Treinamento de estagiários de psicologia para ensinar repertórios verbais e não verbais em crianças com transtorno do espectro autista

Training psychology interns to teach verbal and non-verbal repertoires in children with autism spectrum disorder

Pasantías en psicología para enseñar repertorios verbales y no verbales en niños con trastorno del espectro autista

Daniel Carvalho de Matos

ORCID: https://orcid.org/0000-0002-6793-0101

Universidade Ceuma e Universidade Federal do Maranhão, Brasil

E-mail: dcmatos23@hotmail.com

Flor de Maria Araujo Mendonça Silva

ORCID: https://orcid.org/0000-0002-2796-0939

Universidade Ceuma, Brasil

E-mail: floragyhn@gmail.com

Wellyson da Cunha Araújo Firmo

ORCID: https://orcid.org/0000-0002-6979-1184

Universidade Ceuma e Universidade Federal do Maranhão, Brasil

E-mail: well_firmo@hotmail.com

Pollianna Galvão Soares de Matos

ORCID: https://orcid.org/0000-0001-7579-8852

Universidade Ceuma e Universidade Federal do Maranhão, Brasil

E-mail: polliannagalvao@yahoo.com

Resumo

O Treinamento de Habilidades Comportamentais (THC) representa uma abordagem eficaz e eficiente para treinar pessoas na implementação de intervenções de Análise de Comportamento Aplicada (ACA) para aprendizes com Transtorno do Espectro Autista (TEA), com o objetivo de reduzir comportamentos indesejáveis e estabelecer comportamentos mais

adequados. Compreende o seguinte: (1) instruções sobre os princípios básicos da ACA, referentes ao ensino de metas comportamentais; (2) demonstração de comportamentos a serem emitidos durante o ensino; (3) ensaio comportamental com um confederado; e (4) feedback de desempenho. O objetivo desta pesquisa foi avaliar os efeitos do treinamento THC no estabelecimento de repertórios, em quatro estagiários de psicologia, para ensinar habilidades não-verbais (emparelhamento audiovisual e imitação motora) e verbais (nomeação e responder perguntas) a um confederado, que fingiu agir como uma criança com TEA. Depois disso, também foi um objetivo avaliar a generalização do ensino para uma criança real com TEA. Os participantes não estavam familiarizados com TEA e ACA, mas os resultados do estudo sugeriram que o THC melhorou a precisão durante o ensino de metas ao confederado. Na linha de base, o percentual de precisão por participante foi o seguinte: P1 (4,55%); P2 (9,73%); P3 (13,76%); P4 (22,29%). Todos atingiram o critério quando o THC, com feedback imediato e tardio, foi implementado. A precisão do desempenho foi superior a 90% para todos. No final, sondas de generalização foram realizadas durante o ensino de metas para uma criança real com TEA, e a precisão do desempenho também foi superior a 90%.

Palavras-chave: Transtorno do espectro autista; Treinamento de habilidades comportamentais; Repertórios não verbais e verbais.

Abstract

Behavioral Skills Training (BST) represents an effective and efficient approach to train staff in implementing Applied Behavior Analysis (ABA) interventions to learners with Autism Spectrum Disorder (ASD), with the purpose of reducing undesirable behaviors and establishing more appropriate ones. It comprises the following components: (1) instructions on ABA basic principles, regarding the teaching of behavior targets; (2) modeling, with demonstration of behaviors to be emitted during the teaching; (3) behavioral rehearsal with a confederate; and (4) performance feedback. The goal of the current research was to evaluate the effects of BST training on the establishment of repertoires, in four undergraduate Psychology interns, to teach nonverbal (audiovisual pairing and motor imitation) and verbal (labeling and answering questions) skills to a confederate, who pretended to act like a child with ASD. Thereafter, it was also a goal to assess generalization of the teaching to a real child with ASD. The participants were unfamiliar with ASD and ABA, but the results of the study suggested that BST improved accuracy during the teaching of targets to the confederate. In baseline, the percentage of accuracy per participant were the following: P1 (4.55%); P2 (9.73%); P3 (13.76%); P4 (22.29%). All participants reached criterion when BST, with both

immediate and delayed feedback, was implemented. Performance accuracy was above 90% for all. In the end, generalization probes were conducted during the teaching of targets to a real child with ASD, and performance accuracy was also above 90%.

