skill-based treatment was ongoing during treatment and was informed by a formal social validity evaluation (described in what follows) at the culmination of the skill-based treatment. Analysts met with each classroom team approximately biweekly to share session footage and discuss client progress. Analysts checked that features of the communication responses, such as the level of eye contact and pacing of requests, were acceptable for teachers. Furthermore, following a social validity evaluation at the end of treatment, analysts recruited feedback from classroom teachers regarding the feasibility of replicating the contexts they had developed

in the pullout space, and made modifications during subsequent maintenance sessions to facilitate a transfer of effects (data not shown). For example, Peter enjoyed playing tag, and although his requests to do so were easily reinforced during the practice sessions in the empty library, the activity was unlikely to be available in his crowded classroom. Therefore, analysts would deny requests to play tag *some of the time* and would redirect Peter to other available activities during reinforcement. Analysts also worked with classroom teachers to ensure that their method of instruction would be feasible in the classroom setting, and incorporated the feedback in a similar manner (e.g., practice trials in which Hank worked on math problems independently while the adult graded papers at her desk).

Treatment Extension After the children performed at the terminal CAB criterion in skill-based treatment (see Table 4), we extended the procedures and effects of the treatment out in three phases. First, we trained relevant people (i.e., lead classroom teachers) to conduct five-trial sessions in the practice context. Second, we supported them in conducting similar five-trial sessions in a relevant context (i.e., their classroom). Finally, we coached them through conducting skill-based treatment procedures across a relevant time period (e.g., an entire math class).

Training relevant people (i.e., the classroom teachers) in the practice context involved behavior skills training. Classroom teachers were invited to watch skill-based treatment at any time and were shown videos of treatment progress throughout the process. They were also asked to watch the lead analyst conduct trials at the terminal phase of CAB chaining. Following this, the lead analyst and BCBA (a) taught the classroom teacher the procedures of the treatment, (b) asked the teacher to role-play implementation of skill-based treatment with the lead analyst acting as the child, (c) asked the teacher to implement trials with their student in the practice context, and (d) provided in vivo and retrospective feedback on teacher performance during those trials. The role-play with the lead analyst acting as the student was conducted until the classroom teacher implemented five trials without any errors. Five-trial sessions with the classroom teacher and participant, in which procedures were identical to the terminal phase of skill-based treatment, were conducted until they achieved two consecutive sessions with participant performance consistent with that which was observed during skill-based treatment, and when classroom teacher, lead analyst, and BCBA felt comfortable extending sessions to the relevant context.

Sessions in the relevant context (i.e., the classroom) were procedurally similar to the sessions in the practice context with the classroom teacher. BCBAs and lead analysts helped re-create the practice/hangout spaces in the classroom. For Hank, this involved bringing the red triangle from the skill-based treatment context to his classroom and telling Hank that the red triangle signaled the area where he could go hang out at any time during the sessions. For Peter, his classroom teacher had already established a "break space" in one corner of her classroom for all students to use, and we therefore designated that area as the hangout space. An important element of the enhanced choice model that could not be transferred to the relevant context was the opportunity to leave the context altogether. This was reviewed with participants prior to beginning this phase of the treatment extension and periodically throughout the extension process. The criteria to progress to the final phase were identical to the previous phase.

The final phase of the treatment extension involved extending the procedures across a relevant time period within the classroom. Peter's teacher wanted to reserve implementing the treatment for his most challenging class periods, which were reading and math. Hank's teacher preferred to implement the treatment during any classroom period dedicated to academics. The BCBA and analyst could not be present for all of the class periods, so they asked the classroom teachers to conduct the treatment in their absence. The BCBA and analyst kept their regular visit schedule (1-hr visits, three times a week), during which probe data were collected and the BCBA and lead analyst provided in vivo and retrospective feedback on teacher performance. This continued until they observed two entire class periods with the participant performance criteria specified previously for previous extension phases.

