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Implementing skill-based treatment within a classroom setting for an adolescent with autism

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Abstract

Research exists to support the efficacy of the Interview-Informed Synthesized Contingency Analysis (IISCA) and skill-based treatment (SBT) to address problem behavior within a clinical setting. However, limited research is available to support their use in a classroom setting and especially as a tool to avoid the display of problem behavior altogether. In the current study, the IISCA, informed by an open-ended interview, was conducted with a single participant in the classroom after a prolonged absence from school due to COVID-19. Results of the IISCA were used to determine the multiple contingencies that were likely to evoke problem behavior upon re-introduction of academic task demands. A skill-based treatment was then developed based on these contingencies, which involved teaching the participant functional communication, delay tolerance, and following academic instruction in relevant contexts. After 25 treatment sessions, the participant had acquired and maintained all of these skills, including the ability to functionally communicate, tolerate removal of preferred items, and follow educational instructions within the typical classroom routine. This study shows the applicability of the IISCA and SBT when implemented within the classroom setting and when used to reintroduce educational instruction to an individual with autism after a prolonged break from school.

1 | INTRODUCTION

For many individuals with autism, extended school year services are necessary to avoid loss of critical skills over prolonged breaks from school (e.g., summer vacation) (Susan, 2002). Without this continuation of educational services, many students experience not only the loss of academic skills, but some may also experience behavioral regression. A prominent example of this was the prolonged break from school due to the COVID-19 pandemic (Ren et al., 2020). An online parent survey conducted by Colizzi et al. (2020) found that behavior problems worsened in more than one third of individuals with autism during the pandemic.

Fortunately, there are many evidence-based procedures designed to identify the function and address behaviors that may be challenging or interfering with success both at home and in an educational setting. Traditionally, behavior analysts have used functional behavior assessments or functional analyses to identify the function of the problem behavior and develop effective, function- based interventions (Napolitano et al., 2012). In 2014, a procedure was introduced by Hanley et al. known as the Interview Informed Synthesized Functional Analysis (IISCA). The purpose of the IISCA, like a traditional functional analysis (Iwata et al., 1994), is to identify the function of problem behavior. However, unlike traditional functional analyses, with the IISCA there may be multiple reinforcers assessed simultaneously within the same assessment session (Slaton et al., 2017). Because of this assumption that a behavior may have multiple functions, the IISCA is composed of a single *synthesized* test condition, consisting of idiosyncratic establishing operations (EO's) and reinforcers, and a single matched-control condition which provides continuous access to all of the same reinforcers as the test condition (Slaton et al., 2017). These EO's and putative reinforcers to be included in the test condition are decided based upon results from an open-ended interview conducted with those who are familiar with the participant being assessed (Slaton et al., 2017). The pre-assessment interview is also important in determining precursors to the target behaviors because during the assessment, precursor behaviors are reinforced *before* the dangerous or more severe behavior even occurs (Slaton et al., 2017). One benefit of the IISCA is its brevity compared to a traditional functional analysis. While a traditional functional analysis typically requires at least 90 min or longer, including multiple sessions, the IISCA can be conducted within a single session in as little as 5–20 min (Jessel et al., 2019; Slaton et al., 2017). A short assessment, like the IISCA, is beneficial because information necessary to design a treatment is acquired quickly and, therefore, implementation of treatment can commence sooner.

Upon introduction of the IISCA, Hanley et al. (2014) also described and implemented a standardized treatment protocol to be conducted following the IISCA. In their 2014 study, Hanley and colleagues described this treatment, known as skill-based treatment (SBT). The components include teaching functional communication to the participant to replace problem behavior, tolerance when their request cannot be immediately honored, and compliance with increasingly difficult tasks during delay of the reinforcement of their request. These skills were then taught and maintained in contextually relevant applications and settings. After 8–14 weeks of treatment in an outpatient clinic, problem behavior for all participants was successfully eliminated in the clinic and the home and each participant had acquired and maintained skills in functional communication, delay tolerance, and compliance. In another example of the utility of SBT, Ferguson et al. (2020) attempted to replicate and extend the Hanley et al. (2014) study with a single participant in a private clinic. Treatment was broken down into several components including teaching functional communication response (FCR), tolerating response (TR), compliance with easy demands, and compliance with hard demands. Communication skills and compliance were maintained and expanded during compliance chaining which included nine phases each increasing in number and difficulty of demands. This study attained similar results to Hanley et al. (2014) in that problem behavior was significantly reduced and desirable behavior, such as functional communication, delay tolerance, and compliance, were increased.

While there is a growing body of evidence to support the efficacy of the IISCA and SBT in a well-controlled clinic-based setting, there is also research, albeit limited, to support its use in more natural settings, such as a classroom. Taylor et al. (2018), for example, attempted to implement the IISCA and SBT within the classroom setting. However, due to an extinction burst which involved property destruction which posed a potential danger to peers and staff, the remainder of treatment was conducted as 1:1 pull-out sessions. Treatment was successful at decreasing problem behavior and increasing compliance to the extent that the participant was able to be re-integrated into the classroom. While the initial treatment was not able to be conducted within the natural classroom setting, the participant's progress was maintained and the new skills were able to be generalized to the classroom setting. In contrast, Santiago et al. (2016) successfully implemented the assessment and SBT within a classroom setting in the context of typical ongoing activities, by a relevant individual to that setting, the teacher. Despite the potential confounds and distractions that occur in the environment, participants in the Santiago et al. (2016) study had the same positive outcomes as participants in other studies who received treatment in a clinic. Specifically, problem behavior was eliminated and functional communication, tolerance skills, and compliance were increased for both participants. The study demonstrated the efficacy of the IISCA and SBT process implemented in its entirety in the natural setting.

