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The Use of Relational Training to Help Children with Autism Learn Emotions in Context: Extending Results with a Case Study

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THE USE OF RELATIONAL TRAINING TO HELP CHILDREN WITH AUTISM LEARN EMOTIONS IN CONTEXT: EXTENDING RESULTS WITH A CASE STUDY

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By

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ABSTRACT

People who have autism spectrum disorder (ASD) have difficulty with identifying and interpreting emotions and coordinating their facial expressions. This defiency extends to both their own emotions and expressions as well as those of other people. Understanding emotions is important in developing social behaviors such as sharing or empathy. However, researchers have found that emotion recognition training, video modeling, and other procedures have helped children with autism build these skills. Previous research demonstrated a method for teaching the identification of private events of others in context using stimulus equivalence and transformation of stimulus function procedures. The current case study addressed two of the limitations found in previous research by including younger children with more limited verbal skills and testing for generalization to novel stimuli and real-life situations. Results demonstrated an increase in correct responding and some generalization to novel stimuli.

KEYWORDS: PEAK, autism, emotions, private events, Applied Behavior Analysis, facial expressions

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INTRODUCTION

The diagnosis of autism is characterized by deficits on social interactions and communication such as inability to engage in conversation, reduced sharing of emotions, poor nonverbal communication, lack of interest in others, and difficulty in developing interpersonal relationships (Centers for Disease Control and Prevention, 2020).

The ability to describe emotions is also a common deficit of individuals with autism spectrum disorder (Hill et al., 2004). Hill et al. (2004) describes the specific emotional dysregulation as being characterized by "difficulties in identifying and describing feelings; difficulties in distinguishing feelings from the bodily sensations of emotional arousal; impaired symbolization…and a tendency to focus on external events rather than inner experiences" (p. 229). In the Hill et al. (2004) article, a 20-item questionnaire to determine mental emotional processing was sent to 27 adults with autism, 35 cognitively normal adults, and 47 adults related to someone with autism. It was found that 48.1% of the adults with autism were severely impaired in their emotional processing compared to 0% of the cognitively normal adults and 2.1% of the adults related to someone with autism. Further, only 14.8% of the adults with autism were considered nonimpaired with their emotional processing compared to 82.9% of the cognitively normal adults and 78.7% of the adults related to someone with autism.

Similarly, in Corbett et al. (2009), the researchers completed multiple neuropsychological measures with children with autism, typically developing children, and children with attention deficit hyperactivity disorder. They found that compared to neurotypical children, children with autism had deficits in inhibition, working memory, flexibility/shifting, and vigilance showing a general, but serious impairment in executive functioning abilities.

Although there are many social deficits characterized in people with autism, this article will focus on the ability to describe emotions. LeBlanc et al. (2003) described that ability to understand another's perspective, as important in developing social behaviors such as sharing or empathy. This is one of the reasons why understanding emotion is important. However, the private nature of emotional experience has limited the amount of behavior analytic research in this area.

Despite the deficits in emotional understanding for individuals, specifically, children, with autism, research has been done to teach them the needed social skills. For example, McHugh et al. (2011) used emotion recognition training which involved videos with stories to teach happy, sad, angry, and afraid. After showing the video, the implementer would ask a question related to the situation. If the child answered correctly, they were reinforced with social praise. If they answered incorrectly or did not respond, the implementer re-presented the question with a learning trial to make sure a correct response was given. The child was then given further situations to identify other emotions until mastery was achieved. Generalization training was then conducted to ensure identification of emotions transferred to new stimuli. For all three participants, the results showed a marked increase in percentage of independent correct responses across all four emotions. They also found that participants generalized emotion recognition to novel situations and stimuli and maintained those skills 15 days after generalization trials. The researchers concluded that children with ASD are capable of learning to identify emotions and generalize that knowledge to new stimuli.

People with autism are said to have difficulties with developing a theory of mind (Perner et al., 1989). According to Perner et al. (1989):

> Having a theory of mind implies being able to conceive of mental states in oneself and others. This is of critical importance in social, affective, and communicative

> relationships. Thus, emotional and behavioral reactions are often contingent upon knowledge or belief rather than upon the real state of the word. Likewise, communication, both verbal and nonverbal, is often deliberately aimed at conveying or influencing states of mind. (p. 689)

In the Perner et al. (1989) study, researchers completed various tests with children with autism primarily to discover if they lacked the ability to determine others' beliefs about a situation, determine others' mental states, and adjust information they give based on someone's knowledge. However, this study also compared children with autism to children with language impairment to determine if an underdeveloped verbal repertoire in itself would impact children's ability to employ theory of mind.

The children completed communication tests and false-belief tests over the span of six months. The children with autism completed first a "boxes" communication test where one experimenter would hide items (i.e., a wax apple and crumpled paper) from the other experimenter in two boxes. When the second experimenter came back in the room, he would either engage in the "total ignorance" condition where he was unable to open either box or the "partial ignorance" condition where he was able to open the box with paper but not with the apple. The child was then asked, "what's in there," not pointing to either box and had to tell the contents of both boxes regardless of the condition. After completing the "boxes" test, the participants completed a false-belief test where a box of Smarties was shown to have a pencil in it and the children answered 1) what was in the box and 2) what did they originally say was in the box. Then they answered the following 1) since the next participant has not seen the box, what will they say is inside it, 2) will what the next participant says be reality, and again, 3) what did the first participant originally say was in the box.

