The Journal of Special Education Apprenticeship

Volume 14 | Number 1 Article 6

3-2025

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Recommended Citation

Marelle, C., Donehower, C., Hansen, S., Roach, A., Boden, L., & Tanner, E. (2025). Using Virtual Reality to Train Teacher Candidates in Classroom Management. *The Journal of Special Education Apprenticeship, 14*(1). https://doi.org/10.58729/2167-3454.1215

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THE JOURNAL OF SPECIAL EDUCATION APPRENTICESHIP
March 2025, Vol.14, No. 1.
ISSN 2167-3454

Using Virtual Reality to Train Teacher Candidates in Classroom Management

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ABSTRACT

This study used a multiple baseline across behaviors design to analyze the effects of didactic training plus simulated rehearsal and feedback on a preservice teacher's implementation of behavior management skills (i.e., opportunities to respond, behavior specific praise, token reward system) with students with autism spectrum disorders (ASD). Results indicate a functional relation between the intervention package and increased teacher performance across all three behavior management skills. Participants reported positive perceptions and experiences of the use of simulated classroom environments like TeachLivE™ as a training component. Implications for future research and practice are provided.

KEYWORDS

simulation technology, teacher candidates, special education teachers, teacher preparation, classroom management, behavior management

ARTICLE HISTORY

Received June 30, 2024
Revised January 15, 2025
Accepted March 13, 2025

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School districts across the country are struggling to hire and retain highly qualified special education teachers (Cowan et al., 2016; Mason-Williams et al., 2020). Across the United States, 49 states have reported shortages of special education teachers (National Coalition on Personnel Shortages in Special Education and Related Services, 2016). Since the passing of the Individuals with Disabilities Education Act (IDEA), the demand for special education teachers has consistently exceeded the supply (McLeskey & Billingsley, 2008). In fact, about 13% of special education teachers leave the field every year and another 20% change to general education, which results in a 33% rate of attrition (Brownell et al., 2018). When asked the reason for leaving the field of teaching special education,

behavior management is frequently cited as the most challenging area of teaching and a major contributor to special education teachers' decision to leave (Sciuchett, 2019; Shernoff et al., 2016). In a survey of 38 special education and 32 general education teachers, challenging behavior was reported as having an adverse effect on both teachers and their students (Westling, 2009). Often, the students demonstrating challenging behavior have some form of diagnosed disability such as autism spectrum disorder.

Autism Spectrum Disorders and Off-Tasks Behaviors

Autism Spectrum Disorder (ASD) is a developmental disability that is characterized by social communication deficits and restricted and repetitive behaviors and interests and can include significant challenges in behavior (CDC, 2020a). According to the most recent statistics published by the Centers for Disease Control (CDC, 2024), 1 in 36 children have been identified with ASD. With this increase in prevalence of ASD, there is an increased demand for teachers who have appropriate training to manage the behavioral challenges that the students with ASD may display in the classroom environment (National Center for Education Statistics, 2013). Behaviors of students with ASD can vary widely depending on the individual but can include aggression, self-injury, non-compliance, off-task, outbursts, tantrums, etc. (CDC, 2020; Munson et al., 2008; Sullivan & Bradshaw, 2012). If not managed appropriately, these behaviors can lead to disruptions in the classroom environment and student learning. To meet this need, preservice teacher training opportunities often focus on behavior management strategies that emphasize increasing desired behaviors such as opportunities to respond (OTRs), behavior specific praise (BSP), and token reward systems (TRS).

Opportunities to Respond (OTRs)

An OTR is an instructional strategy that promotes student engagement and can be provided across a variety of instructional approaches (Haydon et al., 2012). More specifically, OTRs include any teacher-delivered academic related question (e.g., question, demand, request) that gives the student an opportunity to engage in various ways (e.g., verbal response, gesture; Ferkis et al., 1997). Furthermore, an increase in OTRs can lead to increases in academic engagement and decreases in disruptive behavior (Bolt et al., 2019; Menzies et al., 2016). Additionally, implementing OTRs is a straightforward strategy that teachers can incorporate into their teaching practices to promote positive student outcomes (MacSugar-Gage and Simonsen (2015). Following a quantitative synthesis of single-case design research in this area, Fitzgerald Leahy et al. (2018) found a functional relation between increasing OTRs and improved student behavioral outcomes. According to MacSugar-Gage and Simonsen (2015), the recommended rate of OTRs should be 2.0 to 5.0 per minute. The impact of implementing a high rate of OTRs is significant, especially considering the minimal planning required by a teacher to implement this strategy. The delivery of an OTR followed by a student response also sets the stage for the second classroom management strategy, behavior specific praise (BSP).

Behavior Specific Praise (BSP)

Similar to OTRs, BSP is another simple behavior management strategy that takes very little preplanning for teachers. By definition, BSP is a positive statement directed towards a student

that acknowledges a desired behavior using specific, observable, and measurable language (The IRIS Center, 2013). Contrary to general praise, BSP includes the precise behavior exhibited and how it met the teacher's expectations (Kennedy & Jolivette, 2008). For example, a teacher might say, 'Great job raising your hand and waiting for your turn to speak, this shows respect for our peers!" In addition, BSP should be sincere, so students are more likely to find the statement reinforcing; therefore, the desired behavior is likely to reoccur (Lane et al., 2015). Behavior specific praise has been used to increase appropriate behaviors for students with disabilities (Royer et al., 2019; Downs et al., 2019). Rathel et al. (2014) demonstrated an increase in engagement with the use of BSP in special education classrooms. Behavior specific praise has also been used to increase on-task behavior (Sutherland et al., 2002) and decrease disruptive behaviors (Dufrene et al., 2014). Furthermore, Donehower and colleagues (2020) found in their study that identified teaching skills to target to maximize the impact of simulation-based professional development. The study confirmed that giving students positive feedback was one of the top ten skills for effective teachers to possess and appropriate to target using simulation.

Token Reward System (TRS)

Another behavior management technique that can be implemented by teachers in the classroom is a token reward system (TRS). Although TRS requires more preparation than OTR and BSP, it is still a relatively simple behavior management strategy for teachers to implement. The preparation for teachers involves creating the tokens that will be delivered and acquiring individualized reinforcers that the student can access when they earn tokens. Token reward systems emphasize the use of positive reinforcement to target behavior change by helping students visualize progress, work for delayed reinforcement, learn to self-monitor, and learn to regulate behavior (Stainbrook et al., 2015). When a TRS is in place, the student earns tokens directly from the teacher for demonstrating a desired behavior (Alberto & Troutman, 2017), then the student is provided the opportunity to use those tokens to purchase reinforcers specific to their interests (Soares et al., 2016). Token reward systems have been used to increase desired behaviors and decrease challenging behaviors of students with disabilities (Carnett et al., 2014; Yeen & Nordin, 2024).