Social Validity Evaluation

Peter's and Hank's classroom teachers were asked to complete social validity questionnaires at three points throughout this process: following a successful practical functional assessment, following the enhanced choice model of skill-based treatment in the pullout context, and upon completion of the treatment extension across a relevant time period. Questions relevant to the practical functional assessment process are listed in Table 5, and questions relevant to the treatment and extension are listed in Table 6. Questions regarding the practical functional assessment were primarily about the acceptability and perceived comfort and safety of the assessment process, including both the interview and the analysis. Questions regarding the enhanced choice model of skill-based treatment and its extension were geared toward understanding the extent to which the classroom teachers found (a) the process helpful, (b) the procedures (including caregiver training) feasible and acceptable, and (c) the outcomes meaningful and satisfying.

Table 5 Social Validity Questionnaire Results for the Practical Functional Assessment Process

Question	Peter	Hank
1. I found the interview process to be acceptable.	7	7
2. I was comfortable during the interview process.	7	7
3. I found the functional analysis of my student's problem behavior to be acceptable.	7	7
4. After having witnessed it, I consider the functional analysis to be safe for my student and the analyst.	7	7
5. I was comfortable watching the functional analysis of my student's problem behavior.	7	7

Note. 1 = *not at all*; 4 = *not sure*; 7 = *very much so*.

Results and Discussion

Practical Functional Assessment Process

Figure 5 depicts results of the IISCAs for Peter and Hank. In both analyses, problem behavior occurred exclusively in the test condition, demonstrating sensitivity to a synthesized contingency of escape to tangibles, attention, and mand compliance (see Table 4 for participant-specific contingency descriptions). The graphs in the right column of Fig. 5 depict counts of occurrences of individual topographies of problem behavior across all test sessions. Peter engaged in two instances of elopement but otherwise engaged only in nondangerous topographies of problem behavior. Hank engaged exclusively in nondangerous problem behavior during his IISCA.

The Enhanced Choice Model of Skill-Based Treatment

Peter's and Hank's treatment processes are depicted in Figs. 6 and 7, respectively. Dangerous problem behavior never occurred during any treatment phase for Hank and occurred a total of three times during Peter's treatment. Nondangerous problem behavior was observed toward the end of complex FCT for both Peter and Hank, and periodically during CAB chaining, but all problem behavior was eliminated by the end of treatment.

Simple, intermediate (Peter only), and complex FCRs, as well as tolerance responses and CABs, emerged only when they were included in the synthesized contingency, and maintained throughout treatment only if they continued to be reinforced at least intermittently. This can be seen in Figs. 6 and 7; the responses for which reinforcement was arranged across

Table 6. Social Validity Questionnaire Results for the Enhanced Choice Model

Question	Peter		Hank	
	After treatment	After extension	After treatment	After extension
1. Rate the extent to which you are satisfied with the amount of improvement seen in your student's problem behavior.	7	7	7	6
2. Rate the extent to which you are concerned about your student's ongoing problem behavior in the classroom.	4	5	4	6
3. Rate the extent to which you have found the assessment and treatment provided by our team helpful to your classroom situation.	7	6	7	5
4. Rate the extent to which you feel confident applying the same strategies you have seen in the practice sessions when addressing your student's problem behavior in the classroom.	5	7	5	7
5. How comfortable are you taking away your student's preferred activities and asking him to do something else?	7	7	7	7
6. Rate the extent to which you found the treatment to be feasible for use within your classroom during regular activities.	—	4	—	4
7. Rate the extent to which you found the training process helpful.	—	6	—	7
8. Rate the likelihood that you would agree to participate in this process again with another student with similar needs.	—	7	—	6

Note. 1 = *not at all*; 4 = *not sure*; 7 = *very much so*. A dash indicates the question was not administered.