Keywords: Autism spectrum disorder; Behavioral skills training; Nonverbal and verbal repertoires.

Resumen

El Entrenamiento de Habilidades de Comportamiento (EHC) representa un enfoque eficaz y eficiente para capacitar al personal en la implementación de intervenciones de Análisis de Comportamiento Aplicado (ACA) a estudiantes con Trastorno del espectro autista (TEA), para reducir comportamientos indeseables y establecer otros más apropiados. El Comprende: (1) instrucciones sobre los principios básicos de ABA, con respecto a la enseñanza de objetivos de comportamiento; (2) demostración de comportamientos que se emitirán durante la enseñanza; (3) ensayo de comportamiento con un confederado; y (4) comentarios sobre el rendimiento. El objetivo de esta investigación fue evaluar los efectos de la capacitación EHC en el establecimiento de repertorios, en cuatro pasantes de psicología, para enseñar habilidades no verbales (emparejamiento audiovisual e imitación motora) y verbales (etiquetar y responder preguntas) a un confederado, quien fingió actuar como un niño con TEA. A partir de entonces, también fue un objetivo evaluar la generalización de la enseñanza a un niño real con TEA. Los participantes no estaban familiarizados con TEA y ACA, pero los resultados sugirieron que EHC mejoró la precisión durante la enseñanza al confederado. En la línea de base, el porcentaje de precisión por participante fue el siguiente: P1 (4,55%); P2 (9,73%); P3 (13,76%); P4 (22,29%). Todos alcanzaron el criterio, cuando se implementó la EHC, con feedback inmediato y tardío. La precisión fue superior al 90% para todos. Al final, se realizaron sondas de generalización durante la enseñanza de objetivos a un niño real con TEA, y la precisión también fue superior al 90%.

Palabras clave: Trastorno del espectro autista; Entrenamiento en habilidades de comportamiento; Repertorios no verbales y verbales.

1. Introduction

Individuals diagnosed with Autism Spectrum Disorder (ASD) commonly present impairments in areas of development such as language, communication and social interaction, besides problem behaviors such as motor and vocal repetitive patterns (American Psychiatric

Association, 2013). These undesirable behaviors may compromise the learning processes of important skills. Impairments in language and communication skills relate to deficits in both listener (e.g., following verbal instructions) and speaker (e.g., verbal behavior) repertoires (Sundberg & Partington, 1998). Verbal behavior represents a kind of operant behavior shaped and maintained by mediated reinforcing consequences, and is related to several language functions or verbal operants such as, for example, requesting wanted items, naming, vocal imitating, answering questions and other verbal stimuli (Skinner, 1957).

In Applied Behavior Analysis (ABA), methodologies of teaching were (and are) delineated with the purpose of producing changes in repertoires, considering social demands, with efforts in manipulating contingencies to reduce undesirable behaviors and establish more appropriate ones, including non-verbal and verbal operants. Investment in research, regarding ABA principles applied to ASD, favored the publication of evidence based intervention manuals, recommended for the treatment of learners with ASD (Sundberg & Partington, 1998; Lovaas, 2003; Barbera, 2007; Greer & Ross, 2008; Matos, 2016).

A teaching format addressed in manuals and scientific articles on ABA employs discrete trial teaching (DTT) in a structured environment with few distractions. In each of several intervention programs, a learner is exposed to a same kind of instruction in a repetitive fashion and response targets are operationally defined for each program, so they may be clearly observed and registered. During teaching, differential reinforcing consequences are delivered contingent to arbitrarily correct responses (Allen & Cowan, 2008).