The participants engaged in other communication and false belief tests similar to the previously described. The results were compelling. In the false belief tests, the children with

autism needed prompting on the questions to the point that the researchers concluded that their responding was “meaningless as indicators of understanding” (p. 693). Also, the children with autism did much worse on the false belief test compared to the children with speech language impairment. It was also concluded from the communication test that children with autism find it difficult to distinguish between what information would be new to another person and what information they already knew. In general, even if the child did well in the original test, when retested, the researchers found unreliable performances.

Based on the results, Perner et al. (1989) ruled out the idea that children with autism struggled with these tests simply due to a language impairment. They concluded instead that children with autism are differently, and severely, afflicted in their theory of mind. Even though some of the participants with autism were able to understand visual access of themselves and others, but this does not involve judging mental states, showing again, that children with autism struggle with understanding emotions in others.

Similarly, to Perner et al. (1989), LeBlanc et al. (2003) used video modeling to help children with autism with perspective-taking. Three common measures were utilized to teach children how to understand another’s beliefs in specific situations. The first measure was the Sally-Anne task (Baron-Cohen et al., 1985). In this procedure, one puppet was seen putting an object under a bowl in the presence of a second puppet. After the second puppet left, the first puppet moved the object under a box and the children were then asked where the second puppet would look for the object. The second measure involved showing a box of M&M’s to the child and it was revealed that a pencil was inside of it instead of candy. The child was then asked what someone who was not in the room when they revealed the pencil would think was inside the box. The third, and final, task was Hide and Seek where a puppet, leaving footprints, hid coins in

chest number 1. After that, one of the experimenters left the room, the footprints were erased, and the puppet, not leaving footprints, moved the coins to chest number 2. The child then had to guess where the absent experimenter would guess the treasure was. The experimenters found that these video modeling tasks and skills were effective in increasing perspective taking in the participants and the skill even generalized to novel stimuli (LeBlanc et al., 2003).

PEAK (Promoting the Emergence of Advanced Knowledge) Relational Training (Dixon, 2016) is a new curriculum that is gaining traction in skill acquisition. It extends Skinner's original work on verbal operants but incorporates current day literature and findings (McKeel et al., 2015). It contains four modules which focus on language skills, extending learner responses, and learning through relations (McKeel et al., 2015). As Schmick et al. (2018) describe, "Found within PEAK are a variety of task analyses for teaching various elements of emotional discrimination within ones' self, as well as detecting similar states of others" (p. 400). PEAK's validity has been compared to other established skill acquisition assessments and curriculum and found to be valid. Dixon et al. (2018) had three adult male participants with autism who had behavioral issues and intellectual impairments. They assessed their verbal skills using the PEAK (Direct Training) DTA module as well as the established *Verbal Behavior Milestones Assessment and Placement Program* (VB-MAPP; Sundberg, 2008). The participants were then trained on specifically identified areas of need using the PEAK-DT module. Once one skill was mastered, the participants then moved onto the next program. After the completion of training, the participants' PEAK-DT and VB-MAPP scores were reassessed and the researchers found both scores increased and stabilized over time (Dixon et al., 2018).

PEAK has also been demonstrated to have a significant correlation with the *Assessment of Basic Language and Learning Skills-Revised* (ABLLS-R; Partington, 2008) and the *Vineland*

Adaptive Behavior Scales (VABS-II; Furniss, 2009) which are established behavior scales (Malkin et al., 2017). Malkin et al. (2017) assessed 21 children with autism on their skills (e.g., learning, academic, social) using all three scales. All scores were compared, and a strong positive correlation was found between the PEAK and ABLLS-R's scores and a moderate correlation was found between PEAK and VABS-II's scores. Malkin et al. (2017) concluded that there is empirical support for the use of the PEAK-DT module.

Dixon et al. (2017) used PEAK curriculum to teach metaphorical emotional tacting. They paired metaphorical pictures with a corresponding emotion (e.g., a picture of a butterfly represented "nervous"). Following baseline that involved testing for correct tacting before any intervention, an adult experimenter would model, in a discrete-trial format, correctly tacting an emotion based on the picture. Researchers also described scenarios that would elicit a specific emotion and had children respond how they thought that person would feel. Dixon et al. (2017) found significant increases in correct tacts and intraverbal responses during the model training and concluded that the results suggest children with ASD can learn how to identify emotions through metaphorical emotional training.