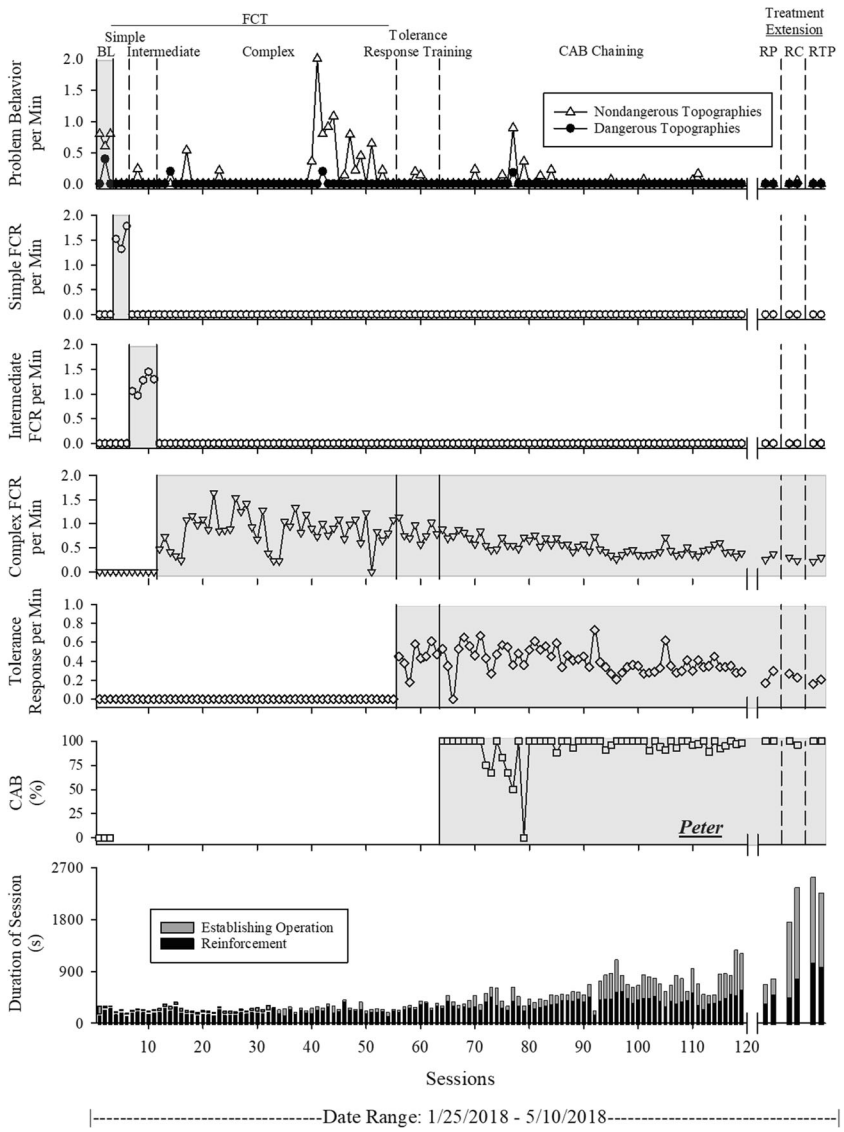

Fig. 6 Enhanced Choice Model Treatment Evaluation for Peter. *Note.* BL = baseline; FCT = functional communication training; FCR = functional communication response; CAB = contextually appropriate behavior; RP = relevant people; RC = relevant context; RTP = relevant time and place. Areas shaded in gray represent responses to which the reinforcement contingency was applied during each phase.

phases are highlighted with gray shading. These results suggest control over targeted social skills by the synthesized contingency, replicating the effects observed with all children in Study 1.

A contingency reversal was conducted for Hank following initial simple FCT, during which performance consistent with that observed in baseline was observed. Upon return to simple FCT, problem behavior was eliminated and replaced with the simple FCR, providing further evidence of control over behavior by the synthesized contingency.

Session duration and time spent experiencing the EO gradually increased throughout CAB chaining for both participants. Across the final three treatment sessions in the pullout context, the average proportion of the session in reinforcement was 49% and 68% for Peter and Hank, respectively.

Peter's pullout assessment and treatment process were completed in 26 visits across 10 weeks 5 days. Throughout all sessions in which Peter experienced the enhanced choice model, he elected to practice 99% of the time. Peter chose to hang out nine times for 4 min total. Peter asked to terminate the visit and return to his regularly scheduled classroom activities five times. Hank's pullout assessment and treatment process were completed in 21 visits across 10 weeks 3 days. Hank never used the hangout space, nor did he ever ask to terminate the visit.