Teacher Candidate Training for Classroom Management

Pre-service teachers of students with ASD require a deep understanding of the unique behavioral challenges that many students with ASD experience and the teaching strategies required to support those needs (Scheuermann, 2003). Unfortunately, many teacher candidates do not receive formal preparation to effectively manage challenging behaviors in their classrooms (Freeman et al., 2014). Teachers report that they learned how to deal with "most" challenging behaviors but did not perceive their professional preparation to be adequate to successfully intervene on all challenging behaviors (Westling, 2009). Without acceptable classroom management training as part of teacher preparation programs, new teachers may use ineffective methods of behavior management which can lead to reduced job satisfaction (Brunsting et al., 2014). Oftentimes, teacher candidates' only opportunity to apply behavior management strategies is in the one or two practicum experiences and a student teaching placement, which may not be enough to acquire and master these skills (Mamlin, 2012). Pre-service teachers of students with ASD require and deserve the opportunity to apply behavior management skills in a

training environment that is safe and allows for supportive performance feedback before attempting to apply these strategies in a classroom or on the job for the first time.

Using Mixed Reality for Teacher Development

Mixed reality environments could provide the opportunity for teacher candidates to apply their behavior management skills prior to stepping into a classroom setting. Mixed reality is a medium in which real and synthetic content are blended (Hughes et al., 2005). This technology allows teacher candidates to practice applying evidence-based practices in specially designed classroom scenarios that include customizable avatar students. More specifically, TeachLivE^{TM} (TLE), a mixed-reality classroom environment allows for the development of teachers' classroom management and instructional skills (ITLL, 2019). TLE utilizes virtual puppetry that targets the performance of preservice and in-service teachers (Dieker et al., 2014). This program was created at the University of Central Florida in 2005 through a collaborative effort to explore the use of blended human and avatar interactions on the development of teacher practice (Dieker et al., 2014). TLE is different from other simulation programs because it is synchronous, meaning interactors are combined with technology and artificial intelligence to provide a unique interactive experience. The fact that there are human interactors in every session allows the avatar students to behave and react to the teacher just as real-life students would respond in a real-life classroom (Dieker et al., 2014).

TLE can provide participants with an opportunity to practice teaching skills with no adverse effect on real students for poor performance (Dieker et al., 2014). Ersozlu and colleagues' (2021) analysis of the current research on TLE highlighted that using this technology with in-service teachers in school-based contexts is beginning to emerge as a new area of interest. Ersozlu and colleagues' results also demonstrate how technology can move from simply being used "in the classroom" to actually serving "as the classroom." For example, Kelly and Wenzel (2019) used TLE to improve teacher candidates' parent conferencing skills by allowing the participants to conduct practice parent-teacher conferences and receive observational feedback. Vince and colleagues (2016) used individualized clinical coaching in the TLE rehearsal environment to successfully increase teachers' fidelity in implementing a system of least-to-most prompts. Judge and colleagues (2013) used TLE to investigate teacher candidates' use of behavior management skills. The results demonstrated that a majority of the teacher candidate participants were able to increase the use of the behavior management strategies. Peterson-Ahmad (2018) used TeachLivE to train teachers in providing OTRs in the simulator classroom. The mixed results of this study resulted in an increase in 50% (n = 4) of the participants' rate of OTR per minute. Another study used TLE combined with professional development and coaching to train special education teachers in classroom management skills, which resulted in a decrease in challenging behaviors among students with ASD (Pas et al., 2016). It is also important to note that generalization is often left out of research surrounding the use of simulation technology to train teachers in classroom management skills. Dawson & Lignugaris/Kraft (2017) used a weekly generalization measure to track participants use of BSP and other skills into their classroom following simulation training sessions. Other studies to include a generalization measure of classroom management skills trained using simulation technology were Pas et al., (2016) and Shernoff et al., (2021).

Statement of Purpose

The purpose of this study was to explore the impact that a training package (i.e., didactic training plus TLE rehearsal sessions) had on pre-service teachers' implementation of three classroom management skills. The following research questions were addressed by this study:

1. To what extent does didactic training plus TLE rehearsal sessions increase the teacher implementation performance for three behavior management strategies (i.e., OTRs, BSP, and TRS) in teacher candidates working with students with ASD in the classroom?
2. To what extent do teacher candidates find the goals, procedures, and outcomes of using TLE as a training component for behavior management skills socially important and acceptable?

Methods

Participants

Following IRB approval, participants for this study were recruited through their student teaching placement assignments with a university in an urban setting. Four student teacher candidates consented to participating in the study (see Table 1) because their placements were in elementary special education classrooms that served eight to ten students with ASD. Student teachers completing their placement in other settings did not meet the inclusion criteria for this study. At the start of the study, the participants were providing a low rate (less than 2.0 per minute) of opportunities to respond. BSP and TRS are connected to OTRs; therefore, the inclusion criteria are based on the participant performance of OTR. Participants were excluded in this study if they were already implementing a token reward system unless they were implementing with low fidelity (50% or less tokens appropriately delivered) and accuracy (40% or less of the trained TRS steps performed correctly). All four participants were serving as the teacher of record for their classroom under a provisional license. Pseudonyms were assigned to each participant to maintain the anonymity of participants.

Ryder was a 37-year-old female majoring in Special Education - Adapted Curriculum who was completing her final student teaching placement. Her highest level of education was a bachelor's degree. This was her first year as the teacher of record for her ASD self-contained classroom for 3rd through 5th grade students. Prior to being teacher of record, she served as a paraprofessional in the same classroom for three years, a paraprofessional in a K to 5th moderate/severe self-contained classroom for two years, and an RBT at an ABA clinic for one year. On a pre-study questionnaire, she reported that her previous classroom management training experience included online modules and an intro to ABA course through the university.

Cindy was a 51-year-old female receiving her teaching certificate in Special Education - General Curriculum. Her highest level of education was a master's degree of education. She reported that she has been teaching for over two years. Previously, she taught middle school English language arts to 6th and 7th graders in general education. She reported that her classroom management training experience included an introduction to ABA course through the university as well as behavior management training from an autism specialist through her school district.