As example, consider the case in which an adult conduct discrete trials to teach listener responses on child with ASD. In a trial, a verbal instruction such as "clap your hands" is presented and, if the child emits the correct response of clapping hands, the adult praises the child and provides an arbitrary preferred reinforcer, according to the criteria of preference assessments (Deleon & Iwata, 1996). Along several trials, different instructions are presented in a randomized fashion and data are taken on the responses, so teacher may be able to monitor child's progress in terms of number of trials on correct responses emitted per session.

The growing demand for more qualified professionals to accurately implement discrete trial teaching to learners with ASD is critical in the world. The training of staff has been successfully attained through a set of strategies known as Behavioral Skills Training (BST), in several studies presented below, aiming to the establishment of important behaviors to appropriately implement the treatment of learners with ASD.

The BST comprises four components: (1) instructions regarding basic concepts in Behavior Analysis and written or vocal instructions for the emission of target behaviors

during the teaching of skills; (2) modeling, consisting of showing how target behaviors should be implemented during the teaching of skills to a confederate; (3) behavioral rehearsal, during which the learner of interventions tries to teach skills; (4) and performance feedback, since any methodological flaws by the learner of interventions may be addressed by a skilled professional (Hübner et al., 2018).

The literature on BST shows that this intervention package effectively trained different populations to implement the teaching of skills, using the principles of ABA, accurately to learners with ASD. Accuracy is related to the percentage of components completed correctly, that is, appropriate behaviors that the learners of ABA interventions should emit during the teaching of skills (e.g., giving a reinforcer to a child upon the emission of a correct response; taking data on a child's performance accurately).

Sarakoff & Sturmey (2004) and Lerman et al. (2008) successfully taught special education teachers to accurately implement the teaching of repertoires through DTT to children with ASD. Barnes, Mellor & Rehfeldt (2014) and Martone (2017) taught psychologists and educators to accurately conduct ABA assessments (Sundberg, 2008) to determine entry repertoires of children with ASD. Barkaia, Stokes & Mikiashvili (2017) successfully trained psychologists to accurately implement the teaching of verbal operants to children with ASD, considering that the training of the professionals was conducted through videoconferences (internet-based training).

Lerman et al. (2013), Lerman et al. (2015) and Shireman, Lerman & Hillman (2017) effectively taught university students with ASD, and without intellectual disabilities, to implement the teaching of basic skills, verbal repertoires, functional play behaviors and how to appropriately manage problem behaviors of children with ASD. Barboza et al. (2015) assessed the effects of a variation of the modeling component of the BST. This variation was called video modeling, and it was used to teach parents of children with ASD to implement the teaching of repertoires through DTT accurately to their children, and the results were positive.

Ferreira, Silva & Barros (2016) conducted a treatment package (modeling, role play with immediate feedback and video feedback) to teach five caregivers (e.g., parents and other relatives) of children with ASD to implement discrete trial teaching of nonverbal and verbal repertoires accurately to a confederate, who pretended to behave like a child with ASD. The procedures were successful and all caregivers showed increase in accuracy in 100%. Nonetheless, generalization of teaching was not assessed with real children with ASD.

Guimarães et al. (2018) assessed the effects of three components (video modeling, written instructions, and role-play with immediate feedback) on the management of undesirable behaviors by caregivers (mothers) of children with ASD. The caregivers had to present low repertoire of managing behaviors with the following functions: 1) attainment of desired items; 2) refusal of items from the environment; 3) refusal in returning a desired item; 4) escape of demand. During all phases of experiment, they interacted with a confederate, who pretended to act like a child with ASD. In baseline, they received written directions to teach repertoires and to manage problem behaviors the way they thought they should be treated. During intervention, they had access to videos with actors demonstrating the correct way of treating each kind of problem behavior, followed by a session of role-play with a confederate. When necessary, up to two levels of prompts were given (written instructions and immediate performance feedback). A follow up was conducted a month later to assess maintenance of performance. The three components produced high levels of performance accuracy for all caregivers and this was maintained over time. Generalization was not assessed with real children with ASD.

