Efficacy of Individualized Clinical Coaching in a Virtual Reality Classroom for Increasing Teachers’ Fidelity of Implementation of Discrete Trial Teaching

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Abstract: Discrete-trials teaching (DTT) is an evidence-based practice used in educational programs for children with autism spectrum disorders (ASD). Although there is strong demand for preparing teachers to effectively implement DTT, there is a scarcity of published research on such studies. A multiple baseline across participants design was utilized to determine if there was a functional relationship between individualized clinical coaching within the TLE TeachLivE™ virtual classroom laboratory and teachers’ fidelity of implementation of discrete trial teaching when working with a student with ASD. Following intervention, participants’ DTT accuracy improved on average from 37% to 87%, a 50% increase over a maximum of six, 15 minute sessions. These results indicate that such training has considerable potential for teaching DTT to educators. Implications and suggestions for future research for teacher preparation that utilizes individualized clinical coaching within a virtual classroom are discussed.

One of the greatest challenges within the field of special education is ensuring that educational staff are adequately prepared to deliver evidence-based interventions with strong procedural integrity (Belfiore, Fritts, & Herman, 2008; Browder & Cooper-Duffy, 2003; National Research Council [NRC], 2001). It has been noted in the literature that teachers may not be adequately prepared to effectively deliver evidence-based interventions to students with special needs and that such shortcomings require improved program development as well as high-quality staff development programs (Simpson, McKee, & Beytien, 2007; Volkmar, Cook, & Pomeroy, 1999). The importance of honing teachers’ skills to select and effectively implement appropriate evidence-based practices (EBPs) for learners with autism spectrum disorders (ASD) cannot be overstated considering the prevalence of ASD, the high-stakes nature of intervention outcomes for children with ASD and their families, and the history of questionable treatments that have been marketed in the past (Belfiore et al., 2008; Mayton, Wheeler, Mendez, & Zhang, 2010; Simpson et al., 2007).

EBPs for children and youth with ASD have been described as educational interventions that have met rigorous peer review, and when consistently and reliably used by qualified persons, have the capacity to yield positive results (NRC, 2001; Simpson, 2005; Simpson et al., 2007). Students on the autism spectrum require teachers who have strong knowledge of how to effectively implement EBPs within school settings. The National Professional Development Center (NPDC) on ASD has identified DTT as one of 24 practices that meet criteria for EBPs for children and youth with ASD (NRC, 2001; Simpson, 2005). DTT is based on the principles of applied behavior analysis (ABA) (Bogin, Sullivan, Rogers, & Stabel, 2008; Dunlap, Kern, Worcester, 2001; Leblanc & Luisselli, 2005; Lovas, 1987; National Professional Development Center for Autism Spectrum Disorders [NPDC], 2009; Odom, 2009; Simpson, 2005). Alberto and Troutman (2006) and Iovannone, Dunlap, Huber, and Kinkaid (2005) have reported that strategies using ABA have been docu-
mented to be effective in systematically teaching target behaviors.

DTT emphasizes a highly systematic approach to learning where objectives are broken into smaller discrete components with positive reinforcement. As skills are acquired, new learning objectives can be added, building upon previous successes and eventually incorporating them into more natural environments such as classroom and home settings (Alberto & Troutman, 2006; Siegel, 2003). Further, DTT can be combined with other ABA methods (i.e. incidental teaching, pivotal response training) to generalize learning into more natural settings (Ghezzi, 2007; Whalen, 2009).

In 2001, the National Research Council released a seminal work Educating Children with Autism, which stated, “teachers must be familiar with theory and research concerning best practices for children with autistic spectrum disorders, including methods of applied behavior analysis” (p. 184). Given that DTT is a highly systematic approach, it follows (as with all evidence-based interventions) that its contribution to the effective education of children is dependent in part on the teaching skills of practitioners (Burnes & Ysseldyke, 2009; Blanc & Luiselli, 2005; Lovaas, 1987; Siegel, 2003; Simpson, 2005). Instruction using DTT with fidelity of implementation is the linkage between evidence-based research and positive student learning outcomes. According to Odom, Boyd, Hall, and Hume (2010), fidelity of implementation may be affected by a number of items, including the development of models and coaching support, professional development and assistance, web-based instruction and posting of modules, interactive communication, the use of technology, and a virtual community of learners.