Although substantial research exists to show that the IISCA and SBT can be successful when implemented in a clinical setting, limited research exists to show that both assessment and treatment can be fully implemented within the classroom safely. Research on SBT generally focuses on reduction in already concerning levels of challenging behavior, therefore it may be difficult to maintain safety when implemented within a less controlled setting. However, the current study aims to show that when the IISCA and SBT are used proactively to limit or avoid the display of dangerous problem behavior, assessment and treatment can be safely conducted in its entirety within a classroom setting. In addition, the study aims to show that SBT can be used to gradually reintroduce classroom instruction and fade noncontingent reinforcement for a student with autism during a transition back to an educational setting following a prolonged break from school.

2 | METHOD

2.1 | Participant

The participant, Lynn, was an 18-year-old Caucasian female with a diagnosis of autism spectrum disorder. Lynn was placed in a classroom with six students, three classroom aides or teacher's assistants, and one teacher at a special education school that served individuals with autism.

In March 2020, COVID-19 caused a temporary shutdown of in-person education and students were kept at home with limited educational and therapeutic services for almost 5 months. Lynn had a history of engaging in challenging behavior, such as aggression, both at home and in school. These behaviors were reported by her parents to have increased at home over the course of the shutdown, similar to the experiences reported by parents in Colizzi et al. (2020). When in-person education resumed, the priority of staff at the school was to reestablish rapport with students and keep them happy, relaxed, and engaged. For Lynn, this involved noncontingent access to her preferred items (e.g., the iPad) and minimal academic expectations. Over several months, the educational staff slowly transitioned from rapport building to reintroducing academic demands and the classroom routine. Staff reported that while Lynn was able to comply with some academic demands when her iPad still played next to her, any requests by staff for Lynn to relinquish the iPad were met with precursor behavior. Because of staff's awareness of Lynn's history, they expected that if Lynn was required to relinquish the iPad, it would likely lead to dangerous problem behavior and potentially the use of a physical intervention. Given that, at this time, it was staff's priority to keep students safe and as socially distant as possible, staff did not require Lynn to relinquish the iPad so as to avoid an unsafe situation in the classroom. However, after several months, staff grew concerned that Lynn's refusal to relinquish preferred items was inhibiting her ability to fully benefit from in-person instruction and exacerbating the effects of the lengthy break

from school. Because of this, the educational and behavioral team, in collaboration with Lynn's family, determined that a treatment was necessary.

The specific treatment of an IISCA and SBT were selected because this assessment and the SBT protocol could result in an intervention that would avoid the display of Lynn's most severe challenging behavior in the classroom as staff attempted to reduce her noncontingent access to preferred items. In addition, this treatment was deemed appropriate for Lynn due to her baseline ability to vocally communicate. For example, Lynn had the ability to use vocal requests for preferred items and activities in 3–5 word phrases.

2.2 | Setting and materials

All IISCA and treatment sessions were conducted in Lynn's classroom. Classroom staff and sometimes additional staff, as well as Lynn's classmates were present in the classroom during sessions. The classroom contained a teacher's desk, several student desks, a smart board, various classroom materials, and a bean bag for Lynn. Other materials used during treatment sessions included an iPad equipped to play videos, a basket to hold the iPad, and work materials such as sorting bins, worksheets, and life skills materials.

2.3 | Measurement

Data were collected on problem behavior during the IISCA and SBT sessions. A frequency measure was taken for problem behavior within and between each trial which was converted into rate per minute across sessions. Participant problem behavior was broken down into two categories, Response 1 (R1) being the most concerning, dangerous and/or disruptive problem behaviors and Response 2 (R2) being the precursors to problem behavior. Concerning problem behavior included aggression (hitting, grabbing, scratching, pulling hair, head butting), property destruction (banging hands and feet against objects/surfaces, throwing, ripping, swiping, and toppling materials), self-injury (hitting body parts, striking head, or banging body parts against surfaces) and, flopping (lowering body to ground without staff permission). Precursor behaviors included verbal refusal (refusing to follow directions or making a verbalization toward staff that consists of denying compliance to directions), angry face (gritting teeth, clenching jaw, and furrowed eyebrows), and repetitive vocalizations (at least one instance of stating a phrase related to the termination of the session or unwanted presence of the teacher i.e., paired with an angry face; pairing of angry face not included in original definition). During sessions, if any of the defined problem behaviors occurred within a given trial, it was scored as an R1 and if any of the defined precursor behaviors occurred, it was scored as an R2. The frequency within each trial were scored for each category of behavior (i.e., R1 or R2), however, the specific topographies of each behavior displayed were not specified within a given trial. If a single instance or multiple instances of problem or precursor behavior occurred, that trial was scored as incorrect.

Data were also collected on skills acquired during SBT sessions. Specifically, data were collected on functional communicative responses (FCRs), both simple (sFCR) and complex (cFCR), tolerance responses (TRs), and participant compliance and completion of the demand in the current step (contextually appropriate behavior [CAB]). Frequency of independent FCRs and TRs emitted by Lynn within each hour-long session were recorded. Each trial was scored as either correct (Lynn engaged in all of the required response independently and without engaging in problem or precursor behavior) or incorrect (one or more of the required verbal responses or completion of a demand required prompting by an instructor, and/or problem or precursor behavior occurred at any point within the trial). A percent correct score was then calculated by dividing the number of correct trials by the total number of trials conducted for that step.