Table 1. ***Participant Demographics***

Participant	Role	Age	Years of teaching experience	Highest level of education	Classroom grade	Observed subject	Initial OTRs	Initial TRS
Ryder	Teacher of record	37	2	Bachelor's Degree	3rd-5th	Review	1.2	No
Cindy	Teacher of record	51	2+	Master's Degree	2nd	Math	1.2	Individual token board
Mary	Teacher of record	55	1	Master of Science in Public Health	4th and 5th	Math	1.6	No
Brookelynn	Teacher of record	25	1	Bachelor's Degree	3rd & 4th	Math	1.3	No

Mary was a 55-year-old female receiving her Master of Arts in Teaching (MAT) in Special Education. Her highest level of education was a Master of Science in Public Health. At the time of the study, she was serving as the teacher of record for her ASD level 3 classroom for 4th and 5th graders. Prior to serving as the teacher of record, she served as a professional in a Moderate Intellectual Disabilities (MOID) classroom for 3rd to 5th grade students. Her previous classroom management training experience included a classroom management course with the university and best practices course for students in low incidence programs through her school district.

Brookelynn was a 25-year-old female who was working on her MAT in Special Education - General Curriculum. Her highest level of education was a bachelor's degree. For this study, she was serving her first year as the teacher of record for a 3rd and 4th grade ASD level three classroom which is a self-contained classroom serving students who have a diagnosis of a mild/moderate level of ASD. Prior to this position, she had experience working previously in an ABA clinic. Her previous classroom management experience also included courses taken as part of her university program.

Setting

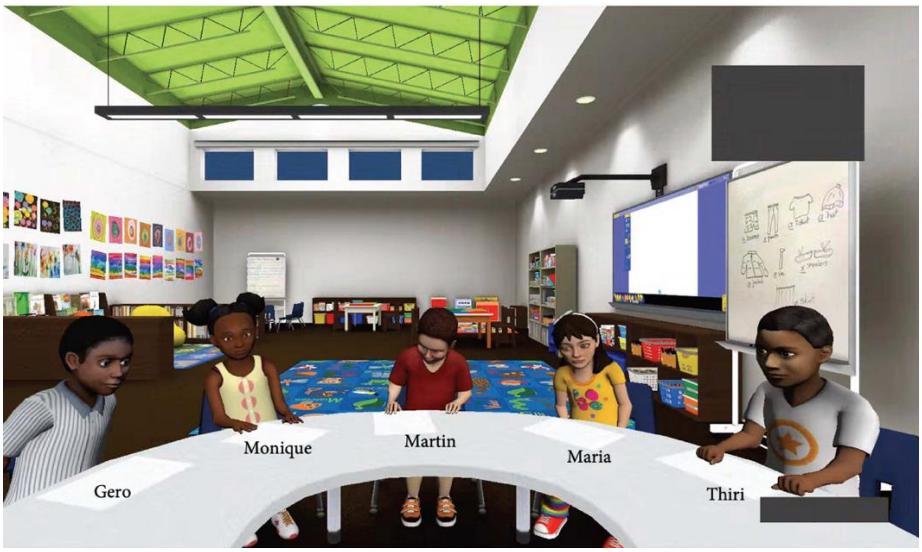
This study had multiple settings including the training environment and classroom environments. The didactic training sessions occurred via WebEx, a virtual meeting platform provided to students and faculty through the university. The TLE sessions were conducted via Zoom in the Interactive Teaching and Learning Lab (ITLL) at the university. An "interactor" from the University of Central Florida played the role of the elementary school students and was connected to the session via zoom. The interactor was provided with a scenario so that they could interact in a way to maximize practice opportunities for the participants. The behaviors of the students occurred in real time although a few behaviors were preplanned and could be

triggered automatically. All data collection for baseline and post intervention sessions took place in the participants' assigned classrooms during the same small group lesson at the same time every day for each observation. During these sessions, the participants were providing instruction to a small group (2-5) of students. These observations were completed virtually via WebEx.

Materials

The training package included a didactic presentation, technology in the form of simulated practice sessions, and performance feedback/coaching. The format for this training package was based on the suggestions of Marelle & Donehower Paul (2022). Marelle and Donehower Paul (2022), made a recommendation of four components that should be included when building a professional development package.

Figure 1. ***TeachLivE™***



TLE is a mixed-reality teaching environment that allows the student avatars' behavior and interactions to be controlled and customizable. Participants can rehearse behavior management skills with a virtual classroom of students and then receive direct coaching and feedback from a supervisor. By participating in two back-to-back rehearsal attempts, the participants in this study were able to promptly implement the feedback from the supervisor. Figure 1 shows the seating chart for an elementary school TLE session and the view that the participants had when they entered the virtual classroom.

Didactic Presentation

A PowerPoint presentation was reviewed during each didactic training session for a total of three different presentations (i.e., OTRs, BSP, TRS). The PowerPoints included direct instruction of the rationale and implementation procedures, modeling with examples and non-examples, practice opportunities to identify examples and non-examples, a post training assessment, and feedback. If the participant was unable to appropriately answer the post training assessment, then

the didactic presentation was repeated and then assessed again. An electronic copy of each presentation was provided to each participant.

Token Reward System Materials

Materials for the TRS included multicolored "dollars" that were delivered as tokens. The students were not limited in the number of "dollars" they could earn; therefore, the students were expected to be provided with a "dollar" for every appropriate response. As part of the TRS, the students used their earned "dollars" to purchase items from the "market." The participants were provided with enough reward items to supply the market for their students. These items were selected based on information gathered about student preferences as recommended by the teacher candidate prior to the study. These items included but are not limited to bubbles, fidgets, pencils, stamps, stickers, etc. The participants were also provided with labeled boxes to store the "market" items based on the dollar value for each prize. For example, pencils were worth five dollars so they would be stored in the box labeled "$5."

Research Design

This study used a single case research design. Since the purpose of this study was to examine the effects of a didactic training coupled with TLE rehearsal on teacher performance for three target behaviors, the design of this study was a multiple baseline across behaviors which was replicated across four participants.

Independent Variables

Didactic Training

The didactic training sessions were 15-30 minutes in duration. The participants attended one didactic training session for each of the three targeted classroom management skills (i.e., OTRs, BSP, TRS). The didactic training sessions always occurred immediately before the TLE rehearsal sessions. Each didactic session was conducted via WebEx and included a PowerPoint as described above.

TeachLive™ Rehearsal Sessions

Following each didactic training session, the participants completed a TLE rehearsal session. The sessions included two 10-minute practice attempts in the TLE simulator. Each session started off with a 5-minute introduction to give the participant a chance to acclimate to the simulator. Then the participant completed the first of the two rehearsal attempts while the PI recorded data on implementation performance. In the rehearsal session, the participant taught a short lesson using a children's book of their choice. The same book could be used across all rehearsal sessions. Following the first 10-minute attempt, the participant received 5 minutes of performance feedback from the PI. This process was repeated for another 10-minute attempt and 5 minutes of feedback. Participants were also provided an opportunity to ask any further questions before the end of the session.