Treatment Extension

The results of the final two sessions of each extension phase are depicted on the right side of Figs. 6 and 7. The treatment extension process was successful in transferring the effects of

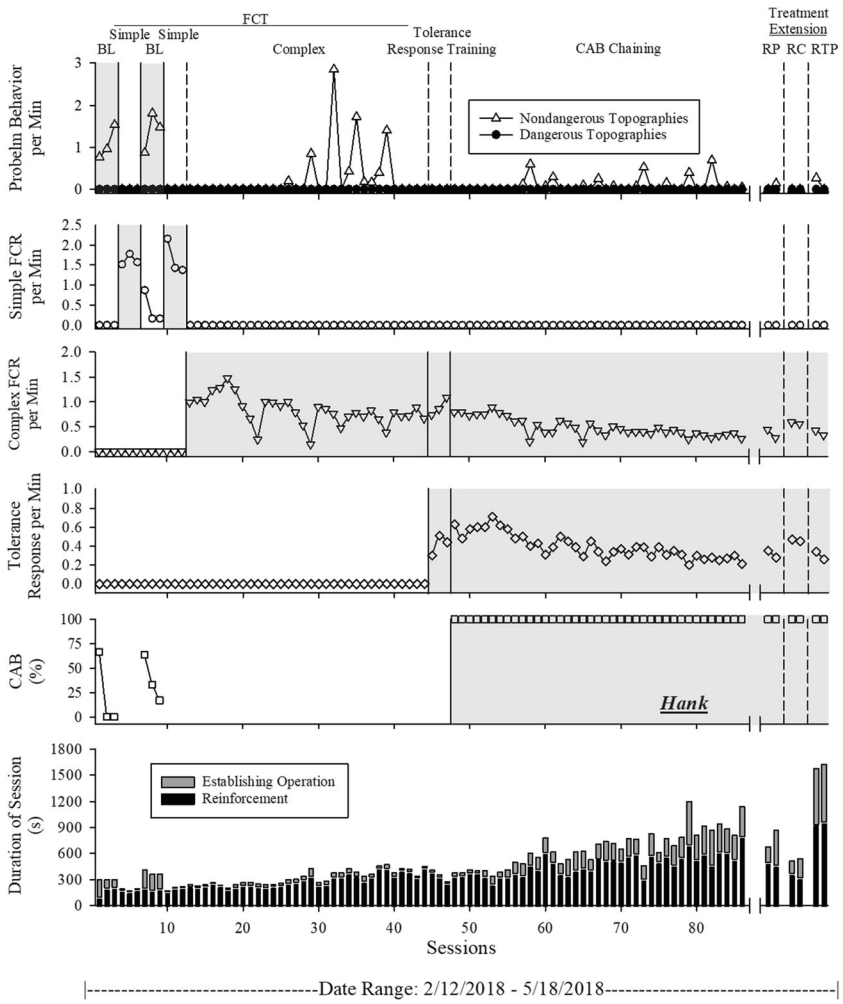

Fig. 7 Enhanced Choice Model Treatment Evaluation for Hank. *Note.* BL = baseline; FCT = functional communication training; FCR = functional communication response; CAB = contextually appropriate behavior; RP = relevant people; RC = relevant context; RTP = relevant time and place. Areas shaded in gray represent responses to which the reinforcement contingency was applied during each phase.

the enhanced choice model of skill-based treatment across relevant people, contexts, and time periods. Child performance data, including rates of problem behavior and targeted social skills, were consistent with that observed at the culmination of skill-based treatment in the pullout context for both participants. Furthermore, both Peter and Hank elected to practice for the duration of all sessions depicted under "Treatment Extension" in Figs. 6 and 7.

By the end of the final phase of the treatment extension, Peter experienced sessions that averaged 41 min in length, and his average proportion of the session in reinforcement was 43%. Hank experienced sessions that averaged 27 min in length, and his average proportion of the session in reinforcement was 59%. Both Peter and Hank were spending significant amounts of time without reinforcement (average of 23 and 11 min in programmed EO for Peter and Hank, respectively) and were engaging in 100% of CAB opportunities as instructed by their classroom teacher (see the right-most column of Table 4 for participant-specific descriptions of terminal CAB expectations during the "relevant time period" phase). Peter's participation in the process, from the initial IISCA visit to the final session in treatment extension, took 15 weeks to complete. Hank's participation in the same process took 13 weeks 4 days to complete.