Belisle et al. (2020) used the PEAK-DT 14-R Public Accompaniment: Expressive program to teach children with Autism to identify private events in others by using most-to-least error correction and prompting strategies as well as publicly accompanying stimuli. Publicly accompanying stimuli are co-occurring stimuli that aids a person in understanding the private event of another person (e.g., a band-aid when someone is hurt). In baseline, experimenters showed each publicly accompanying stimulus and asked, "How might I be feeling right now" and scored if they were able to answer correctly within 3-5 seconds. In training, experimenters used most-to-least error correction to train the correct responses. With the first-level prompt, if

the participant had not answered at all within 5 seconds or answered incorrectly, the experimenters vocally gave the correct response and prompted the participants to repeat. Once participants had given the correct responses, any following incorrect responses would be met with a second-level prompt. With the second-level prompt, instead of giving the full correct response, the experimenter gave just the first sound. The results of this study demonstrated increases in correct independent tacting of private events in others with all three participants.

The Relational Frame Theory (RFT), as described by Barnes-Holmes et al. (2004), specifies that, "arbitrarily applicable relational responding is the core process involved in the human language and cognitive abilities from the simplest act of naming a toy to the understating of the most complex and intricate trilogy" (p. 3). It describes that one can learn relations between objects or ideas even if their relationship is arbitrary because of contextual control and verbal processes. Based on training and a learning history, children can then derive other relations not specifically taught. For example, a child may be taught to orient towards a glass of juice when someone says juice. Then they could test for bidirectional relations by pointing to juice and asking, "What's this?" There are different types of relational frame theories, but the most relevant is the perspective-taking frames. This describes the development of "I" and "You," "Here" and "There," and "Now" and "Then." Understanding the perspective of another requires taking in consideration different relations and factors. RFT poses that understanding relations is extremely important in development, educational success, psychological processes, and cognitive skills (Barnes-Holmes et al., 2004). It is described that questions such as "What was I doing there," or other questions relating a person to an event/environment builds frames for understanding perspective. RFT predicts that these kind of questions and framing, as well as multiple-exemplar training is the best way to develop perspective-taking and derived relations

(Barnes-Holmes et al., 2004).

In Rehfeldt's (2011) analysis of articles on derived relations, when teaching children skills, it is important to develop derived relations to ensure the child's ability to expand and generalize the taught skill. An example of a derived relation would be given that the word "hat" is the same as an actual hat and an actual hat is the same as a picture of a hat, that the word "hat" is also the same as a picture of a hat. This kind of learning is necessary for building skills that require relational responding. Building in multiple exemplars helps develop relational skills and the emergence of derived relations and lessens rote responding (Rehfeldt, 2011).

Derived relations, multiple exemplar training, and the overarching RFT are used in the development of many types of skills. Dixon et al. (2016) used stimulus equivalence and *PEAK: Equivalence Module* to teach two teenage males with autism geometry skills, especially the features of different shapes. They trained direct relations of shape name to shape features and tested for the transitive relation of shape features and shape name and the derived relations of shape name to shape picture. During training (the A-B relation), the participants were asked how many sides a shape had, given praise upon correct responding, or least-to most prompting upon incorrect responding. Upon mastery, the transitive and derived relations were tested for and no feedback was given upon responding. Dixon et al. (2016) found mastery in correct A-B responding as well as the emergence of transitive relations as well as derived relations.

Rosales et al. (2011) utilized multiple exemplar training to teach typically developing children English a second language. During baseline, the researchers asked the children "Where is *item*" (A-B relation) and a correct response would be pointing to or retrieving the specified item. The researchers then asked presented the children with an item and asked, "What is it?" (B-A relation). A correct response would be saying the item in English. During training, the

researchers focused only on training the A-B relation. Correct responding resulted in descriptive praise and a token and incorrect responding resulted in corrective feedback. After training, a probe was conducted of the B-A relation and if they failed that test, remedial listener training and subsequently multiple exemplar training was completed. Upon training, the participants showed marked improvement in responding for both A-B and B-C relation although mastery was not met in all cases (Rosales et al., 2011).

Schmick et al. (2018) used PEAK-T as well as the principles of RFT to help two teenagers with autism learn to recognize and identify private events in other people. Using a multielement design, the participants were trained to accurately tact emotions of people in video scenarios. Each scenario showed that context aids in understanding emotional affect (e.g., crying can mean sad if at a funeral or happy if at a wedding). Using relational training, testing for derived relations, and multiple exemplar training (for one participant who initially struggled), all participants showed an increase in correct tacting of emotions of other people.

The aims of this research project were as follows. The Schmick et al. (2018) demonstrated a limitation in that the researchers did not attempt to generalize these skills to novel stimuli or situations beyond the PEAK curriculum. After completing training, the ended the study. In Rehfeldt's (2011) study, this was a common limitation of articles studying derived relations. The research that utilized generalization demonstrated significant educational effects and implications outside of the context of the study (Rehfeldt, 2011). Therefore, the first aim of this study was to check for generalization. Another limitation was that the participants all had developed verbal repertoire's and the procedures applicability to younger participants with less well-developed verbal repertoires is unknown. Therefore, the second aim of the current study was to include younger participants with less well-developed verbal repertoires.