Institutes of higher education may have difficulty in providing field experiences that are consistent in quality, caliber, and diversity. In an effort to alleviate such concerns in field experiences, educators are exploring the role that technology plays in supplementing traditional field experiences (Hixon & So, 2009). Field experiences that utilize a simulated environment have been termed “virtual practicums” and can play a part in meeting these needs, not as a replacement for real classroom experience, but as a way to better educate and prepare people for their first encounters (Zibit & Gibson, 2005). Additionally, technology-based platforms provide a medium for instructors and supervisors to deliver feedback to learners (Scheeler, McKinnon, & Stout, 2012).

In the arena of counselor education, Rosenberg (2006) described a technique for providing feedback through a technology called Real-Time Training whereby a psychotherapy trainee was videotaped while conducting a counseling session while the supervisor simultaneously typed and displayed text-based feedback on a monitor that the trainee reviewed after the session ended. Schools of medicine are also actively engaged in simulation research in education. Dotger, Dotger, and Maher (2009) describe the evolution of a Simulated Interaction Model (SIM) within the medical profession by providing an educational pedagogy that focuses on allowing medical students to practice their communication and diagnostic skills within simulated clinical settings.

In teacher preparation, more effective pathways and practices are needed for preparing, placing, and supporting beginning teachers and principals (Darling-Hammond, 2010; U.S. Department of Education, 2009). A common issue in the field of special education is the lack of skill transfer from one setting to another (Dieker, Hynes, Hughes, & Smith, 2008). It has been posited that “practicing up” is not ethical in that novice teachers must attempt to teach with a limited knowledge of appropriate pedagogy and skill (Dieker et al., 2008). The new challenge becomes finding an effective mechanism that provides essential learning experiences and opportunities to refine teaching techniques to the highest standards of fidelity in a safely controlled and coordinated environment (Odom, Boyd et al., 2010).

Perhaps because of the ethical concerns in honing teacher skills on actual children, and despite the strong demand for professionals who are trained in DTT, few studies have been published on training methodologies (Fazzio, Martin, Arnal, & Yu, 2009). Even fewer studies have been published that examine methods for teaching educators to implement DTT with high levels of fidelity. The training of teachers to implement evidence-based inter-

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ventions such as DTT with fidelity while they are working with students with ASDs cannot be over-emphasized in a teacher preparation program (Scheuermann, Webber, Boutot, & Goodwin, 2003; Simpson, 2004, 2005). Such investigations are essential since teachers who work with students with ASDs not only need a sound theoretical knowledge of these concepts, they also need to have practice incorporating these skills into their teachings in order to deliver teaching practices with fidelity (Attwood, 2007; Odom, 2009).

The purpose of this study was to measure the efficacy of teacher training in a virtual environment on teachers’ implementation of DTT. Specifically, the study asks: To what extent does individualized clinical coaching in a virtual reality learning modality (TLE TeachLivE™ virtual classroom laboratory) increase the fidelity of implementation of DTT for teachers?

**Method**

**Participants and Setting**

Four Caucasian female graduate students participated in this study. Participants ranged in age from 23–54 years and had varying numbers of years experience in the classroom setting (range 2–15 years) and were employed in K-12 public school systems at the time of study. All four participants were enrolled in a Graduate Certificate in Autism Spectrum Disorders to meet requirements for State Endorsement in Autism. To be selected for participation, individuals had to first respond to the course instructor via an email sent through course mail allowing the option for participation in the study. Second, participants were selected if they reported that they had limited exposure to DTT. Limited exposure was defined as having no previous formal professional development or class work in DTT, nor classroom experience performing DTT with students in their classrooms. Finally, participants were selected if the above criteria were met and they were able to meet on campus for scheduled dates of the study.