Social Validity Evaluation

Table 5 depicts the results of the social validity evaluation of the practical functional assessment process for Peter and Hank. Both Peter's and Hank's respective classroom teachers found the caregiver interview to be a very comfortable, acceptable experience. Furthermore, they deemed the IISCA experienced by their student to be a very safe, acceptable process that was very comfortable to watch.

Table 6 depicts the results of the social validity assessment that was administered following completion of the pullout enhanced choice model of skill-based treatment, as well as after the culmination of the extension process. Both teachers

found the process to be very helpful, indicating that they would strongly consider participating in it again for a student with similar needs. Both teachers were very satisfied with the outcomes of the process, especially related to their student's problem behavior and the extent to which they felt comfortable imposing EOs. After skill-based treatment but before the treatment extension, both teachers indicated that they felt only somewhat confident applying the strategies observed in the practice context (Item 4 in Table 6). These scores and the open-ended comments alongside them prompted each BCBA and lead analyst to work with the classroom teacher to adjust the teaching context to make it suitable for implementation in the classroom. Scores on Item 4 improved following the treatment extension process, and both teachers rated the helpfulness of their training highly. Finally, despite satisfaction and comfort with the procedures and outcomes, both teachers finished the process unsure about the extent to which they found the treatment and their own training to be feasible during regularly scheduled classroom activities, citing demands on staff time and challenges associated with creating the proper physical space in crowded classrooms.

Results from the social validity evaluation provide many opportunities for future inquiry. It is notable that the BCBAs were present during every session of the pullout skill-based treatment and were heavily involved in the treatment extension. This may have contributed to the teachers' report that the process was somewhat demanding, and it also may not emulate the "real-world" funding models typical of such settings. That the teachers were unsure of the feasibility of the procedures suggests that future research could examine ways to refine, streamline, and increase acceptability of the enhanced choice model procedures, as well as the treatment extension process. To address demands on staff time and to progress toward more practical models of BCBA collaboration, future studies could investigate the implementation of the enhanced choice model via a weekly BCBA consultation involving behavior skills training of teachers and paraprofessionals, such that they act as primary implementers of the skill-based treatment from the beginning (Ruppel, Hanley, Landa, & Rajaraman, 2021). This may also promote feasibility within the classroom, as the initial treatment planning would necessarily take physical space and teacher concerns into account. Finally, although (a) relevant implementers socially validated the process and outcomes and (b) children indicated their preference for the procedures by consistently choosing to practice, future replications of the model should recruit subjective feedback from those directly receiving the skill-based treatment. Social validation by the recipients of behavioral interventions is critical to preventing marginalization and to expanding the scope of behavior-analytic practice (Hanley, 2010).

General Discussion

We systematically replicated the practical functional assessment and skill-based treatment procedures introduced in Hanley et al. (2014) within an enhanced choice model, produced efficacious outcomes for three children in an outpatient clinic, and achieved effective, socially validated outcomes for two children in a specialized public school. These outcomes were accomplished in the near absence of dangerous problem behavior and across a time frame similar to that which has been reported in other evaluations of skill-based treatment (e.g., Hanley et al., 2014; Santiago et al., 2016).

The findings of Studies 1 and 2 suggest that it is possible to eliminate problem behavior and improve cooperation with previously evocative CAB expectations without any physical management, with minimal observance of dangerous behavior, and while offering children the ongoing option to participate in a function-based treatment. The ongoing availability of options to leave the treatment (i.e., practice) context did not appear to negatively influence progress toward an effective outcome, as demonstrated when all five children volunteered to enter the practice context for an average of 96% of the time (range 92%–100%). The findings from Study 2 further demonstrate that such procedures and outcomes can be extended into relevant contexts (e.g., busy classrooms) and across relevant time periods in a manner that is agreeable to constituents, suggesting that the model may have utility in settings where escalation of problem behavior is most untenable (e.g., underresourced schools). The socially meaningful behavior change produced by the enhanced choice model of skill-based treatment has clear and immediate implications for practitioners tasked with addressing dangerous problem behavior that may necessitate the use of physical management procedures; problem behavior can be effectively treated without any escalation or need for physical management.