METHOD

Participants

Four children with autism served as participants. One child, FV, was a 12-year-old female with Autism, primarily receiving ABA for skill acquisition. Two others were a brother and sister. The brother, ViM, was a 13-year-old male with Autism, ADHD, and anxiety and was at the time receiving ABA services for tolerance training of phobias. The sister, VaM, was 8-years old with Autism and was at the time receiving ABA services for verbal aggression and noncompliance. One child, TS, was an 8-year-old female with Autism and was at the time receiving ABA services for noncompliance, whining, and screaming. The investigator completed a PEAK-Transformation pre-assessment (PEAK-T-PA) on the participants to evaluate their skill levels prior to training.

Due to the inability to maintain regular sessions, TS was terminated from the study after five training trial blocks.

Guardians for all participants signed a consent form and the clients gave assent before conducting any sessions.

Setting

The researcher went to the participant's homes to conduct each session for convenience of the guardians. For FV, each session was held in her home in her bedroom as it was most comfortable for her and her ABA sessions typically were held in her bedroom. The investigator sat on a chair next to her bed. For VaM and ViM, each session was held in their home at the dining room table. For TS, each session occurred in different places within the apartment

complex she and her family lived on. Sessions either occurred in the living room, her bedroom, or the park. Location was based on suggestions from her parents and the primary BCBA.

Materials

Four videos depicting specific situations that demonstrate private events, including happy, angry, scared, and excited, were utilized. The videos were described in the *PEAK-T* program *11H-Coordination: Private Events of Others in Context*, but the investigator chose relevant ones from YouTube. Video links are available upon request. The videos depicting "happy" included a groom crying at a wedding and a players/coaches yelling and jumping in a locker room. The videos for "angry" included an athlete crying in a game and a bride yelling while at her wedding. Each video was under 10 seconds.

Research Design

Before commencing this study, the researcher sought IRB approval to work with human participants and received it on January 17, 2019, case number IRB-FY2019-249. Refer to the appendix for further information. The researcher conducted a case study across four children to analyze the effects of the interventions. Since the baseline for each participant was the same length, it was not a multiple baseline design as the original study. Also, all participants were being served by the same company and all lived in the generally same area, which is typical in a case study, but does limit generalizability. This study sought to apply what was found by Schmick et al. 2018 in a more naturalistic way, incorporating this training into a client's home environment and cooperating it with their established ABA programming. Without extending the baseline, it allowed training and the acquiring of the important emotional tacting skills to

commence quicker. It also helped determine if the Schmick et al. 2018 study and results could be adapted for less controlled situations. However, this does mean the researcher cannot conclude causation and this study is not considered a direct replication.

Dependent Variable

The dependent variable was the responses to the questions (i.e., A-B, B-C, and A-C). Correct responding was determined based on an answer key developed by the researcher. The percent correct was determined by number of correct responses divided by total questions.

Interobserver Agreement

Two observers collected data during 33% of the sessions for ViM, VaM and 28.6% for FV and compared for interobserver agreement (IOA). The observers were each participant's primary BCBA and they were given the template with the correct answers and recorded information on each child's responding. IOA was determined by taking the total number of agreements and dividing it by the total number of agreements and disagreements and multiplying by 100. Recorded IOA for ViM was an average of 100%. Recorded IOA for VaM was an average of 97.2%, ranging from 83.3% to 100% for each trial. Recorded IOA for FV averaged 100%.

Procedural Fidelity

Procedural fidelity was determined by each child's BCBA during IOA sessions also recorded if the investigator followed the correct steps (e.g., presenting question, appropriately responding to the child's answer). This was collected during 33% of the sessions for ViM, VaM

and 28.6% for FV. Recorded average procedural fidelity was 100% for trials with ViM. Recorded average procedural fidelity was 99.44%, ranging from 91.7% to 100% for each trial. Recorded average procedural fidelity was 100% for trials with FV.

Baseline and Relational Testing

A 30-60 -minute session was conducted each week, or as available, with the clients until mastery of relational training was shown. See the descriptions of mastery below. The clients chose what they worked for each session. Their primary board-certified behavior analyst (BCBA) and guardians described preferred items and provided preferred items as well.

A baseline pre-assessment was given to assess if the participants had any existing knowledge of trained, derived, and transformation relations. The first step, testing the A-B relation, was presenting the participants with the video and asking, "What is happening?" Then, to test the B-C relation, the participants were asked, "If someone is (behavior being demonstrated), how might they feel?" Then, to test for the A-C relation, the participant was shown the original video and asked, "How might they feel?" Finally, to test for the Y-Z transformation, the participants were asked, "I felt (emotion) and I was (behavior), where was I?"

Throughout the assessment, participants were allowed access to preferred items/activities after each trial. No reinforcement was given for responding correctly to the questions given. No prompts, verbal or otherwise, were given if the participant responded incorrectly. All conditions mirrored that of the baseline phase.

Relational Training

Relational training will be conducted for the A-B and B-C relations. The method is the same as baseline, however praise will be given when the participants answer correctly. If the participant answers incorrectly, the correct answer will be modeled, and the participant will repeat it. Relational training will be considered mastered when three trials in a row are completed with participants answering correctly more than 80% of the time. Once training is mastered, the participants will progress to relational testing. Once relational testing is mastered for the A-B pairing, training of the B-C pairing will begin. The same mastery criteria will apply for training of the B-C pairing, once mastered B-C relational testing will begin. Note that there were some differences in how the investigator trained each participant. These are described in the results section. Also note the differences between the method and what was conducted in the limitations section.