The independent variable of coaching was conducted in the TLE TeachLivE™ virtual classroom located at a major university in the southeast. The TLE TeachLivE™ lab virtual classroom space was a windowless room with three beige colored walls and one green wall. A large projection screen was located slightly left of the center of the room, and is roughly 12 feet from the entryway. It is on this screen that the avatar was projected. An additional privacy screen adjoins the projection screen on the left hand side, and provided a divider for an on-site TLE TeachLivE™ technician to assist in program operations. A logistics web cam was mounted on the top of the projection screen that allowed the interactor to view the participant during sessions. Several microphones were mounted on the ceiling perimeter of the laboratory, and enabled the interactor to hear what the participant was saying during sessions. Real time communications occurred via Skype, allowing the participant and interactor to respond immediately to one another.

Within the TLE TeachLivE™ virtual classroom laboratory setting a trained interactor controlled the behavior of a male avatar. This avatar took the characteristics of a non-verbal elementary student with autism named Austin. Although Austin had the ability to demonstrate various mannerisms such as rocking, hand flapping, and non-responsive behaviors, these were not implemented during sessions so that participants could focus on grasping the concept of the intervention. Participants attempted to instruct Austin utilizing DTT to the best of their ability conducting one session (10 trials) of DTT with Austin.

Coaching (with feedback and demonstration) served as the independent variable in this experiment and occurred exclusively in the TLE Teach LivE™ lab. Coaching is a particularly effective form of follow-up support with an expert such as a skilled peer, lead teacher, or university professor (Filcheck, McNeil, Greco, & Bernard, 2004; Kohler, Crilley, & Shearer, 2001; Kretlow & Bartholomew, 2010; Maheady, Harper, Mallette, & Karnes, 2004; Stitcher, Lewis, Richter, Johnson, & Bradley, 2006) and serves the purpose of providing teachers with a “means of examining and reflecting on what they do in a psychologically safe environment where it is all right to experiment, fail, revise, and try again” (Raney & Robbins, 1989, p. 37).
Materials and Equipment

Written instructions included an overview of DTT and a description of the steps in the DTT cycle. These were provided to the participants for ten minutes prior to entering the lab setting during baseline (available from first author upon request). Teaching materials that the participants utilized across all sessions included a data sheet, pencil, choice of two reinforcers (motion activated squeeze ball, and animated plush dog), green laminated walk sign, red laminated don’t walk sign, and a clip board. These materials were placed on the upper left-hand corner of a table with a chair, located approximately four feet from the projection screen that displayed the student avatar. Sessions were videotaped using a web camera for a Sony Vaio laptop computer. Software for the web camera utilized was WebCam Companion 3. Other materials included an operational definition worksheet utilized in the coaching intervention, and Discrete Trials Teaching Evaluation Rubric (DTTER; Table 1).

Data Collection

The dependent variable in this study was participants’ performance on the implementation of the DTT procedure while teaching one task per session, as measured by the DTTER. The DTTER was developed based on a review of steps five and six of the NPDC on ASD’s’ Implementation Checklist (Bogin et al., 2008) and components ten through twenty-one of the Discrete Trials Teaching Evaluation Form by Fazzio et al. (2009). Components were grouped into five categories: a) management of antecedents, b) management of discriminative stimuli, c) management of consequences for a correct response, d) management of consequences for an incorrect response, and e) management of the inter-trial interval. Each of these components was further sub-divided into subcomponents that totaled between 10 and 13 steps depending upon Austin’s response to the trial. A total of 72 points could be earned on the DTTER, and points were converted to a scale of 100%.