Dependent Variables

Opportunities to Respond

A single OTR occurred when a teacher participant presented an inquiry (e.g., asking a question) or provided a direction that required a student to produce an observable action (e.g., a verbal or written response; Simonsen & Myers, 2015). For the purpose of this study, an OTR is any occurrence of the teacher providing an opportunity to respond either verbally, written, or physically to a question or the delivery of a direction. This does not include any follow-up prompts that a teacher would provide for a student who is not responding. An appropriate example of a single OTR consisted of a teacher asking a student to answer a question independently or as part of a small group. If the student or students did not respond and the teacher used a follow-up response prompt as the first OTR that would be counted as one OTR. For example, the teacher asks a student to name a character in the story and, when the student does not respond, she then asks the student to tell her one person in the story or uses a gestural prompt by pointing to a character in the story. This exchange would be counted as one OTR. Conversely, if the teacher modifies the original OTR in the follow-up prompt by expecting a different and unique response then this would be counted as two separate OTRs. For example, the teacher asks the student to name a character in the story and the student does initially respond, so the teacher asks the student to give the title of the story. A single OTR included a request for a verbal response, gesture, choral response, or physical response appropriate to the OTR or direction. Participants were told to target 2.0 to 5.0 OTRs per minute. This criterion will be included in the didactic training but if participants are outside of the criteria of OTRs per minute during the rehearsal then feedback and coaching will be provided and will redo the rehearsal session.

Behavior Specific Praise

Behavior specific praise (BSP) was defined as any occurrence of the teacher providing a student or group of students with positive, verbal feedback that is specific to a display of appropriate behavior. The appropriate delivery of BSP was tracked as well as any missed opportunities or errors. An example of appropriate delivery of BSP was if a student responds to a question by raising their hand and answering when called upon, the teacher could use BSP by saying “Great job raising your hand to answer the question!” Missed opportunities or errors included the absence of a praise statement or delivery of a general praise statement. For example, a teacher asked a question, a student responded after being called upon, and the teacher replied with only “That’s right!”. Behavior specific praise did not have to be connected to an OTR and was counted as appropriately delivered if it was used freely during data collection. For example, the teacher said “Group, I love how you all are sitting quietly!”, which counts as a single occurrence of BSP.

Token Reward System

A token reward system (TRS) is defined as the teacher responding to an appropriate behavior by delivering a token within five seconds of the student engaging in that behavior. Token reward system was tracked by appropriate delivery and missed opportunities/errors. One example of

appropriate delivery would be if a student responds to a question by raising their hand and waiting to be called on before answering, the participant will deliver a token by handing it to him or her or placing it on the table in front of them. On the contrary, a missed opportunity/error would be anytime the participant fails to deliver a token for a desired behavior, delivers a token for a non-target behavior, delivers a token for no reason, or removes a token. The delivery of a token did not have to be related to a BSP statement to be counted as appropriately delivered. A token could also be delivered freely for any appropriate behavior as the teacher deemed necessary.

Data Analysis

Data were collected across all conditions (baseline, rehearsal, and intervention) for every target behavior. Data for OTR was collected by completing a frequency count and then converting it to rate per minute. For BSP and TRS, data were collected for both appropriate delivery and missed opportunities/errors. Therefore, data were collected for appropriate BSP, missed/ error BSP, appropriate TRS, and missed/ error TRS. The data for BSP and TRS was collected as a frequency count during each session and converted into rate per minute. A traditional single-case visual analysis was conducted to interpret the results of the study.

Social Validity

Social validity data were collected by two methods. First, the Treatment Acceptability Rating Form-Revised (TARF-R; Reimers & Wacker, 1988) was completed by all participants at the end of the study. Second, a sustained use social validity measure was conducted two weeks after the wrap up of the intervention data collection. The PI observed the participants in the same setting and used the same data collection methods to assess whether participants were still implementing the target behavior management skills.

Generalization

Following the final training session, the participants were observed in a setting different from the original small group data collection setting using the same data sheets. This new setting could include a whole group lesson, small group lesson on a different subject, or a lesson being taught to other students not included in the data collection small group. During this observation, the PI used the same data collection methods. This provided the PI with data regarding the generalization of the behavior management skills.

Reliability

Fidelity of intervention.

The fidelity of intervention for both the didactic training and TLE rehearsal sessions were tracked via an implementation rubric. The rubric was completed by a secondary data collector for one-third of the training sessions. A fidelity checklist for the performance feedback provided following each rehearsal session was also used. The secondary data collector was trained using a training developed using the BST format which included direct instruction, modeling, practice,

and feedback. Acceptable fidelity per session is 90% or higher. Procedural fidelity was 99% across all four training sessions.

Inter Observer Agreement.

A secondary data collector was trained to collect interobserver agreement (IOA) data prior to the start of the study. The training was designed using the BST format which included direct instruction on the operational definitions of each dependent variable, modeling of data collection, data collection practice, and performance feedback. The data collector then scored 36% (n = 28) of the baseline and intervention data collection sessions. Interobserver agreement (IOA) was calculated by dividing agreements by agreements plus disagreements then multiplying by 100 to convert to percentage. Acceptable IOA per session is 90% overall and 85% per behavior. For session 12 for Ryder, the IOA for OTRs scored 82%, which was below the 85% threshold; therefore, the data collectors conducted a meeting to discuss discrepancies. Following the meeting, the data collector was retrained and coded independently to ensure reliability. In total IOA was 96%.

Visual Analysis

Visual analysis was used to determine the appropriate time to change from the baseline condition to the training intervention for each participant across the behaviors. The visual analysis included an assessment of level, trend, variability, and immediacy of effect between conditions to determine if the intervention training caused an increase or decrease in the level and trend of the data. To meet the standard for What Works Clearinghouse (WWC), a multiple baseline design must have a minimum of six phases with at least five data points per phase.