Maintenance and Generalization Probes

Two weeks following mastery of the *PEAK-T* videos, novel stimuli were presented to ensure generalization as well as maintenance of the skill. Each child was presented with six Ekman facial expressions and asked, “How do they feel?” as well as a as well as six situations and asked, “How do I feel?” (e.g., “I lost my dog and can’t find him; how do I feel?”). This phase assessed the child’s ability to understand facial expressions as well as situational emotion.

RESULTS

Figure 1 shows the percentage of correct responses for FV, VaM, and ViM. During baseline, FV responded correctly for 25% of the A-B relations, 50% of the B-C relations, 75% of the A-C relations, and 75% of the Y-Z transformation probe. FV was trained on all relations at once and reached mastery after four trial blocks or seven trials. During the last trial block, all trained relations were completed with 100% accuracy. During training, correct responding ranged from 50% to 100%. During the maintenance and generalization probes, FV responded with 80% accuracy on the Eckman faces and 83.33% accuracy on the scenarios. It should be noted that one of FV's answers to the Eckman faces was not recorded by mistake.

During baseline, VaM responded correctly for 50% of the A-B relations, 50% of the B-C relations, 50% of the A-C relations, and 0% of the Y-Z transformation probe. A-B and B-C, then A-B, B-C, and A-C relations were trained, but VaM did not meet mastery, so A-B relations were trained, and then B-C and A-C were added once mastery for A-B was attained. Following mastery of B-C and A-C, a probe of A-B again found that the trained relation had not held, and training resumed with A-B, followed by B-C and A-C. VaM reached mastery after 11 trial blocks or 45 trials. During the last trial block, VaM responded to the A-B relations with 100% accuracy, the B-C relation with 75% accuracy (ranging from 50% to 100%), the A-C relation with 100% accuracy, and the Y-Z transformation probe with 50% accuracy. For the maintenance and generalization probes, VaM responded with 50% accuracy on the Eckman faces and 33.33% accuracy on the scenarios.

During baseline, ViM responded correctly for 25% of the A-B relations, 75% of the B-C relations, 75% of the A-C relations, and 100% of the Y-Z transformation probes. ViM was

trained on all relations and reached mastery after four trial blocks or nine trials. During the last trial block, ViM responded correctly to all relations with 100% accuracy. During training, correct responding ranged from 50% to 100%. For the maintenance and generalization probes, ViM responded with 83.33% accuracy on the Eckman faces and 100% accuracy on the scenarios.

Figure 2 shows the percentage of correct responses for TS. During baseline, TS responded correctly for 0% of the A-B relations, 0% of the B-C relations, 50% of the A-C relations, and 0% of the Y-Z transformation probes. Five trial blocks were conducted, or 15 trials. Due to inconsistent participation (i.e., consistent cancellations), TS was terminated from the study. During the last trial block, TS reached 93.75 % accuracy for the A-B relations (ranging from 75% to 100%), 43.75% accuracy for the B-C relation (ranging from 25% to 50%), and 81.25% accuracy for the A-C relation (ranging from 75% to 100%). As she was terminated from the study, she did not complete the generalization and maintenance probe.

DISCUSSION

The findings from this study suggest some corroboration of previous research on teaching children to identify private events in others. This applied study has demonstrated that in less controlled situations, participants can learn to identify emotions in others in context. It also demonstrated that some younger children may learn emotional tacting, with more support and extended training. Checking maintenance and generalization determined that the training was generally sustained, but there were some specifically difficult emotions and situations.

In the current study, it was found that older children learned using the 11H *Coordination: Private Events of Others in Context* module easier and quicker than did younger children, who required some modifications. For example, it was found that the question, "What is happening" when inferring about what behavior the person in the video was engaging in, was a difficult question for VaM. Therefore, the question was modified to say, "What is happening, what is (he/she) doing?" which she understood better and responded correctly to more frequently.

As previously mentioned in the methods section, the current study utilized a case study research design instead of a more controlled, scientific multiple baseline design. A multiple baseline design would have ensured better internal validity, specifically with the concerns of "history" or rather, if simply measuring baseline responding would impact responding in training. It would have also led to a more direct replication of the original study. The strengths of a case study are its ability to explore and develop new ideas, investigate topics further, and go deeper into a certain area (McLeod, 2019). This was demonstrated in this study, for example, by the researcher's ability to edit the questions to better suit a younger participant. However, the limitations of a case study are it is more difficult to replicate, less generalizable, and not

scientific (McLeod, 2019).

There are several further limitations in this study. First, unlike in the original study where A-B and B-C were trained and A-C was tested, the current study trained A-C as well as it was mistakenly thought to be another trained relation instead of the tested transitive relation. In the original Schmick et al. (2018), the purpose for testing the A-C relation rather than training it, would have been to check for derived relations which would have tested if the relation was understood, rather than memorized. Therefore, training on both the B-C relation as well as the A-C relation does not allow for this test. The consequence of not testing for derived relations is that the researchers cannot conclude that the children obtained the ability to understand the emotion in context or if they answered according to the researcher's feedback. Therefore, this study did not replicate the original study and cannot corroborate their results. Derived relations are extremely important and future research should be careful to allow for testing of this. The generalization/maintenance probe completed did aid in giving some information about the child's knowledge of emotions outside of training, but it would have been key to complete the A-C test as well.