2.4 | Interobserver agreement

Interobserver agreement was assessed by having a second observer simultaneously collect data on all target behaviors and required responses during at least 44% of all sessions. Trial by trial IOA was used to calculate reliability.

Sessions were broken down into trials (a single trial begins with the presentation of the EO, includes the intertrial period, and ends before the next presentation of the EO). If both observers scored the same number of problem behavior (R1s) and precursor behavior (R2s) and agreed on the independence of a response, that trial was scored as an agreement. IOA was calculated by the number of agreements divided by the number of agreements and disagreements and multiplied by 100. IOA scores from each session were then averaged together to get the final IOA score. IOA averaged 93% (range, 82%–100%).

2.5 | Experimental design

A multi-element design was used during the IISCA to compare the test and control conditions. skill-based treatment followed the logic of a changing-criterion design in that certain criteria were required to be met before moving on to the next step which required greater response effort. Functional control was demonstrated by Lynn meeting criteria within each step and progressing through increasingly more difficult tasks while maintaining the previously established skills. If skills were lost or not being appropriately maintained, returning to the previous step would be necessary.

2.6 | Procedures

2.6.1 | Open-ended interview

Prior to the implementation of the IISCA, an open- ended interview was conducted by the first author with Lynn's mother over the phone and with Lynn's teacher in-person. The interview included questions about Lynn's history of problem behavior, situations in which the problem behavior was likely to occur, precursors to the problem behavior, how others typically responded to the problem behavior, and how to prevent or turn off the problem behavior. The purpose of these questions was to determine (a) the most concerning behaviors that could occur given the right establishing operation, (b) reliable precursors to the behavior that can be reinforced during the assessment, and (c) putative reinforcers to the behavior. The results of the interview were used to design the control and test conditions for the assessment.

2.6.2 | IISCA- baseline

Based on responses from the open-ended interviews, several potential problem behaviors were identified along with their precursor behaviors. In addition, it was hypothesized that access to an iPad and escape from academic tasks may be reinforcers. The purpose of the IISCA was to test this hypothesis and confirm the contingencies maintaining the behavior. The assessment involved alternating between test and control condition. During the control condition, Lynn was given access to all putative reinforcers (i.e., free access to a beanbag and iPad with no academic demands placed). This control condition is also referred to as HRE because Lynn should have been Happy, Relaxed and Engaged, similar to the ongoing environmental condition within the educational setting upon returning to school after the prolonged break. The test condition, commencing with the presentation of the EO, was meant to evoke the problem behavior. Specifically, the instructor approached Lynn while saying "It is time to work. Pause your iPad and put it in the basket". Once the EO was presented, if problem or precursor behavior occurred, it was immediately reinforced by the instructor removing the demand and saying, "never mind, you can keep your iPad". At the start of the assessment, Lynn was in the HRE condition for 5 min. The presentation of the EO signaled the beginning of the test condition. The subsequent reinforcement of any problem behavior immediately signaled the beginning of the control condition,

which lasted approximately 30 s. This process continued until problem behavior was reliably controlled, indicated by the occurrence of the problem behavior solely and consistently during the test condition and its absence during the control condition, which allowed for the conclusion of the assessment.

The one-session IISCA lasted 17 min. Results (Figure 1) suggested that behavior was maintained by multiple contingencies, access to preferred items and escape from academic tasks. Baseline of problem behavior before treatment was recorded from the test condition trials during the IISCA.

2.6.3 | Skill-based treatment

Skill-based treatment commenced immediately after the completion of the IISCA. Based on the results from the IISCA, access to the iPad and removal of academic tasks were used as the reinforcer in all treatment sessions. During treatment, problem behavior was placed on extinction (i.e., problem and precursor behavior no longer resulted in escape from demands and access to the iPad). Responses such as appropriate communicative responses or compliance with a demand were reinforced. Skill- based treatment sessions were conducted by the same instructor three to 4 days a week for 1- hour within the classroom. The criteria for moving to the next step was three consecutive trials of the current step that were performed independently by Lynn with zero instances of problem behavior.

Simple functional communication response (sFCR)
For this first step of SBT, Lynn was taught to emit the simple functional communicative response (sFCR), "my way", in response to a demand from the instructor. A trial would begin with the presentation of the demand (EO) in which the instructor would approach Lynn and say "it's time to do some work". If Lynn said "my way", the instructor would immediately reinforce this response by saying "okay, you can have your way" and moving away from Lynn, therefore, removing the demand and allowing Lynn to return to the HRE condition (no demands and access to iPad). The inter-trial period of HRE typically ranged between 30 s and 2 min. A hierarchy of prompting was used to initially teach the sFCR. At the introduction of the EO, Lynn was immediately shown a textual prompt that she could read aloud to emit the desired response. If Lynn did not respond to the textual prompt, a verbal prompt was to be used, followed by touching the cue card to Lynn. This prompt hierarchy was also followed if Lynn emitted an incorrect verbal response or did not respond within 5 s on any given trial. Lynn received reinforcement, regardless of the level of prompting required, once the sFCR was emitted. The same method of prompting was used for the complex functional communication response (cFCR) and tolerance response (TR).