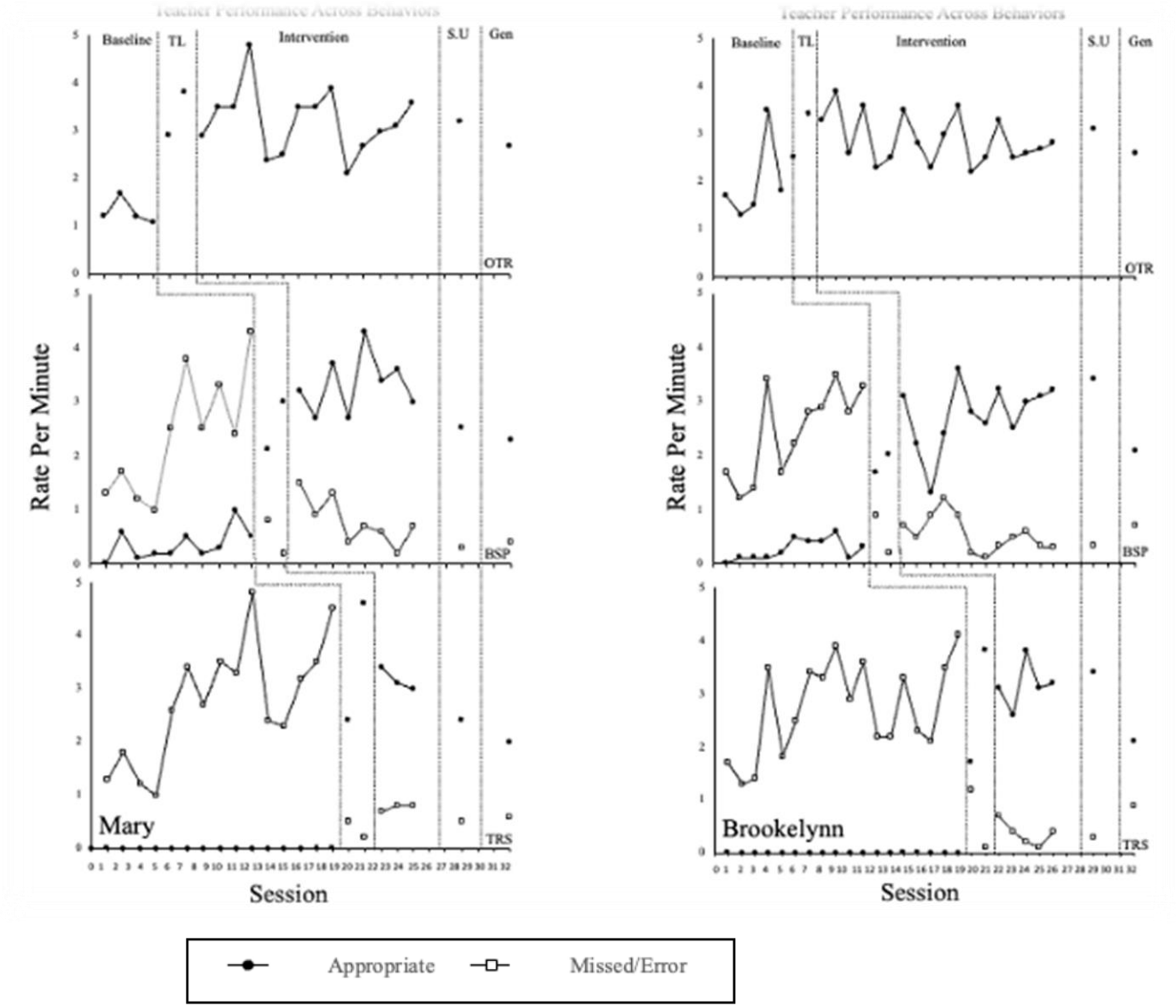
Effect Size

An effect size was calculated using the Tau-U which combines non-overlap between phases with intervention phase trend and can correct for a baseline trend (Parker et al., 2011). The Tau-U was calculated using an online calculator for single case design research (Vannest et al., 2016).

Results

Figure 2 displays the results of each teacher participant's performance across behaviors. For each graph, the x-axis represents the session number, and the y-axis represents the rate per minute. The top graph is the rate of opportunities to respond, the middle graph is behavior specific praise, and the bottom graph is implementation of the token reward system. For BSP and TRS, the closed circles represent appropriate delivery, and the open squares represent missed opportunities or errors.

Figure 2. *Teacher Performance Across Behaviors*



Ryder

For OTRs, Ryder provided a median of 1.65 OTRs (range 1.2 – 1.7) per minute in baseline. The OTR baseline data were stable with a narrow range that spanned less than 0.5 OTRs per minute across sessions. During training for OTRs, she delivered 3.13 and 4.1 OTRs per minute. Following training, she delivered a median of 3.5 (range 2.4 – 4.8) OTRs per minute. There was an abrupt increase in level from baseline to the post training condition for OTRs. It is important to note that Ryder was able to provide 3.4 and 4.0 OTRs during the second training session in the simulator (session 11 and 12) and 3.4 and 3.6 during the third training session (session 20 and 21). A positive effect size of 1 was calculated for OTR.

Baseline for BSP was variable for missed opportunities and showed a high level of missed opportunities/errors. Baseline for BSP appropriate deliveries were relatively stable and at a low level. In baseline, she appropriately delivered a median of 0.5 BSP statements (range 0.2 – 1.0) per minute and missed or delivered in error a median of 2.5 (range 1.0 – 3.9) BSP statements per minute. During the second two training simulation sessions which was specifically dedicated to BSP she appropriately delivered 3.4 and 4.0 BSP statements per minute and missed or delivered in error 0.3 and 0.2 BSP statements per minute. Following the training sessions, the participant was able to deliver a median of 3.3 (range 2.7 – 4.3) BSP statements appropriately and missed or delivered in error a median of 0.45 (range 0.1 – 3.0) BSP statements. During the third simulation training session, she appropriately delivered 3.6 and 4.3 BSP statements and missed or delivered in error 0.3 BSP statements per minute for both sessions. The level for BSP appropriately delivered increased while the level for missed opportunities or errors decreased. The trends in the data collected after the BSP training session were more variable with missed opportunities happening more than appropriate deliveries in session 18. For appropriately delivered BSP the effect size was 0.7 and for missed opportunities or BSP statements delivered in error the effect size was 1.

The level for missed opportunities for token delivery was high in baseline and the level for appropriate delivery was low. More specifically, in baseline, Ryder was able to appropriately deliver 0 tokens across all sessions and missed or delivered in error a median of 3.13 tokens (range 1.2 – 5.0). During the final training session, which was specific to TRS, Ryder was able to appropriately deliver 2.8 and 3.9 (sessions 20 and 21) and missed or delivered in error 0.8 and 0.4 tokens. Following the final training session, there was an abrupt change in level with Ryder appropriately delivering a median of 3.1 (range 2.7 – 3.6) and missed or delivering in error a median of 0.6 (range 0.4 – 1.6) tokens. The level of tokens delivered appropriately increased from baseline to post training and stayed relatively stable during post training. The level for missed opportunities or tokens delivered in error decreased from baseline and remained relatively stable post training. The effect size for both TRS delivered appropriately, and missed/error was 1.