Second, due to the previous limitation (training of A-C, instead of solely testing), the participant VaM did not meet mastery for the B-C relation. When the researcher was calculating mastery for the B-C relation (i.e., four questions), she combined the A-C questions (i.e., four more questions) which skewed the percentage. For example, if the participant scored 75% on the B-C relation and 100% on the A-C relation, the researcher mistakenly calculated these together as one score, 87.5%, representing the B-C relation, which would have given the appearance or meeting the mastery requirement of 80%. However, the participant did not meet the mastery requirement for the B-C relation as they only answered 75% correct.

Third, IOA for FV was only taken for 28.5% of trials instead of 33% which was the goal level. This was due to a calculation error. IOA is extremely important to ensure that the data being collected are as accurate as possible and determines any possible inconsistences.

Fourth, the trial blocks were not conducted correctly. Instead of training for mastery across trial blocks, the current study trained for mastery in each trial. In the original study, it was required to reach 80% mastery across three consecutive trial blocks of eight. The purpose of the trial blocks was to ensure that participant responding was stable. In the current study, it was required to reach 80% mastery across three trials. The consequence of this mistake is the responding may not reach the same stability as in the original study, relevant especially for participant VaM. If the researcher would have measured mastery over trial blocks, VaM would not have met mastery and would have proceeded to multiple exemplar training. However, with clients FV and ViM who were at 100% responding, this likely did not have an effect. This did also shorten the length of the study.

Lower treatment integrity and procedural fidelity have been demonstrated to negatively impact intervention effects (DiGennaro Reed & Codding, 2013; Noell et al., 2002). DiGennaro Reed and Codding (2013) conducted a literature review on procedural fidelity and its impact on education and research. They wrote, about its impact on research specifically, that, “failure to carefully attend to and measure the degree of implementation of the independent variable results in poor science and may have a profound impact on the applied work of practitioners” (DiGennaro Reed & Codding, 2013, p. 6). Similarly, Noell et al. (2002) conducted an experiment to assess varying levels of treatment integrity on student responding. The researchers utilized a computer program to teach addition and substraction through prompts, feedback, and praise. However, the researchers specifically compared correct digits, the dependent variable, with 33%,

67% and 100% prompt fidelity. Although the results were variable, they generally found that performance varied based on the treatment integrity of the prompts. The students tended to respond less accurately with the lowering levels of prompt fidelity (Noell et al., 2002). Therefore, the performance of the participants of this current study was likely impacted by lower treatment integrity to the original study.

Following the completion of data collection, the above shortcomings became evident. This could have been addressed by more frequently referring to the original study, more frequent conversation with advisors, consulting the authors of the original study to address any confusion, and ensuring complete understanding before implementing the study.

Further, the complex nature of thesis completion further hindered the results. Completing a thesis involves many behaviors and skills that had not been developed (e.g., understanding the progression of a research project). Likewise, the rigors of graduate school and a full-time job make it difficult to devote as much effort and focus to the research project as needed. Although the researcher was allowed to complete the research during the workday, there are competing goals for graduate school and work. For example, work billing requirements and nonbillable time spent with research participants. Instead of seeing this as a failure, the researcher sees this as an opportunity for growth and the betterment of research practice. Likewise, through the process of defending and further studying articles on RFT, Theory of Mind, and social deficits, the author has gained better understanding of the topics, how to train relations, and how to test for derived relations. She will better utilize the strategies and theories she has learned in the future.

The current project commenced with the intention of replicating and extending the work of Schmick et al. (2018) but the practical difficulties of applied work in a busy organization sometimes interfered. While there were some issues with methodology and procedural integrity,

the author has come away with a far better understanding of practical difficulties involved in applied research and better equipped for more research in the future.

The failure to adequately replicate the study, and replication of research in general is a largely noted issue across science in general, and specifically psychology as well (Diener & Biswas-Diener, 2018). The greater issue is that many studies do not replicate, that is, produce similar results when re-tested. When this occurs, the findings cannot become part of the scientific canon and potentially important information cannot be disbursed. According to Diener and Biswas-Diener (2018), only 36% of studies from four notable psychology journals replicated. This draws concern about poorly conducted studies and non-generalizable populations and environments. However, it can also be due to poor replications. Although in this study, varying methodologies and circumstances demonstrated that even in less controlled studies, the participants did generally acquire the emotional tacting skills, we cannot conclude replication. This is due to the previously mentioned limitations and the fact that it was a case study instead of a multiple baseline.