Complex functional communication response (cFCR)
After reaching criteria for step 1, the response "my way" was put on extinction and only the more complex response (cFCR), "I want my way, please" was reinforced. Aside from the response requirement, procedures for this step, including teaching method, prompting hierarchy, and reinforcement, were identical to the previous step.

Tolerance response (TR)
The purpose of this step was to teach Lynn to tolerate a denial in her request for "I want my way, please". For this step, when Lynn emitted the cFCR, the instructor responded, "not right now", and Lynn was expected to respond with "okay". If Lynn emitted the tolerance response ("okay"), the instructor would immediately reinforce this communication by saying "never mind, you can have your way". For this and all subsequent steps, trials were randomized between the current and previous steps. This randomization of required responses was achieved by following a data sheet developed by Hanley and Fiani (2020), which outlined specifically which step the instructor should follow for each trial. Randomization was used to decrease the likelihood that Lynn would predict how much response effort

was required to receive reinforcement and to help maintain previously mastered responses by offering occasional immediate reinforcement.

Contextually appropriate behavior (CAB)
Details on the breakdown of all CAB levels are available via the corresponding author:

CAB 1. For this step, Lynn was still required to emit the cFCR and TR, but was also required to relinquish her iPad. On the first trial, physical prompting was used to help Lynn complete the task because she displayed some precursor behavior including verbal refusal and some dangerous problem behavior. Because of the presence of problem behavior and the high priority placed on maintaining a safe environment within the classroom throughout treatment, CAB1 was broken down into smaller components so as to more gradually increase the response effort for Lynn. When criteria were met for each component step, the next level of response was required to receive reinforcement. For example, after three consecutive trials of Lynn independently pausing her iPad (CAB 1a) with no problem behavior, on the next trial she was required to both pause the iPad and relinquish it by placing it into a basket presented by the instructor (CAB 1b). The instructor then immediately reinforced this behavior by returning the iPad and saying "I changed my mind, you can keep your iPad". Trials were randomized between the current and previous steps.

CAB 2. The ultimate goal of this step was for Lynn to transition to her desk, however, similar to the previous step, because of the presence of problem behavior and prompting required upon the introduction of this demand, the step was broken down into smaller components.

CAB 3. For this step, once Lynn was seated at her desk, she was presented with a work task. The work selected for this step was minimally aversive and not challenging, based on reports from Lynn's teacher. Some examples of work tasks included sorting items, identifying more or less on a worksheet, or discrete trial pronoun identification. Each CAB 3 trial was randomized in terms of how many responses were required *or* how much time Lynn was required to work, although Lynn was unaware of the response/time requirement. Randomization was achieved by placing numbers 1–3 (to represent number or work demands) and 10–60 counted by tens (to represent time in seconds) in a jar and randomly selecting one before each trial. Least to most prompting was used to ensure completion of the task. When the allotted time/required response was complete, the instructor provided verbal praise and reinforced by returning the iPad. Trials were randomized between the current and previous steps.

CAB 4–6. The procedure for these steps was identical to the previous step, except with systematic increases in response requirements.

2.6.4 | Outside of session procedure

Outside of the treatment sessions, a procedure was introduced beginning on the eighth day of treatment, during which classroom staff required Lynn to relinquish the iPad throughout the school day. Prior to this procedure, Lynn still had consistent, noncontingent access to the iPad across the school day, *except* during treatment sessions. Because of this, Lynn began showing signs of aversion toward the treatment sessions and the instructor. The classroom procedure started with Lynn having to relinquish the iPad every 15 min throughout the day and then engage in one high probability demand to earn the iPad back. The classroom staff gradually decreased the duration of access to the iPad from 15 to 5 min, as well as gradually increased response effort required from Lynn to gain the iPad back, similar to the progression seen within treatment sessions. The purpose of introducing this procedure was to (a) decrease the aversiveness of the SBT sessions and the instructor and (b) maintain and generalize the progress that was achieved within SBT sessions, specifically tolerating not having access to the iPad and completing work tasks, across her entire school day.

2.7 | Social validity and treatment integrity

To assess the acceptability of the IISCA and skill-based treatment, a questionnaire was provided to two of Lynn's teachers who had observed the implementation and effects of treatment. The questionnaire consisted of nine statements rated on a 5- point Likert scale; a 5 indicated strong agreement, and a 1 indicated strong disagreement. The statements focused on perceived effects of treatment on Lynn's behavior and communication, perceived impact of implementing the treatment within the classroom, and overall satisfaction with the treatment. The social validity score was calculated by averaging scores for each respondent.

Data were collected on fidelity of implementation across two skill-based treatment by a BCBA. Using a task analysis data sheet, the BCBA assessed the implementor's ability to correctly conduct each trial within a session across different steps. Fidelity was scored for five trials during both a session that included cFCR trials only and a session that included trials up to CAB 3. The fidelity score for the cFCR session was 100% (20 steps performed correctly out of 20). The fidelity score for the CAB 3 session was also 100% (66 steps performed correctly out of 66).