Cindy

In baseline for OTRs, Cindy provided a median of 1.55 (range 1.5 – 1.8) per minute. The OTR baseline data were stable with a narrow range that spanned less than 0.3 OTRs per minute across sessions. During training she delivered 1.9 and 2.6 OTRs per minute. There was an abrupt increase in the level of OTRs provided per session following the training sessions. Cindy delivered a median of 2.9 (1.5 – 3.6) per minute. The calculated effect size for OTRs for Cindy was 0.87.

There was a high level of missed opportunities or errors of BSP in baseline with an increasing trend while the level of appropriately delivered BSP statements was at a relatively stable and low level. In baseline for BSP, she appropriately delivered a median of 0.2 (range 0 – 0.7) BSP statements per minute and missed or delivered in error a median of 2.55 (range 1.4 – 3.3). During both training practice opportunities for BSP, she appropriately delivered 1.7 BSP statements per minute and missed or delivered in error 0.5 and 0.9 BSP statements per minute. There was an abrupt change in the level following the BSP training session. Appropriately delivered BSP statements increased while the level for missed opportunities decreased. Cindy was able to appropriately deliver a median of 2.3 (range 1.7 – 3.5) BSP statements per minute

and missed or delivered in error a median of .45 (range 0.2 – 1.2) following the training sessions. The calculated effect size for appropriately delivered BSP statements for Cindy was 0.92 and for missed opportunities or errors was 1.

The appropriate delivery of tokens was at a low level and stable trend for baseline and the missed opportunities for errors was at a high level and variable trend. For the baseline condition in TRS, Cindy deliver 0 tokens appropriately and missed or delivered a median of 2.4 (range 1.4 – 3.8) tokens in error. During the TRS training sessions, Cindy was able to deliver 1.4 and 2.4 tokens appropriately and missed or deliver in error 0.4 and 0.1 tokens. Following the training, the level for missed opportunities decreased and the level for appropriately delivered increased. She was able to appropriately deliver a median of 2.4 (range1.6 – 3.0) tokens in the post training condition and missed or delivered in error a median of 0.7 (range 0.2 – 1.13). The calculated effect size for TRS appropriately delivered and missed opportunities or error was 1.

Mary

In baseline for OTRs, Mary provided a median of 1.2 (range 1.1 – 1.7) per minute. The OTR baseline data were stable with a narrow range that spanned less than 0.6 OTRs per minute across sessions. During training she provided 2.9 and 3.8 OTRs per minute. There was an abrupt change in level following the training session. The level of OTRs increased to a median of 3.3 (range 2.1 – 4.8). The calculated effect size was 1.

For BSP, the level of missed opportunities or statements delivered in error was high and on an increasing trend during baseline while the appropriate delivered statements were low and stable in baseline. She appropriately delivered a median of 0.25 (range 0 – 1.0) BSP statements per minute and missed or delivered in error a median of 2.5 (range 1.0 – 4.3) BSP per minute. During the training sessions, Mary was able to appropriately deliver 2.1 and 3.0 BSP statements and missed or delivered in error 0.8 and 0.2 BSP statements per minute. Following the training sessions, the level of appropriately delivered statements increased while the missed opportunities level decreased. Mary was able to appropriately deliver a median of 3.3 (range 2.7 – 4.3) statements and missed or delivered in error a median of 0.7 (range 0.4 – 1.5) statements per minute. The calculated effect size was 0.74 for appropriately delivered BSP and 1 for missed opportunities or errors.

In baseline for TRS, Mary did not deliver any tokens appropriately and missed or delivered in error a median of 2.7 (range 1.0 – 4.5) tokens. Missed opportunities or tokens delivered in error were on an increasing trend in baseline. During the TRS training sessions, she was able to deliver 2.4 and 4.6 tokens appropriately and missed or delivered 0.5 and 0.2 tokens in error. Following the training sessions, Mary, was able to appropriately deliver a median of 3.1 (range 3.0 – 3.4) tokens and missed or delivered a median of 0.8 (range 0.7 – 0.8) tokens per minute which was an abrupt change in level. The calculated effect size for appropriately delivered tokens and missed opportunities or errors was 1.

Brookelynn

In baseline, Brookelynn provided a median of 1.7 OTRs (range 1.3 – 3.5) per minute. During the two training sessions, she provided 2.5 and 3.4 OTRs per minute. The trend during baseline was variable but the level demonstrated an immediate increase from baseline to the post training

condition. Following the intervention, she was able to provide a median of 2.75 OTRs (range 2.2 – 3.9) per minute. The calculated effect size for OTRs was 0.63.

In baseline, she appropriately delivered a median of 0.2 BSP statements (range 0 – 0.6) per minute and missed or delivered in error a median of 2.8 (range 1.2 – 3.4) BSP statements per minute during baseline. The level for appropriately delivered BSP statements increased from baseline to post training while the missed opportunities and errors decreased. During the training sessions she appropriately delivered 1.7 and 2.0 BSP statements per minute and missed or delivered in error 0.9 and 0.2 BSP statements per minute. Following the training sessions, the levels abruptly changed, she appropriately delivered a median of 2.9 (range 1.3 – 3.6) BSP statements and missed or delivered in error a median of 0.5 (range 0.1 – 1.2). The calculated effect size was 0.8 for appropriately delivered BSP and 1 for missed opportunities or errors.

During baseline for TRS, she appropriately delivered 0 tokens and missed or delivered in error a median of 2.7 (range 1.3 – 4.1) tokens. In the final training sessions, she was able to appropriately deliver 1.7 and 3.8 tokens per minute and missed or delivered 1.2 and 0.1 tokens in error. The level of appropriately delivered tokens increased following the training sessions while the missed opportunities or errors decreased. Following the training sessions, she was able to appropriately deliver a median of 3.1 (range 2.6 –3.8) tokens and missed or delivered in error a median of 0.4 (range 0.1 – 0.7). The calculated effect size was 1 for both appropriately delivered and missed opportunities or errors for TRS.

Overall, the effect size was calculated separately for all trained behaviors across participants including appropriately delivered skills and missed opportunities. This effect size was also corrected for the baseline trend. For OTRs the calculated effect size was 0.89. The calculated effect size for appropriately delivered BSP was 0.79 and missed opportunities or errors was 1. The calculated effect size for appropriately delivered TRS and missed or delivered in error TRS was 1.