Studies were also conducted to assess the effects of BST components on Psychology undergraduate students. Faggiani (2014) assessed the effects of a computerized tutorial on the teaching of nonverbal repertoires by Psychology students. In three experiments, instructions on how to teach the repertoires were sufficient in producing high accuracy in student performance. According to the author, the results suggest that a computerized training may be an effective alternative to a presential BST. On the other hand, Faggiani (2014) also suggested that instructions were enough in producing high accuracy in student performance, because the level of demand was low.

Aureliano (2018) conducted an intervention proposal to enhance accuracy in ABA services provided by Psychology interns to children with ASD, and their parents, from a local community. The study was conducted in the context of a center called "Centro para o Autismo e Inclusão Social (CAIS-USP), from a public University in Brazil. The components of BST were used to teach the interns how to accurately implement the teaching of skills through DTT. The interns had classes on learning processes related to skills to be taught to children with ASD, and answered tasks regarding them. They were taught how to implement the teaching of nonverbal and verbal repertoires to a confederate through modeling, behavioral rehearsal and performance feedback. Assessments were conducted to determine accuracy of teaching in three moments (the beginning, the middle and the end of study). Accuracy increased for all and Aureliano asserted that training undergraduate students, as future

professionals in the field, is an important way to do something about the need for more qualified ABA service providers for learners with ASD. The results of this research influenced the creation of a new discipline at the University by the manager of CAIS-USP. It is about Applied Behavior Analysis (ABA) to ASD and has the purpose of increasing the efficiency of training of Psychology interns.

In a manner similar to the study by Aureliano (2018) and Matos et al. (2019) used the BST components to teach Psychology interns to accurately implement the teaching of verbal repertoires through DTT. The study was conducted in a laboratory from a private University in Brazil. The interns were taught the learning processes, regarding the skills to be taught to a confederate, who pretended to behave like a child with ASD. And they were also taught how to implement the teaching of repertoires through modeling, behavioral rehearsal and performance feedback.

The interns, in the beginning of the study, were unfamiliar to ASD and ABA applied to ASD. However, their curricular stage, initially, was observational and they were able to watch ABA sessions conducted to children with ASD by well-trained volunteers on discrete trial teaching (although that would not be recommended for experimental purposes). This occurred for a month since the beginning of the curricular stage. When the study started, part of an intervention manual on ABA to ASD was provided to six Psychology undergraduate students. They were told to read the manual during a week, regarding the way to teach four verbal repertoires and the basic processes involved to learners with ASD. No other instruction was provided.

When data collection on participant performance in teaching verbal repertoires to a confederate commenced, five conditions were programmed. The first and second conditions consisted of a probe and baseline sessions to ensure that the components of BST could be later implemented to increase participant accuracy during the teaching of targets.

When intervention initiated, the BST components (instructions on how to teach targets, modeling, behavioral rehearsal and performance feedback) were applied. During rehearsal, a given participant tried to teach the four verbal targets in 12 trials. After each trial, an experimenter provided immediate feedback, consisting in verbalizing what was done correctly and errors during the teaching. When errors were committed, the experimenter demonstrated the correct way of teaching with the confederate (modeling component) and, later, the participant had to administer the trial again. After sessions, the experimenter explained the basic processes involved in the teaching of targets and also asked the participant to read written instructions regarding the subject.

The first part of intervention always involved immediate feedback on participant performance. This condition was terminated when a given participant was able to teach 12 trials of the targets to the confederate with at least 90% accuracy. Then, the second part of intervention began. The only difference was that the feedback now was delayed, that is, it occurred after an entire block of 12 trials during which the participant tried to teach the verbal repertoires. The criteria involved also consisted in teaching a block of trials with at least 90% accuracy. Finally, the last condition of the study consisted in probing participant performance with a real child with ASD. This was a way of assessing generalization. If the precision with which the repertoires were taught to the child was low, intervention would be applied as well, but this was not necessary for any participant.