Moving forward, other professionals, as well as this researcher, should seek to overcome the replication crisis by continuing to re-test studies, utilize tighter methodology, and seek to generalize to different populations and circumstances (Diener & Biswas-Diener, 2018). Practitioners in the field of Applied Behavior Analysis have a great opportunity to aid in discovering the generalizability and applicability of studies by utilizing literature results with their individual clients and reporting their findings. This can and should be done in controlled settings that closely replicate the methods of the original study as well in case study situations.

For future research on the hypotheses posed by Schmick et al. (2018), researchers should focus on testing for derived relations and utilizing multiple-exemplar training. Utilizing these

aspects and RFT will help ensure the learning is not rote memorization but understanding of the private event in context. Also doing a more controlled multiple-baseline study instead of the case study format that was done for this article would be better for ensuring there were no systematic confounds or other variables in effect.

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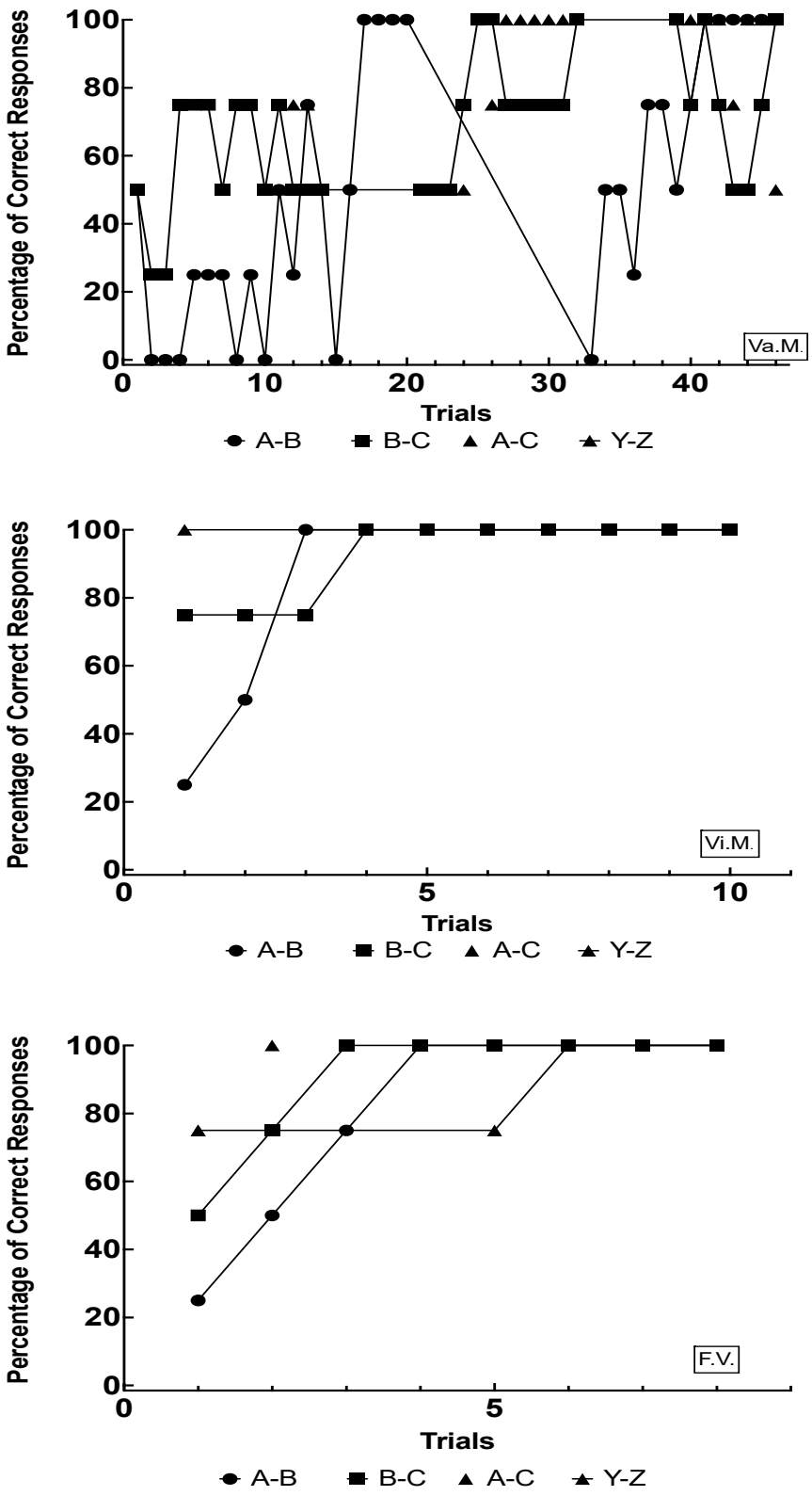

Figure 1. Results of 11-H *Coordination: Private Events of Others in Context* module training on VaM's, ViM's, and FV's correct responding and generalization.