Correct implementation of DTT steps were operationally defined and proceduralized based on a review of published research on DTT (Arnal et al., 2007; Belfiore et al., 2008; Fazzio et al., 2009; Koegel, Glahn, & Nieminen, 1978; Koegel, Russo, & Rincover, 1977; Leblanc & Luiselli, 2005; NPDC, 2009; Ryan & Hemmes, 2005; Sarokoff & Sturmey, 2004; Simpson, 2005; Smith, 2001). On the DTTER, responses of a participant were recorded by coding (+) for each component correctly demonstrated and (−) for each component incorrectly demonstrated. The instrument was designed to collect data for a session with ten consecutive trials. Percentages of correct responses per session on applicable components were calculated on a point-by-point basis to determine proficiency level of the DTT implementation. A panel of experts was asked to review and provide feedback on the DTTER, operational definitions, and abbreviated instructions. This panel included two individuals who hold Ph.D.s in Exceptional Education, a parent of a child with autism, and a certified B.C.B.A. practitioner.

Interobserver Agreement

The investigator and a second observer practiced data collection using the DTTER while observing both live and taped baseline performance of a volunteer who was not used in study. The observers practiced until reaching 90% agreement. Agreement was calculated point-by-point on the DTT teacher worksheet by dividing the number of agreements by the number of agreements plus disagreements for the session, and multiplying by 100% (Gast, 2010). A disagreement was documented if there was a discrepancy between observers. Interobserver agreement (IOA) checks occurred across 30% of each phase of the study on each participant. Inter-rater reliability for scored sessions averaged 96% average agreement, ranging from 90%–100%.

Experimental Design and Conditions

A multiple-baseline design across four participants was used to evaluate the effects of coaching in the TLE TeachLiv™ virtual classroom on participants’ performance when being trained to implement the five components of the DTT procedure. Baseline was collected concurrently, and treatment was staggered across participants. If baseline data
remained stable and DTT improved only following intervention of coaching sessions, the following conclusions would be supported: a) observed effects were likely due to the intervention and not due to an external variable that may have occurred, and b) repeated exposure to baseline conditions did not affect performance. Four baseline sessions were conducted concurrently with each of the participants at the beginning of the study. Based upon visual analysis, the first participant was brought into the treatment phase and other participants were given scheduled dates for baseline probes. When a participant in the intervention phase demonstrated a consistent gain across five intervention sessions, the next

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<tr>
<th>Name:</th>
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<td>Video Start Time:</td>
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### Management of Antecedents

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<tr>
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<th>+</th>
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<tbody>
<tr>
<td>1. Arrange materials.</td>
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<td>2. Develop rapport/positive mood</td>
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<td>3. Introduce task</td>
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<td>4. Provide opportunity for the learner to choose a reinforcer.</td>
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### Management of Discriminative Stimuli

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<td>5. Secure learner’s attention</td>
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<td>6. Present correct teaching materials</td>
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<td>7. Present correct instruction</td>
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### Management of Consequences for Correct Response

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<td>8. Provide specific verbal praise</td>
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participant was brought into the treatment phase.

Procedure

Baseline. In session one, each participant was given ten minutes to read the task instruction sheet, review the data sheet for teaching the task, and asked to perform ten teaching trials with Austin. The task to be delivered in the sessions was an auditory-visual discrimination task, for which the correct mand by the participant was a request such as “point to the