The enhanced choice model introduces several simultaneous modifications to the original practical functional assessment and skill-based treatment procedures described in Hanley et al. (2014), rendering unclear the extent to which each component played a critical role in the obtained treatment outcomes. The current study serves as an initial demonstration of what is possible with a hands-off, enhanced choice model. Hanley et al. (2014) discussed the bidirectional relation between analytic and synthetic studies and suggested that empirical syntheses such as the enhanced choice model are important because they are capable of (a) demonstrating large and socially meaningful changes in behavior, (b) systematically replicating effects of previously studied variables, and (c) occasioning further inquiry and analysis of less understood variables (p. 31). Some of the procedural modifications within the enhanced choice model represent such replications of independent variables from the extant assessment and treatment literature, whereas others could benefit from further analysis.

First, using escape extinction without physical guidance during treatment was a replication of procedures described by Piazza et al. (1996), but also an extension in that it was incorporated into procedural extinction involving *synthesized reinforcers* as opposed to escape in isolation. Withholding positive reinforcers while repeatedly delivering demands vocally and providing other avenues of escape allowed for the treatment of problem behavior sensitive to escape without any physical management, which we submit is critical in avoiding the escalation of behavior and expanding the scope of application of these procedures. For example, had we not made this modification in the specialized public school, the analysts in Study 2 would legally not have been able to conduct this process with Peter and Hank.

Second, the provision of choice-making opportunities during certain trials in CAB chaining was informed by findings from several studies that have suggested that opportunities to make choices can be reinforcing and preferred (Fisher, Thompson, Piazza, Crosland, & Gotjen, 1997; Thompson, Fisher, & Contrucci, 1998). Incorporating choice during periods of instruction was a replication of procedures described in multiple other studies (Dunlap et al., 1994; Dunlap et al., 1991; Moes, 1998; Peck Peterson et al., 2005; Powell & Nelson, 1997; Taylor et al., 2018), but also an extension in that choice-making opportunities were only *intermittently presented* to the children during instruction. It is unclear (a) the direct impact of these choice-making opportunities on problem behavior and CAB engagement and (b) the ideal schedule with which it should be programmed when embedded in the already-intermittent, unpredictable reinforcement schedule germane to skill-based treatment. Although it seems reasonable to infer that programmed choice-making opportunities facilitated the elimination of problem behavior and increased CAB engagement based on prior research, future investigation is needed to understand the extent of their direct impact on enhanced choice model outcomes.

Third, the addition of detailed prospective and retrospective feedback between analyst, child, and caregiver(s) throughout the process was loosely informed by the finding that programmed signals of the pending onset of an aversive event (e.g., imposition of a synthesized EO) can enhance the efficacy of reinforcement-based interventions (Flannery & Horner, 1994; Mace, Shapiro, & Mace, 1998; Schreibman, Whalen, & Stahmer, 2000). Being transparent about what was to be expected of the child in the practice and hangout contexts may have mitigated certain aversive features of either context. We found anecdotally that children enjoyed this part of the enhanced choice model and were especially eager to discuss their successes with caregivers following a productive visit. We suggest that the inclusion of this treatment component contributed to the maintenance of a positive therapeutic relationship between child and analyst, but future research should examine more closely how the addition of these procedures impacted treatment outcomes, as well as the applicability of these procedures to individuals with a less robust verbal repertoire.

Finally, embedding the entire treatment program in an enhanced choice model and reporting on participant choices made throughout the process represent the first application of skill-based treatment (Hanley et al., 2014) in which participants had several concurrently available options to experience or escape programmed EOs and various reinforcement arrangements. It also represents the first application of skill-based treatment in which synthesized positive and negative reinforcement was available continuously in a noncontingent manner outside of the practice context throughout treatment.