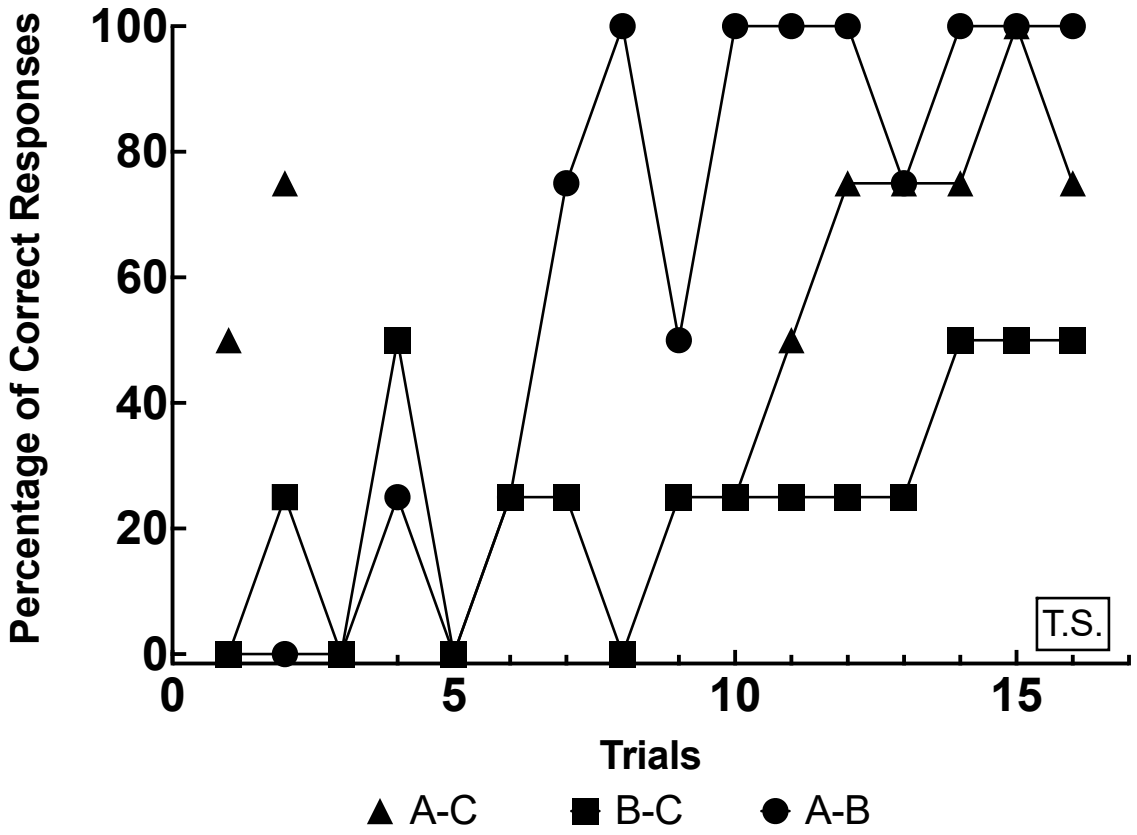

Figure 2. Results of 11-H *Coordination: Private Events of Others in Context* module training on TS's correct responding until termination from study.

APPENDIX

Missouri State
UNIVERSITY

To:
Michael Clayton
Psychology

RE: Notice of IRB Approval
Submission Type: Initial
Study #: IRB-FY2019-249
Study Title: Teaching Children with Autism to Identify Private Events of Others in Context
Decision: Approved

Approval Date: January 17, 2019
Expiration Date: January 17, 2020

This submission has been approved by the Missouri State University Institutional Review Board (IRB) for the period indicated.

Federal regulations require that all research be reviewed at least annually. It is the Principal Investigator's responsibility to submit for renewal and obtain approval before the expiration date. You may not continue any research activity beyond the expiration date without IRB approval. Failure to receive approval for continuation before the expiration date will result in automatic termination of the approval for this study on the expiration date.

You are required to obtain IRB approval for any changes to any aspect of this study before they can be implemented. Should any adverse event or unanticipated problem involving risks to subjects or others occur it must be reported immediately to the IRB.

This study was reviewed in accordance with federal regulations governing human subjects research, including those found at 45 CFR 46 (Common Rule), 45 CFR 164 (HIPAA), 21 CFR 50 & 56 (FDA), and 40 CFR 26 (EPA), where applicable.

Researchers Associated with this Project:
PI: Michael Clayton
Co-PI:
Primary Contact: Ashlee Ellingsworth
Other Investigators:

Missouri State
UNIVERSITY

To:
Michael Clayton
Psychology

RE: Notice of IRB Approval
Submission Type: Renewal
Study #: IRB-FY2019-249
Study Title: Teaching Children with Autism to Identify Private Events of Others in Context
Decision: Approved

Approval Date: January 27, 2020
Expiration Date: January 26, 2021

This submission has been approved by the Missouri State University Institutional Review Board (IRB). You are required to obtain IRB approval for any changes to any aspect of this study before they can be implemented. Should any adverse event or unanticipated problem involving risks to subjects or others occur it must be reported immediately to the IRB.

This study was reviewed in accordance with federal regulations governing human subjects research, including those found at 45 CFR 46 (Common Rule), 45 CFR 164 (HIPAA), 21 CFR 50 & 56 (FDA), and 40 CFR 26 (EPA), where applicable.

Researchers Associated with this Project:
PI: Michael Clayton
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