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<th>TABLE 1</th>
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<tbody>
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<td>Components</td>
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<td>8. Remove materials, look down (2-3 secs.)</td>
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<td>9. Re-present materials (with prompt)</td>
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<td>10. Re-present instruction &amp; prompt to ensure correct response</td>
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<td>11. Affirm correct response</td>
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<p>| <strong>Management of the Inter-Trial Interval</strong> |  |</p>
<table>
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<td>9/12. Provides a break between instructional trials (3-5 secs.)</td>
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<p>| <strong>Totals</strong> |  |</p>
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<th>Points Earned</th>
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<td>Management of Antecedents (Steps 1-4)</td>
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<tr>
<td>Management of Discriminative Stimuli (Steps 5-7)</td>
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<tr>
<td>Management of Consequences for Correct Response (Step 8)</td>
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<tr>
<td>Management of Consequences for Incorrect Response (Alt. Steps 8-11)</td>
<td>12</td>
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<tr>
<td>Management of Inter-trial Interval (Steps 9-10/ Alt Steps 12-13)</td>
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<td>Totals</td>
<td>72</td>
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don’t walk sign”. As a part of this task, the participant held two laminated cards (e.g. walk sign, don’t walk sign) in front of Austin, at shoulder-height. Austin indicated his response by pointing to the correct picture (e.g. don’t walk sign) named by the participant for each trial. The participant was asked to inform the experimenter when she had completed the trials.

When the participant completed the task or 15 minutes elapsed, the session was concluded and the participant was thanked for her time. This procedure was repeated for each participant for the second session. Baseline was conducted with all participants at the beginning of the study. Following four baseline sessions for each participant, visual analysis was conducted, and the highest performing participant was brought into the intervention phase first. Additional participants were introduced one at a time when previous participant showed consistent progress. Baseline probes were conducted for participants two, three, and four before they began the intervention phase.

Intervention. For intervention, the experimenter reviewed the participant’s performance, as measured by the DTTER. This form was used to identify components within the 13 steps that were performed correctly as well those that were performed incorrectly. When reviewing the participant’s performance, the participant was given a copy of the operational definitions for components, which were arranged in the correct order of procedure and grouped into five categories: a) management of antecedents, b) management of discriminative stimuli, c) management of consequences for a correct response, d) management of consequences for an incorrect response, and e) management of the inter-trial interval. A total of each of the components within the five categories was reviewed via an operational definition worksheet (available from first author upon request), and the experimenter provided written and verbal feedback of the participant’s previous DTT session.

If the component was performed correctly, a star was placed to the left of the operational definition. If the component was performed incorrectly, a delta sign was placed to the left of the definition. Instructional feedback for incorrect responses included reviewing the operational definition of the step, modeling of the steps by the evaluator, and practice with the evaluator. Positive praise was expressed to participants and no demonstration was required. At the culmination of the coaching component for the session, the experimenter fluidly demonstrated three trials in a row with Austin (a correct trial, an incorrect trial, and another correct trial). The participant was allowed to ask questions to clarify the correct implementation of each component, but questions were not prompted. Coaching sessions did not last longer than 15 minutes. Following a training session, the participant performed ten uninterrupted discrete trials which were scored for fidelity. Criterion for mastery of fidelity of implementation was 90% across all components of the DTT session. All sessions were videotaped for IOA and further coding review as necessary.

Treatment integrity. Training with the interactor occurred in both face-to-face and virtual settings. A one hour face-to-face training session occurred first, followed by a separate one hour training session with the investigator in the virtual classroom setting and the interactor present in the remote command center of the lab (as would occur in a typical session). A response protocol was followed that scripted for Austin to respond with seven correct responses interspersed with three incorrect responses. Austin’s behaviors were also scripted and held constant across phases and participants (e.g. look away behaviors, eye gaze, and lack of escalation behaviors). Response protocols for the interactor were assessed across all sessions for each participant, and averaged 99% accuracy.

Fidelity checks of the researcher’s coaching when interacting with Austin were conducted by an independent observer over 30% of each participant’s sessions. Specifically, when modeling correct and incorrect trials, the same teacher evaluation rubric that was utilized with participants was used to measure fidelity of the evaluator. Fidelity of implementation for the researcher was 100%.

Upon completion of the TLE TeachLivE™ sessions, interviews were conducted with participants from the study. These interviews were designed to evaluate objectives, proce-
dures, and learning outcomes from the investigation, and provide triangulation for future study. Questions that were asked inquired about participants’ perceptions of EBPs, the process of the training they received, comfort levels throughout the study, and recommendations for future studies.