3 | RESULTS

3.1 | IISCA

As seen in Figure 1, during the IISCA precursor behavior reliably occurred when the instructor presented the EO. When access to the iPad and removal of academic tasks were provided contingent on Lynn's problem behavior, there was clear differentiation between the control and test condition, with the exception of one control trial during which precursor behavior occurred. Across the seven test trials, precursor behavior occurred at an average rate of 1.14 per minute (range 1–2). Across the eight control trials, there were zero occurrences of problem behavior in all but one of the trials. The average rate during control trials was 0.25 per minute (range 0–2).
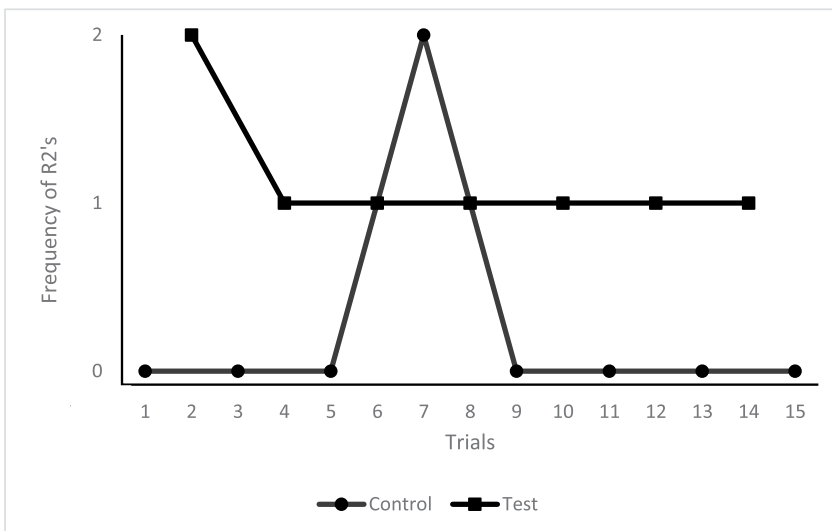

FIGURE 1 Problem behavior during the Interview-Informed Synthesized Contingency Analysis (IISCA). This figure shows the frequency of precursor behavior (R2's) during the Interview-informed synthesized functional analyses. Only R2's are included because zero instances of R1 (problem behavior) behavior occurred in either test or control condition across the entire assessment.

3.2 | Skill-based treatment

Figure 2 represents the rate of problem behavior and precursor behavior (R1 and R2); the test conditions within the IISCA served as a baseline for comparing problem behavior before and after treatment. During baseline, zero instances of problem behavior (R1) occurred and precursor behaviors (R2) were observed at an average rate of 1.5 per minute. During intervention, before the change in definition for repetitive vocalizations, precursor behavior occurred at an average rate of 0.36 per minute (range 0.07–1.18). After the change in definition, precursor behavior occurred at a rate of 0.09 per minute (range 0–0.2). Throughout the entire treatment, dangerous problem behavior (R1) only occurred during three sessions at an average rate of 0.01 across all sessions (range 0–0.08).

Figure 3 displays the frequency of independent sFCRs during the first session and frequency of independent cFCRs and TRs across all treatment sessions. During the first treatment session, Lynn displayed the sFCR two times before the response was placed on extinction and she was taught the complex FCR. In the second treatment session, during which Lynn was taught to emit the complex FCR, she independently responded 19 times. Lynn met criteria to progress to step 3 (teaching of the tolerance response) within the same session, but only emitted an independent tolerance response one time. In the third treatment session, Lynn engaged in an independent cFCR 18 times and tolerance response 12 times and was able to progress to step 4 (introduction of CAB 1) within the same session. Over the next several sessions on CAB 1 (including substeps of CAB 1), Lynn emitted the cFCR an average of 18 times per session (range 8–27) and the TR an average of 16 times per session (range 11–25). While on step 5 (introduction of CAB 2 including all substeps), Lynn emitted the cFCR an average of 14 times per session (range 6–22) and the tolerance response an average of 17 times per session (range 8–20). During CAB 3, Lynn displayed an average of 19 instances of cFCR (range 17–21) and 16 instances of the TR (range 13–20) per session. During the single session of
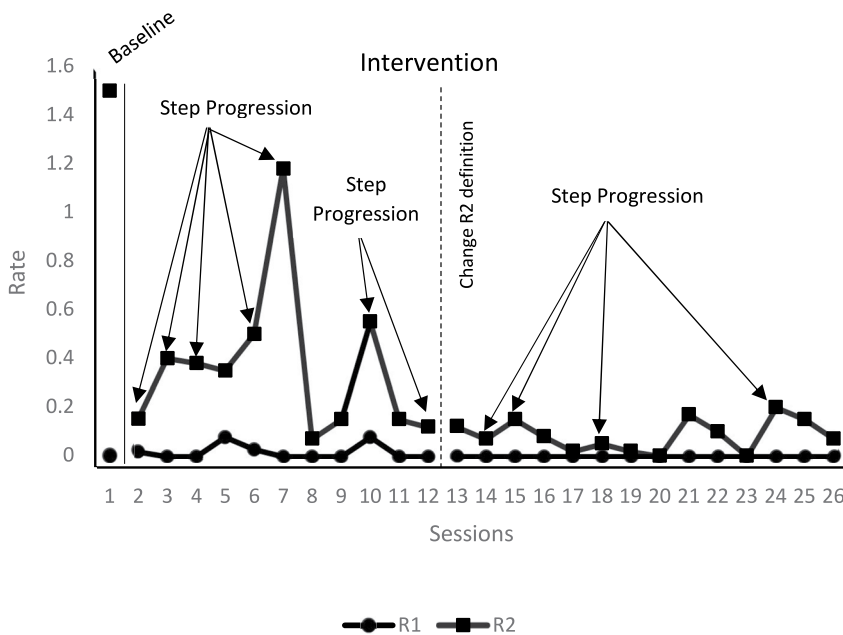

FIGURE 2 Problem behavior across baseline and intervention. This figure shows rate (frequency per minute) of problem behavior (R1's and R2's) across baseline (Interview-Informed Synthesized Contingency Analysis [IISCA]) and intervention (skill-based treatment). Arrows indicate when Lynn progressed to the next step of treatment at the start of or within the session. The dotted phase line indicates when the definition for repetitive vocalizations was changed. The data before the phase line reflects R2's recorded based on the original definition and the data after the phase line reflects R2's recorded based on the new definition.