Social Validity

The participants completed a social validity questionnaire to assess their perceptions of the effectiveness and impact of the intervention. The results of this survey are displayed in Table 2. The participants rated the degree to which they agreed or disagreed with each statement on a 5-point Likert-type scale as described previously. On average, the participants highly rated the acceptability of the intervention, their willingness to participate in the intervention, effectiveness of the intervention, and the fit of the goals of the intervention. Overall, participants scored the social validity measure at an average of 4.47 (range 3.75 – 5). Ryder scored the highest on the social validity measure with an average score of 4.87 (range 4 – 5). Brookelynn had the next highest social validity score with an average of 4.67 (range 4 – 5) across all fifteen questions. Cindy and Mary had the two lowest social validity scores of the four participants. Cindy scored an average of 4.27 (range 2 – 5) and Mary scored an average of 4.07 (range 3 – 5).

All four participants rated their willingness to participate in the TLE training package at a 5 which was the highest rating option. On average, the participants rated their acceptability of taking part in practice sessions in the TLE simulator and their confidence that the simulator was effective for their teaching career at a 4.75 (range 4 – 5). The participants also rated the fit of the goals of the intervention relating to their teaching practice at a 4.75 (range 4 – 5). Regarding their participation resulting in permanent improvements in their classroom management skills, the participants rated a 4.5 (range 4 – 5). Furthermore, the participants rated the fit of the

classroom management skills into their daily classroom routine and how much they liked the TLE intervention as a 4.5 (range 4 – 5). When asked about how willing the participants would be to continue the classroom management skills in their classroom, the participants on average said a 4.25 (range 3 – 5). Finally, the participants scored a 4 (range 3 – 5) for how willing they would be to participate in a TLE intervention again.

Table 2. *Social Validity Results*

	Ryder	Cindy	Mary	Brookelynn	Total
How acceptable did you find this TeachLivE intervention?	5	5	4	5	4.75
How willing were you to participate in this TeachLivE intervention?	5	5	5	5	5
How confident are you that this TeachLivE was effective for your teaching career?	5	4	5	5	4.75
To what extent do you feel like this intervention made permanent improvements to your classroom management skills?	5	4	4	5	4.5
How much did you like the TeachLivE intervention procedures?	5	5	4	4	4.5
How willing would you be to participate in TeachLivE again?	5	5	3	3	4
How willing would you be to continue these classroom management skills in the future?	5	4	3	5	4.25
How well did these classroom management skills fit into your daily classroom routine?	5	4	4	5	4.5
How effective was this intervention in improving your classroom management skills?	5	3	4	5	4.25
How well does the goal of the intervention fit with your goals for yourself as a teacher?	5	5	4	5	4.75
To what extent do you think there might be disadvantages of this TeachLivE intervention?	2	2	3	2	2.25
How much time was needed each day to carry out the classroom management interventions?	1	4	2	2	2.25
How disruptive was it to carry out these classroom management tools?	2	2	1	1	1.5
To what extent did you experience undesirable side effects of this intervention?	1	1	2	1	1.25
How much discomfort did your students experience with this intervention?	1	1	1	1	1

All four participants rated the amount of discomfort their students experienced during this intervention as a 5 which was the lowest amount of discomfort. The participants scored a 4.75 (range 4 – 5) on the extent of disadvantages they felt by participating in the intervention. The amount of disruption the classroom management skills caused in the classroom was rated a 4.5 on average (range 4 – 5). Finally, the participants scored a 3.75 (range 3 – 4) for any disadvantages to the TLE intervention and how much time was needed to carry out the classroom management skills.

It is interesting to note a few outliers on the TARF-R social validity measure. Cindy rated the amount of time that was required each day to carry out the classroom management skills at a 2 meaning she marked that significantly more time was needed when the other participants scored a 4 or 5. Cindy also marked the effectiveness of the intervention as a 3. Mary rated the disadvantages of the TeachLivE intervention as a 3 which was lower than the other three participants who marked it as a 4. Mary also rated how willing she was to carry out the classroom management skills as a 3 which was lower than the other participants who scored this question as a 4 or 5. Brookelynn and Mary both rated how willing they would be to participate in an intervention using TeachLivE again as a 3 while Ryder and Cindy marked this one as a 5.

Two weeks after the final data collection session, a sustained use measure was taken by the primary investigator. The PI conducted a brief 10-minute observation in the classroom at a scheduled time that was different than the lesson time that was used during the daily data collection sessions. All four participants were still implementing the classroom management skills. Ryder demonstrated a rate of 3.0 OTRs, 3.1 appropriate BSP statements, 0.2 missed BSP statements, 2.8 tokens delivered appropriately, and 0.7 missed tokens per minute. Cindy demonstrated a rate of 2.3 OTRs, 1.8 appropriate BSP statements, 0.5 missed BSP statements, 1.7 tokens delivered appropriately, and 0.5 missed tokens per minute. Mary demonstrated a rate of 3.2 OTRs, 2.5 appropriate BSP statements, 0.3 missed BSP statements, 2.4 tokens delivered appropriately, and 0.5 missed tokens per minute. Brookelynn demonstrated a rate of 3.1 OTRs, 3.4 appropriate BSP statements, 0.3 missed BSP statements, 3.4 tokens delivered appropriately, and 0.3 missed tokens per minute.

Generalization

Two weeks following the data collection sessions, each participant was observed in person during a lesson different from the original lesson or environment from the original observations. Ryder demonstrated a rate of 3.9 OTRs, 3.0 appropriate BSP statements, 0.7 missed BSP statements, 3.2 tokens delivered appropriately, and 0.9 missed tokens per minute. Cindy demonstrated a rate of 2.1 OTRs, 1.5 appropriate BSP statements, 0.6 missed BSP statements, 1.7 tokens delivered appropriately, and 0.7 missed tokens per minute. Mary demonstrated a rate of 2.7 OTRs, 2.3 appropriate BSP statements, 0.4 missed BSP statements, 2.0 tokens delivered appropriately, and 0.6 missed tokens per minute. Brookelynn demonstrated a rate of 2.6 OTRs, 2.1 appropriate BSP statements, 0.7 missed BSP statements, 2.1 tokens delivered appropriately, and 0.9 missed tokens per minute.

Discussion

The purpose of this study was to examine the effects of using a training package that included simulated practice opportunities using TLE on teacher candidates' implementation of behavior

management skills with students with ASD. This study also explored the extent to which the teacher candidates found TLE to be an acceptable and effective part of the training package for behavior management skills. Finally, the study included a measure of the sustained use of the trained skills as another measure of social validity.

Following the initial training for OTRs, results indicated a functional relation between implementation of the training package and an increase in teacher performance. During baseline, all four participants had low rates of opportunities for students to respond per minute. Following the training, every participant demonstrated an immediate increase in level to a high and relatively stable amount of OTRs. Brookelynn demonstrated the most stable rate of opportunities to respond across sessions with a range that spanned around 1.7. Ryder demonstrated the most variable number of opportunities to respond post training with a range that spanned 2.4.