Results

Visual analysis indicated that teachers demonstrated a functional relationship between individualized clinical coaching utilizing feedback, demonstration, and practice in the TLE TeachLive™ virtual classroom and fidelity of implementation of DTT. Figure 1 demonstrates the percentage of fidelity of implementation of DTT for all four participants, across baseline and intervention phases. The mean accuracy across participants during baseline while attempting to teach an avatar was 37%, with a range from 18% to 54%. Participant one averaged 52.3% (range of 50% to 54%). Participant two averaged 37% (range of 27% to 47%); and participant three averaged 23% (range of 15% to 34%). Participant four averaged 19%, with a range of 18% to 19%.

Comparison of the mean DTT performance accuracy in baseline to that of accuracy after coaching sessions (with feedback and demonstration) shows a strong improvement in the fidelity of implementation for all participants. Overall mean accuracy for participants one through three improved from 37% in baseline (range from 15% to 54%) to 87% (range of 63% to 100%) after six sessions of coaching in the TLE TeachLive™ virtual classroom. Due to limitations of time, participant four only received one coaching session, and therefore was not included in the mean gain scores. This participant’s achievements were still of note, as the mean baseline score is 19% (range 18% to 19%), and the treatment score was raised to 60%. A baseline probe was conducted before the intervention session took place, with the participant demonstrating 15% accuracy in delivering DTT. This demonstrates a strong increase in skill acquisition, with a 41% increase in fidelity of implementation for DTT.

Results of Individual Participants

Participant one scored 44% higher after the first coaching session than in baseline condition (average baseline proficiency level was 52%, with a range of 50% to 54%), and maintained an average of 94% proficiency in the fidelity of implementation of DTT over six sessions of treatment (range of 86% to 99%). Percentage of non-overlapping data for all participants was 100%. During the time that participant one was in treatment, other participants were instructed not to discuss the study or research any information regarding DTT. This procedure was implemented with all following participants.

Similar results were found when reviewing scores from participant two. Average baseline proficiency was 37% (with a range of 27% to 47%). A baseline probe taken three weeks after initial baseline testing revealed a score of 38%, displaying no effects of practice or outside learning. As seen in Figure 1, a strong increasing trend can be observed graphically after receiving six sessions of coaching in the TLE TeachLive™ lab. Participant two’s average lifted to 86% (range of 69% to 100%). An increase of 49% is observed from baseline to treatment. It should be noted that a perfect score was obtained on the last session.

Average baseline score for participant three was calculated to be 23% (range of 15% to 34%) and a baseline probe taken five weeks after the last baseline session was scored at 15% proficiency for fidelity of implementation of DTT skills. After six sessions of coaching in the TLE TeachLive™ lab, fidelity of implementation rose to 82% (range of 63% to 93%). While results were not as immediate as observed for participants one and two, strong improvement can clearly be seen in results. A 59% gain occurred from baseline to treatment.

Baseline average for participant four was 19%. A baseline probe was taken six weeks after baseline assessment, and proficiency was recorded to be 18%. After one session of coaching, participant four’s score was raised to 60%. A 41% increase in fidelity of implementing DTT was observed, demonstrating the strong effect that coaching had when in the TLE TeachLive™ virtual classroom. Across participants, the overall mean gain in
The objective in this experiment was to determine the effect that coaching had on the fidelity of implementation of DTT when teachers are trained in the TLE TeachLivE™ virtual classroom. The only variable that changed between conditions was the addition of coaching with feedback and demonstration. A positive change in trend direction was noted across all four participants when moving from baseline to treatment conditions, and change was directly relative to the coaching intervention. This is evidenced by deceler-
ating-deteriorating trends in Condition A across participants one through three, and a zero-accelerating trend in participant four, when compared to observed accelerating-improving trends in Condition B seen across all participants. An analysis of change across similar conditions indicates that, across participants, baseline levels were maintained until coaching was introduced, and the level and trend in each of the participants’ data improved abruptly and immediately after the introduction of the coaching intervention in the TLE TeachLivE™ virtual classroom laboratory. Percentage of non-overlapping data for all participants was 100%. Likewise, the percent of overlapping data for all participants was zero.