It appeared that the addition of the enhanced choice model thwarted escalation to dangerous problem behavior, as it seldom occurred during treatment, but one important question remains: Why did all children choose to participate in the differential reinforcement arrangement for an average of 96% of the time when they could consume the same reinforcers "for free" in the hangout context? In other words, what was the putative variable controlling child preference for the practice context as opposed to the other two enhanced choice options? Although choice-making opportunities and increased transparency about expectations may have mitigated certain aversive properties of the practice context, these treatment components were in place in the hangout context as well and therefore cannot explain why children chose to practice with such regularity. We offer that participants preferred the practice context due to a preference for contingent over noncontingent reinforcement, a pervasive finding across human and nonhuman-animal research (e.g., Hanley, Piazza, Fisher, Contrucci, & Maglieri, 1997; Luczynski & Hanley, 2009; Singh, 1970; Singh & Query, 1971). It is likely the case that children in the current study chose to practice because they would prefer to have reinforcement delivered contingent on their behavior as opposed to response-independent reinforcement delivery. Experiencing the effectiveness of one's own socially appropriate behavior under conditions that historically maintained problem behavior may itself reinforce an entire class of approach responses with respect to those contexts (e.g., choosing to participate; Bannerman, Sheldon, Sherman, & Harchik, 1990). The experimental arrangement in the current study did not allow for sufficient evaluation of this hypothesis because we did not carefully control the extent to which equivalent reinforcement was programmed across contexts. In fact, although not explicitly programmed, there were certain situations in which the synthesized reinforcer was different across contexts. For example, Peter often played tag during practice in the empty library, but playing tag was not possible in the smaller corner where he hung out, suggesting that the practice context may have been unintentionally correlated with higher quality reinforcement given the environmental arrangement. A future study could evaluate client

preference for contingent reinforcement (i.e., practice context) over noncontingent reinforcement (i.e., hangout context) by carefully matching all dimensions of synthesized reinforcement (e.g., magnitude, quality) across both contexts, measuring the integrity with which equivalent reinforcement is programmed in each and examining client choices made in a more formal concurrent-chains arrangement (e.g., Hanley et al., 1997). A carefully matched concurrent-chains arrangement may also allow for the systematic exploration of how to adjust intervention procedures in the event that clients repeatedly choose to hang out instead of practice. Understanding the mechanism driving the choice to practice (or not) may help researchers and practitioners investigate strategies for shifting that preference. However, an important implication of the current study's findings is that practitioners may be able to mitigate dangerous behavior sensitive to escape by programming concurrently available noncontingent reinforcement during a skill-based treatment involving contingent, differential reinforcement.

Two features of the methods employed in the current study may render outcomes particularly difficult to interpret: the fact that only nondangerous problem behavior was observed and reinforced during all functional analyses (except Jeffrey's), and the lack of data showing the isolated effect of escape on problem behavior. The former makes it difficult to assert that the dangerous problem behavior—for which all participants were originally referred for treatment—was actually addressed, whereas the latter makes it difficult to know the extent to which supplementary procedures were necessary to mitigate collateral effects of escape extinction procedures. These features may be considered limitations of the validity and utility of the current study; however, we believe that the safety and practical utility afforded by these procedural details outweigh the interpretive difficulties posed by the analytical imprecision, warranting further discussion.

Although enrollment criteria for this study required that all participants had reported histories of dangerous problem behavior that escalated when physical management was attempted, it may seem unusual to consider the treatment outcomes indicative of having meaningfully addressed dangerous problem behavior given that it rarely occurred and was never explicitly controlled. There are, however, two pieces of evidence to take into account when appraising the validity of these findings. First, it bears repeating that multiple studies have demonstrated that "precursor" (i.e., nondangerous) responses that are reported to co-occur with dangerous problem behavior tend to share response-class membership with the more dangerous topographies (e.g., Borrero & Borrero, 2008; Herscovitch et al., 2009; Magee & Ellis, 2000; Schmidt et al., 2020; Smith & Churchill, 2002; Warner et al., 2020). Recently, Warner et al. (2020) demonstrated that it was *highly probable* that caregiver-reported nondangerous topographies of problem behavior would be sensitive to the same synthesized reinforcement contingency as the more dangerous forms with which they co-occurred; a finding that was replicated in 9 out of 10 consecutive applications of the IISCA. Furthermore, Dracobly and Smith (2012), Hoffmann et al. (2018), and Najdowski et al. (2008) successfully treated dangerous problem behavior with an intervention informed by an analysis of nondangerous behavior. Thus, we felt confident in inferring that the contingency that controlled the nondangerous problem behavior of all children was functionally related to their dangerous behavior as well. Second, the social validity evaluations in Study 2 suggest the ecology of the controlling contingency in that caregivers reported (a) high levels of satisfaction with the improvements in dangerous problem behavior both within and outside of dedicated practice sessions (M = 6.5) and (b) a high level of comfort in imposing EOs that were previously associated with high-intensity, dangerous problem behavior (M = 7). Taken together, the inference that nondangerous and dangerous problem behavior were functionally equivalent, the observation that it remained at zero throughout treatment, and the social validation of the outcomes with respect to Peter's and Hank's problem behavior support the assertion that this model sufficiently addressed the dangerous behavior of the enrolled participants.