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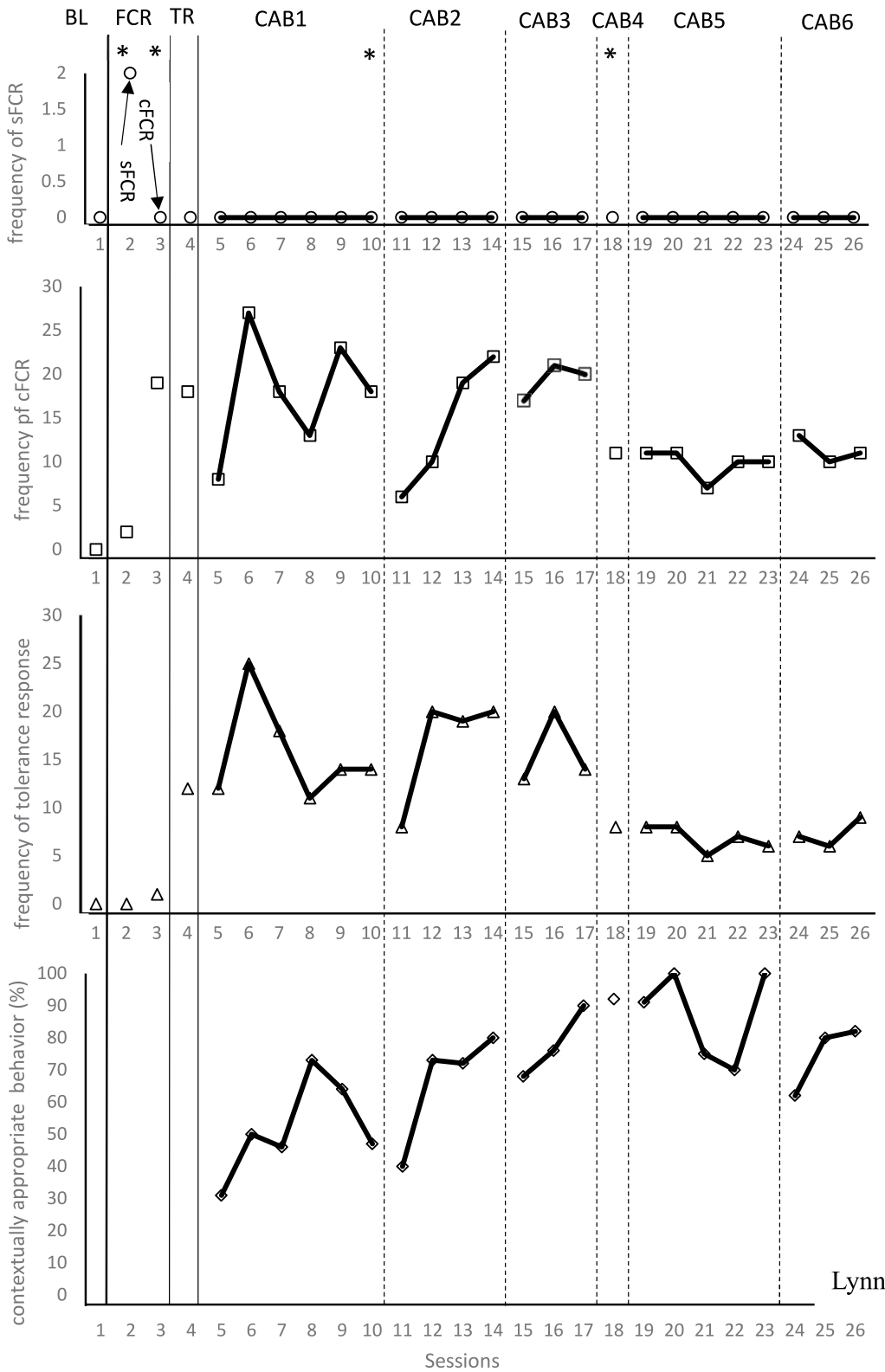
Lynn

CAB 4, Lynn emitted the cFCR 11 times and TR 8 times and progressed to CAB 5 within the same session. During the following sessions on CAB 5, Lynn emitted the cFCR an average of 10 times per session (range 7–11) and the TR an average of 7 times per session (range 5–8). Lastly, while on the last step of CAB 6, Lynn emitted the cFCR an average of 11 times per session (range 10–13) and the TR an average of 7 times per session (range 6–9).