Social Validity

Analysis of interview questions revealed that all participants felt they benefitted greatly from the training received on DTT, they would use the information from their training sessions in their classrooms, and that they were satisfied with their experience. Two of the participants specifically remarked that they had a much higher confidence level administering DTT after receiving coaching in the TLE TeachLivE™ virtual classroom. One participant stated that she felt that she understood the “ebb and flow” of DTT much better after receiving coaching in TLE TeachLivE™.

Another participant stated that she preferred to utilize the TeachLive™ lab when learning about and practicing new methods of teaching, as she could not “damage” her students while practicing a new technique. She also stated that she felt that using the TLE TeachLivE™ lab was a more efficient use of time than attempting to learn with an actual student, as observable behaviors that are targeted for change are able to be produced upon request, thereby guaranteeing opportunity to practice the teaching strategy. Two of the four participants said that they felt more comfortable making mistakes with an avatar rather than with an actual student. All participants said that they felt that coaching was enhanced because they were able to practice in the TLE TeachLivE™ lab.

Participants responded that they felt very comfortable working in the lab after the intervention phase began and that they found themselves thinking about Austin during the week and looked forward to working with him. Participants also commented that they would enjoy working with the other avatars featured in the TLE TeachLivE™ lab, and complimented the creator for designing realistic students that they could relate to. Several participants remarked that they would miss Austin, remarking that saying goodbye to him at the end of the intervention evoked similar feelings that they have had when saying goodbye to their students at the end of the school year. Key points mentioned from participants regarding positive aspects of coaching within the TLE TeachLivE™ virtual classroom were that feedback was very structured and systematic.

Suggestions for change. Suggestions for change with the TLE TeachLivE™ virtual classroom and coaching intervention included providing an introductory video that would introduce the participant to Austin so that they would have a better understanding of the virtual setting and the avatar’s capabilities and limitations (i.e. Austin’s hands were not able to cross at the vertical midline, examples of what constituted correct eye contact for Austin, and examples of Austin’s ability to point). Participants also mentioned that it was frustrating when tracking issues occurred (i.e. screen projection would turn away from Austin and toward another student). Two participants suggested that they would like further coaching sessions with Austin in particular and that they would enjoy it if he were able to demonstrate more complex behaviors.

Discussion

The importance of providing teachers of students with ASD a solid foundational knowledge of evidence-based practices cannot be over-emphasized (Scheuermann et al., 2003; Simpson, 2004). Educators who work with students with disabilities must be prepared to provide individual instruction that addresses the unique needs of the student, and it is critical that such research-based instruction be delivered with a high fidelity of implementation (Belfiore et al., 2008; Odom, Boyd et al., 2010; Simpson et al., 2007). This study
sought to measure the efficacy of individualized clinical coaching when utilizing a virtual reality learning modality (TLE TeachLivE™) and the effects on teachers’ fidelity of implementation of DTT. Results indicate that across all four participants, performance improved from a mean accuracy of 32% in baseline to 86% after receiving coaching in the TLE TeachLivE™ virtual classroom setting. A stable baseline and baseline probes indicated that additional learning had not occurred outside of sessions and improved performance feedback was noted through visual analysis after the first intervention session. Results of the intervention were immediate and significant across all participants and strong experimental control was maintained throughout the experiment, indicating that teachers’ improvements in fidelity of implementation of DTT can be directly attributed to coaching in the TLE TeachLivE™ virtual classroom.