Although IISCAs for all five participants demonstrated behavioral sensitivity to escape when synthesized with other reinforcers, the escape contingency was not tested in isolation, making it difficult to know the extent to which escape served as a putative reinforcer for each participant's problem behavior. This demonstration may be considered important to warrant the addition of procedures explicitly meant to mitigate the negative effects associated with escape extinction in treatment; however, we chose to evaluate a personalized, synthesized contingency because (a) there is evidence to suggest that treatments have a higher likelihood of effectiveness when informed by a synthesized contingency (e.g., Jessel, Ingvarsson, Metras, Kirk, & Whipple, 2018; Slaton et al., 2017) as opposed to an isolated contingency (see Slaton & Hanley, 2018), (b) we were attempting to replicate and extend the particular assessment and treatment procedures described in Hanley et al. (2014), and (c) due to the nature of the purpose of the study (i.e., to address dangerous problem behavior with minimal experience of said dangerous behavior), we preferred the practical utility of an efficient assessment capable of demonstrating control over problem behavior to the analytical precision afforded by lengthier assessment processes (Coffey et al., 2020; Jessel, Metras, Hanley, Jessel, & Ingvarsson, 2020). From the perspective of the practitioner charged with treating dangerous problem behavior, the benefits of an efficient assessment and treatment that teaches clients

a multitude of adaptive skills across multiple evocative contexts probably outweigh the cost of possibly not knowing the isolated effects of any one reinforcement contingency.

A primary impetus for developing the enhanced choice model was to be able to apply skill-based treatment to clients for whom the mere possibility of evoking or inducing dangerous problem behavior would constitute an unmanageable, unacceptable safety concern. Although the process experienced by the five children in the current study was safe (i.e., little to no dangerous behavior) and devoid of any physical management, we cannot conclude the extent to which the enhanced choice model was indeed *safer* and *more feasible* than the typical skill-based treatment process. Problem behavior data are typically reported as one aggregate measure in the skill-based treatment literature (e.g., Hanley et al., 2014; Jessel, Ingvarsson, Metras, Kirk, & Whipple, 2018), so although we reported almost no dangerous problem behavior, future studies will have to compare procedures of the enhanced choice model and typical skill-based treatment, report outcomes across dangerous and nondangerous topographies, and determine the relative efficacy, safety, and feasibility of this approach.

Nevertheless, meaningful outcomes are possible with an enhanced choice model of practical functional assessment and skill-based treatment. Heal and Hanley (2007) submitted that "children may be more inclined to seek out and less likely to actively avoid learning opportunities provided under highly preferred and properly motivating conditions" (p. 259). We propose that this model had a similar effect, as it relied heavily on child preference and a hands-off treatment process, while still capitalizing on a synthesized reinforcement contingency to engender positive behavior change. Future evaluations of the model can help us understand the mechanisms driving its success and expand the scope of its application so that those who are not typically the beneficiaries of behavior-analytic services may become eligible.

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Declarations

Informed consent Informed consent was obtained from all individual participants included in the study.

Ethical approval

All procedures performed in this study were in accordance with the ethical standards of the institutional review board and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This study does not contain any experimentation with animals performed by any authors.

Conflict of interest The authors declare that they have no conflict of interest.

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