Figure 3 also displays percentage of trials correct across sessions within each CAB. Across all CAB 1 sessions, Lynn responded correctly on an average of 52% of trials (range 31%–73%). Across all CAB 2 sessions, Lynn responded correctly on an average of 66% of trials (range 40%–80%). Across all CAB 3 sessions, Lynn responded correctly on an average of 78% of trials (range 68%–90%). During the single CAB 4 session, Lynn responded correctly on 92% trials. Up until CAB 5, mean percent correct had a consistently upward trend. When CAB 5 was introduced, mean percent correct across sessions decreased slightly to an average of 87% (range, 70%–100%) of trials. Across all CAB 6 sessions, Lynn responded correctly on an average of 75% of trials (range 60%–82%).

3.3 | Social validity

Results from the social validity questionnaire indicated that both of Lynn's teachers were satisfied with the treatment and its effects and would recommend this treatment to other teachers. Both respondents reported that they felt the treatment was not only effective at improving Lynn's behavior and communication, but also was minimally disruptive and safe to implement within the classroom setting. Respondent 1's answers averaged a score of 4.56 on the 5- point Likert scale (5 being the most positive rating of the treatment overall). Respondent 2's answers averaged a score of 4.89 on the 5- point Likert scale. The overall social validity score from both respondents averaged 4.73 out of 5.

4 | DISCUSSION

The purpose of the present study was to determine if SBT informed by the IISCA could be implemented in its entirety safely within a classroom, be used to fade noncontingent reinforcement, and gradually reintroduce academic instruction to an adolescent student with autism after a prolonged break from school. After 25 treatment sessions, Lynn was able to consistently relinquish her iPad and achieve a level of functional communication and compliance with academic tasks that allowed her to function within the classroom routine. This assessment and treatment were successfully implemented in its entirety within the classroom setting. The treatment was designed based on differentiated results from the IISCA which, in 17 min, was used successfully to determine that Lynn's problem behavior was controlled by multiple contingencies, including tangible and escape. One reason for the successful implementation within the classroom setting may be the low risk of dangerous problem behavior associated with the IISCA due to the reinforcement of precursor behaviors before the participant is given the opportunity to engage in a more severe problem behavior (Slaton et al., 2017). In fact, for the current study, zero instances of dangerous problem behavior were observed during the IISCA. Only precursor behaviors were observed and reinforced, making the assessment safe enough to implement within the classroom setting.

Problem behavior and precursor behavior during test conditions within the IISCA were used as a baseline to compare to levels of behavior during intervention. Unlike previous studies that implemented SBT (e.g., Hanley et al., 2014), problem behavior was not completely eliminated by the end of treatment. Although more dangerous problem behavior (R1) occurred during treatment than during baseline, R1s were stable at a rate of 0 by the end of treatment. In addition, while precursor behaviors (R2) were not completely eliminated by the end of treatment, rate of R2s were reduced compared

FIGURE 3 Skill-based treatment evaluation for Lynn. Results of Lynn's skill-based treatment evaluation. BL refers to baseline. FCR refers to functional communication response. Arrows indicate simple and complex FCR's. Contextually appropriate behaviors (CAB's) 1–6 refer to the different steps of contextually appropriate behavior. An asterisk refers to progressing to the next step within a session.

to baseline. Although safety and prevention of dangerous problem behavior was a high priority throughout treatment, there is a potential explanation as to why some more severe behavior was observed. First, many of the targeted behaviors displayed throughout the treatment sessions are believed to be a product of extinction bursts. Specifically, prior to the IISCA and treatment, Lynn never needed to engage in problem behavior to receive what she wanted because she always had access to the iPad and was never asked to relinquish it. Similarly, during the IISCA, even when the iPad was relinquished, she did not need to engage in problem behavior because precursor behavior was always reinforced. During treatment, however, all problem behavior and precursor behavior were placed on extinction. Therefore, there were some instances when precursor behavior was displayed, however, the demand remained in place and Lynn escalated to more severe behavior. Extinction bursts were often observed during the introduction of a new step. This is most likely because when a new step was introduced, a new expectation was in place and therefore more response effort, and sometimes a new response altogether, was required of Lynn. For example, the first time CAB 2 was introduced in session 10 (participant was instructed to sit down at her desk), Lynn engaged in five instances of problem behavior and 21 instances of precursor behavior. Because of the level of problem behavior that occurred and extent of prompting needed to achieve compliance with the demand, CAB 1 and CAB 2 were broken down into smaller, more achievable steps. These adjustments, conducted in a controlled way, were deemed to be necessary to maintain safety within the classroom and to be in the best interest of Lynn to allow for continued progression of treatment.

In addition to modifications within treatment, the outside of session procedure was introduced throughout Lynn's day to help her progress. The decision to implement this outside of session procedure came after a session during which 71 instances of precursor behavior were observed. The repetitive vocalizations observed within the session appeared to be a result of pairing the instructor with aversive conditions such as initiating task demands and removing the iPad. This may have increased the likelihood that Lynn's relationship with the instructor was poor and therefore, interfered with the success of treatment. In addition, the frequent display of precursor behaviors also negatively impacted Lynn's ability to meet criteria for progressing through the steps. Therefore, it was deemed necessary to generalize the expectation of relinquishing the iPad across the school day and with other staff. A reduction and stabilization of precursor behavior did occur shortly after this procedure was implemented, however, the change in behavior cannot completely be attributed to the outside of session procedure because the change in precursor behavior (R2) definition also occurred around the same time. It cannot be determined if either modification independently or combination of both were the cause of the subsequent change in behavior. This is a limitation discussed further.