Interviews with participants indicated that there was a perceived value to the coaching intervention within the virtual classroom setting and that they would be inclined to utilize what they learned within TLE TeachLivE™ to lessons in their actual classrooms. Respecting the complexities within traditional classroom settings, the researcher acknowledges that there may be low generalization from lab experiences into actual classrooms without the ability to incorporate various environmental elements such as student behaviors, increased class size, and student interactions. Layering such levels into TLE TeachLivE™ learning sessions may assist in lending authenticity to the experience and providing for a higher level of generalization when working with students. A benefit to learning within the virtual classroom setting is that such nuances can be manipulated so that during the beginning stages of learning, teachers are able to focus on the concept at hand. As teachers become more adept in delivering the strategy, more complexities may be layered within sessions, thereby more closely replicating typical classrooms in which teachers may be instructing.

Benefits to teachers who engage in preparation via coaching in TLE TeachLivE™ were numerous and included results that indicated participants gained improved performance in delivering DTT, increased confidence in delivering DTT. Teachers’ fidelity of implementation was strongly increased after receiving a relatively small number of coaching sessions. Teachers also remarked that they gained confidence in delivering DTT and they would be much more likely to utilize this evidence-based practice when working with students with ASD in their classrooms. Because the behavioral characteristics could be manipulated, teachers were able to focus solely on improving their delivery of DTT. The nature of individualized clinical coaching also allowed for instruction to be tailored to the needs of each teacher while progressing through sessions. Benefits for teacher educators include the ability to diagnostically assess learners’ areas of strengths and weaknesses within each of the areas within the DTT cycle when utilizing the DTTER, and the ability to review recorded video of the sessions at a later time for further analysis if needed. Using an avatar afforded the opportunity to move directly to a specific area of the DTT cycle that needed to be practiced and provided the teacher the ability to practice as needed without tiring, confusing, or frustrating an actual student.

Limitations

Limitations of the experiment included lack of demonstrated generalizability of increased skill acquisition to the classroom setting, and lack of maintenance probes to ensure that fidelity of implementation of DTT delivery was maintained over time after coaching sessions terminated. Difficulties with technology were also a limiting factor of control. A broken foot pedal caused the avatar to appear jumpy in two sessions across participants and this may have affected participants’ comfort level during those sessions. Two sessions were interrupted when the system dropped, and the participants had to pause their sessions while this was attended to. Participants’ level of comfort was also variable, as one participant appeared to take longer to become acclimated to working in a virtual setting. Cost of the TLE TeachLivE™ virtual classroom set-up and time may also be a limiting factor for researchers. Time and virtual classroom lab usage was generously donated by the university at which this study was conducted.
Implementing evidence-based practices correctly is hypothesized to result in improved outcomes for learners and are the foundation on which teachers and other service providers are required to design educational programs for students with ASD (Nosik, & Williams, 2011; Odom, 2009; Odom, Collet-Klingerberg, Rogers, & Hatton, 2010). Today’s educators of students with ASD must enter the classroom fully prepared to effectively administer a variety of research-based strategies (Simpson, 2005). Future research in providing effective methods for teaching DTT with strong fidelity is essential for both teachers and students. Studies should include exploring various immersive learning platforms such as simSchool and Second Life, as learning via these modalities has the added benefit of allowing learners to engage in sessions from remote locations, provided that they have web capabilities. Web conferencing technologies such as Adobe Connect, Saba, and Elluminate should also be given consideration in future research endeavors for efficient teacher instruction in DTT. If using the web conferencing platforms previously listed, all parties would be logged onto video chat, and the instructor might be able to act as a confederate of an individual with ASD, thereby potentially eliminating the need for an avatar.

Researchers should also contemplate conducting an assessment of participants’ knowledge and comfort when utilizing technology in a virtual setting. Experimenters may consider familiarizing participants with the virtual setting by facilitating a short introductory period whereby participants interact with their virtual students. Other items to investigate include determining if fidelity of implementation of DTT can be maintained over time and across settings. Field testing the DTTER may lend strength to future research. It is also worthy of consideration to explore the efficacy that the TLE TeachLive™ virtual classroom laboratory may have on fidelity of implementation of additional EBPs for students with ASD or other exceptionalities.

References


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