During the baseline sessions, all participants demonstrated a low level of BSP statements. Following the training sessions, all participants demonstrated an immediate increase in level for appropriately delivered BSP statements. In session 18, Ryder demonstrated a slight decrease in appropriately delivered BSP statements which results in the instability of the post training data. Cindy demonstrated the most variable level for BSP appropriately delivered post training with a range that spanned 1.8.

The results indicate overall improvement in participants' implementation across all targeted skills. These findings indicate that including TeachLivE simulator practice sessions in teacher training packages can have significant improvements in teacher performance in the classroom. The findings of this research align with the current research regarding simulation technology in training teachers by demonstrating a positive relationship between simulation practice and skill acquisition. This study highlights the potential of simulation-based training as an impactful tool for better preparing special education teachers to meet the needs of students with a diagnosis of ASD.

Overall, the participants provided reasonably positive feedback regarding their participation in the TLE training package. The sustained use measure noted as S.U. in Figure 2.2, shows that all participants continued to implement the three classroom management skills that they were trained to use at the two-week follow-up observation. Regarding the generalization measure taken at a separate two-week follow-up observation conducted in person, all participants were implementing the trained classroom management skills in other areas of their teaching. For example, Ryder was implementing the classroom management skills in a small group science lesson. Cindy and Brookelynn were using the classroom management skills during a whole group math lesson. Finally, Mary was implementing the classroom management skills with her 4^{th} grade students, who were not her target students during typical observations, during a small group health lesson. The results of these measurements demonstrate an acceptability of the training procedures used in the intervention package.

The results of the social validity measure demonstrate that the participants found the goals, procedures, and outcomes of using TeachLivE as a training component for behavior management skills as socially important and acceptable. These results align with current research and practices in and outside of the education field. As mentioned previously, simulation technology has historically been used to train professionals in other fields successfully. The results of this study demonstrate that simulation technology has great potential to provide future special education teachers with the necessary practice opportunities to feel confident in behavior management skills.

Limitations

There are various limitations to this study. In general, the observation sessions were ten minutes in length although some unexpected circumstances and/or technical issues prohibited all sessions from being ten minutes. For example, session 3 for Cindy only lasted eight minutes because the internet connection was dropped and session 22 was cut short to only nine minutes by an unexpected fire drill. Session 7 for Ryder was cut to only eight minutes due to internet connection issues. Finally, session 7 for Mary started late due to technical issues.

Another limitation to this study is that participants were not required to teach a specific lesson and were given flexibility to teach a content of their choice as long as it was small group. For example, in session four, Brookelynn taught a scripted guided reading lesson instead of her typical math review lesson; therefore, she provided a high rate of OTRs. In session seven, Mary incorporated a video into her typical math instruction which left her with little time to provide a consistent amount of OTRs.

Relying on student engagement is another limitation of this project. In some sessions, participants had to spend a lot of time prompting students who were refusing to engage in lessons or displaying challenging behavior. As described in the OTR operational definition, continual prompts do not count as individual OTRs; therefore, the number of OTRs would significantly dip for that session. For example, in session 14 and 15 for Mary, her students were requiring a lot of prompting to stay on task and engaged with the lesson; therefore, her OTRs were lower.

Another limitation is the instability of data in baseline. It can be inferred that the instability of data for BSP delivered in error/ missed and TRS missed or delivered in error resulted from the training of OTRs. Once the OTR training was completed the data shows an abrupt increase in missed opportunities/ errors for both BSP and TRS. This abrupt increase can be credited to the number of opportunities to implement those skills appropriately automatically increased when the OTRs increased per session. Since the participants had not been trained in BSP or TRS, there was a higher rate of missed opportunities and errors for both skills.

A final limitation to this study was scheduling of training sessions. Because this study included participants who were students and teachers of record, scheduling sessions was challenging. TLE training sessions had to be scheduled in advance; therefore, they could not be scheduled based on participant performance. Although the schedule was originally built with at least five data collection sessions for each condition, due to participant cancellations that was not able to happen consistently. For example, Ryder only completed three observation sessions following the second training which was on behavior specific praise even with slight variation in trend leading up to the third training.

A few other limitations to consider of this project are the fact that lesson plans were not regulated. The participants were given the freedom to choose any ten-minute small group lesson they wanted to teach. Often, the lesson was a quick review of previously learned math materials, leveled reading, or community skills activities. It also should be considered that the participants were not afforded an opportunity to explore the simulator prior to the first training session. Participating in the simulator is novel and often participants are apprehensive upon starting the first session; therefore, the data could reflect this limitation.

Implications for Practice

The results of this study highlight several implications for practice, particularly in teacher preparation programs. First, incorporating simulated practice opportunities, such as those provided by TeachLivE, offers an effective method for training teacher candidates in behavior management skills. These simulations enable candidates to receive direct, actionable feedback in a controlled environment, making them an excellent extension of classroom assignments. Using simulation technology in teacher preparation programs also give university faculty the opportunity to observe their teacher candidates implement interventions and behavior management strategies in order to provide coaching and feedback. The use of this technology removes the geographical and logistical limitations that are put on university faculty that hinder their ability to provide ample observations and feedback of their teacher candidates.

The virtual nature of this study eliminates geographical and logistical barriers, creating new opportunities for universities and teacher preparation programs to expand their reach and increase their impact on educators nationwide. This training package has the potential to be implemented across the country, offering school districts the chance to provide teachers with valuable training, practice opportunities, and expert feedback. As a result, the benefits of this technology extend beyond teacher candidates to include current educators and aspiring future teachers. The use of simulation technology could help support professional development initiatives for special education teachers across the country but can also provide beginning experiences for high school or younger college students who are still exploring career options.

Future Research

The potential impact of using TLE to train teacher candidates has been highlighted by this study. Future research should consider adding follow-up feedback either via email or text messages following daily observations. It would be interesting to examine the impact of providing the participants with the rates per minute related to each skill following every observation and then fading that support for a sustained measure. Similarly, examining the effect of providing the participants with an opportunity to participate in a self-reflection or monitoring activity following each classroom observation. Future research should also explore implementing a more frequent social validity measure to give participants the opportunity to express their comfort level as well as provide the PI with any feedback needed to adjust the training sessions. Finally, it would be interesting to also track behavior data on the students that are present during the small group. This study examined only the implementation of the teacher, but it would be even more impactful to be able to show the impact of the combination of trained skills (OTR, BSP, and TRS) on student behavior as well.

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