With the support of these procedural modifications, Lynn's performance progressed throughout treatment and she maintained previously learned skills. Lynn ultimately progressed to and mastered the last step of treatment which required functional communication, tolerating denial of requests, relinquishing her iPad when instructed, tolerating not having access to her iPad for unpredicted durations, and complying with challenging academic tasks for extended periods of time. Prior to treatment, it was reported by staff that Lynn was unable to relinquish her iPad without engaging in problem behavior. After treatment, Lynn worked during a session for up to 11 min and 41 s without her iPad. Although, there is no quantitative data to measure the progress of the outside of session procedure, the classroom staff anecdotally reported that outside of sessions, Lynn was able to work upwards of 15 min without her iPad. The classroom staff who observed these results out of session were the same staff who gave positive reports of the overall process and results.

Although the treatment yielded positive outcomes in both participant performance and social validity, the study had several limitations. First, the definition for a precursor behavior was changed in the middle of the intervention. The reason for this was because during session 7, Lynn engaged in repetitive vocalizations, which were previously counted as a precursor behavior, 71 times. Upon review of this session, it was proposed that certain phrases that were currently being counted as precursor behavior more closely resembled scripting behavior rather than a precursor to problem behavior. These phrases being miscounted as precursor behavior was preventing Lynn from meeting criteria and progressing through the steps. After a few more sessions of closely monitoring these behaviors and their topography, it was determined not all instances of repetitive vocalizations were true precursor behaviors. Instead, a precursor behavior could be distinguished from scripting behavior if the phrase was paired with an "angry face" (i.e., gritting teeth, clenching jaw, and furrowed eyebrows). The definition was changed accordingly and, as seen in

Figure 2, a subsequent reduction and stabilization of precursor behavior was observed. However, that data prior to the definition change was not and could not be adjusted to reflect precursor behavior that only applied to the new definition and may include some instances of scripting behavior. Therefore, the R2 data prior to the phase line in Figure 2 may not be completely representative of the true level of precursor behavior that occurred during that time.

A second limitation is related to the inconsistent rate of presentation of the EO each session. While every session was the same length (1 h), the number of trials presented each session varied based on a few factors. First, sessions further into the treatment process included less trials because each trial took longer to complete. For example, during the step where only the cFCR was required, each trial took a few seconds to complete, whereas, during CAB 6, one trial could take as long as 10 min depending on how much work was required to be completed. Second, the length of the intertrial period sometimes varied. During every intertrial period, the instructor allowed Lynn to be HRE for at least 30 s, however, sometimes the instructor allowed longer. Specifically, if Lynn was engaging in precursor behavior during the intertrial period, the instructor would wait for Lynn to be HRE (no problem or precursor behavior) for at least 30 s before presenting the next trial. These factors contributed to an inconsistent number of trials and timing of trial presentation each session. This inconsistency can be reflected in the frequency of cFCRs and TRs, as some sessions did not have as many opportunities to engage in these communicative responses as others.

Another limitation was the absence of "time without iPad" as a dependent variable. Specifically, there was no official baseline measure for how long Lynn could tolerate without her iPad (anecdotally, baseline was 0 s). There was also no consistent measure during intervention for how long Lynn could tolerate not having her iPad. In later CAB sessions, the length of which Lynn completed academic tasks was timed, however, this was not consistently recorded. If this had been established as a dependent variable from the beginning, this could have been the most comprehensive representation of Lynn's progress throughout treatment in terms of her biggest obstacle, relinquishing the iPad. It could have shown the gradual increase in amount of time as treatment progressed.

Given these limitations, further research is necessary to improve upon and extend the findings of this study. Future research should examine this treatment process using more participants of varying demographics and explore the implementation of treatment in different settings. While previous research has shown the effectiveness of SBT informed by the IISCA in a clinical setting (Ferguson et al., 2020; Hanley et al., 2014), the current study added to limited research (Santiago et al., 2016) on the use of this process within a classroom setting. Results from the current study showed that, despite distractions within a classroom environment, the control necessary to implement assessment and intervention is still possible. However, more research is needed to further examine the feasibility, safety, and efficacy of implementing treatment in this setting versus a more controlled clinical setting. In addition, replication of the current study should focus on maintenance and generalization of treatment effects outside of treatment sessions. Teachers did anecdotally report to the researcher that Lynn continued to be able to participate in the classroom routine without her iPad. However, future research on this topic should focus on identifying if maintenance and generalization effects are maximized by the implementation of treatment in the natural setting. In addition, future researchers should assess the capacity of such treatment being conducted and/or generalized within the home. Lastly, future researchers should further examine the use of IISCA and SBT for the novel purpose introduced by this study. While previous research has implemented SBT for the purpose of behavior reduction, the primary purpose of intervention for the current study was to address loss of skills and gradually reintroduce academic instruction to a student who had been used to noncontingent reinforcement and minimal expectations for an extended period. Exploring the use of this process for this purpose can expand the applicability of SBT for so many students and offer a new tool for schools to use to address this evolving issue.

thesis submitted by the first author, under the supervision of the second author, to the Department of Behavioral Science at Daemen University for the Master of Science in Applied Behavior Analysis.

CONFLICT OF INTEREST STATEMENT

We have no known conflict of interest to disclose.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions. Deidentified data may be made available upon request after review by the covered educational entity under FERPA. Due to confidentiality guidelines, however, data will not be made available otherwise.

ETHICS STATEMENT

The research proposal was approved through the Institutional Review Board at Daemen University.

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