The results of the study by Matos et al. (2019) suggested that BST training was effective for all participants (the six undergraduate Psychology students). All of them reached above 90% accuracy during the teaching of targets to the confederate. Plus, all of them demonstrated generalization during the teaching to a real child with ASD with 100% accuracy. Thus, the results suggested that interventions were effective and that they ensured generalization, one of the main goals of ABA interventions (Baer, Wolf & Risley, 1968).

Nevertheless, the study showed an important methodological limitation. Since the Psychology students were enrolled in a curricular stage, which was observational during a month, it is highly possible that they were able to learn DTT procedures by modeling in some way, since they consistently watched experienced volunteers teaching real children with ASD through DTT. It is possible that this variable influenced the results of the research. Besides, there was a problem with the baseline condition. Three participants already presented approximately 70% performance accuracy and, two other participants, higher. This might have been due to variables, such as observing DTT sessions for a month before the start of the study, and the possibility that the participants might have talked among them.

The study by Matos et al. (2019) might be considered socially relevant, since Brazil needs more experienced staff to work with ABA applied to learners with ASD. It is interesting to note that the participants were all unfamiliar with DTT, and its use with ASD, before their curricular stage in the laboratory. More research, however, is needed to address the methodological limitations previously mentioned. The goal of the current research was to evaluate the effects of BST training on the establishment of repertoires, in four undergraduate Psychology interns, to teach nonverbal (audiovisual pairing and motor imitation) and verbal (labeling and answering questions) skills to a confederate, who pretended to act like a child with ASD. Thereafter, it was also a goal to assess generalization of the teaching to a real child

with ASD. Differences of the current study, compared to the previous one, were as follows: 1) the participants, four undergraduate Psychology students, were not allowed to watch ABA therapy sessions to children with ASD before the beginning of the study during a month; 2) only students with low levels of performance accuracy (below 50%) would be selected as participants.

2. Material and Methods

The current investigation represented an experimental research, conducted in the context of a University-based research laboratory, under the responsibility of the first author. An experimental study involves the manipulation of an independent variable (IV), and the investigation of its effects on a given dependent variable (DV). The main IV of this study was a BST training package with four components described later. The BST was used to train four undergraduate Psychology interns to teach non-verbal and verbal repertoires to a confederate, who pretended to act like a child with ASD, and to a real child with ASD for generalization purpose. The interns taught targets through discrete trial teaching (DTT). The purpose with BST was to train the interns to teach targets through DTT accurately. So, the DV of the current research corresponded to the percentage of discrete trial components completed correctly by a given intern. That meant that the intern had to emit several behaviors (described in Table 1), representing accurate performance, while teaching targets to a confederate or child with ASD. To be selected as participants, the interns first had to demonstrate that performance accuracy was below 50% (less than 50% of discrete trial components completed correctly), which actually happened. Data collection was conducted individually with each participant and the study lasted, approximately, a semester. Data were taken twice a week (with some exceptions, considering holidays and illness). During each session/day in which procedures were implemented, the duration was, approximately, 40 minutes. Considering that the study was experimental in nature, it was used a single case research design, commonly established to assess experimental control of the IV in investigations regarding ABA applied to ASD, and other cases of learning disabilities. The experimental design of the study is described later in a specific session (for more details regarding experimental research, the reader may consult Cooper, Heron & Heward (2006) and Pereira et al. (2018).

2.1 Participants

Four undergraduate Psychology interns participated in the study. The average age of the interns was 22 years old. Two 10 year-old children with ASD also participated for generalization purposes. The interns had to demonstrate interest in learning how to develop appropriately activities to children with atypical development. According to the Milestones Assessment Protocol from the Verbal Behavior Milestones Assessment and Placement Program - VB-MAPP (Sundberg, 2008), both children were, depending on the repertoire, in part level two learners and, in part, level three learners. They were both able to label, and receptively discriminate, hundreds of nonverbal stimuli, such as pictures and objects; both of them could answer over 50 questions and follow verbal instructions; they both could request several wanted items by the names; and also demonstrated a generalized repertoire of vocal imitation. The interventions, regarding verbal and nonverbal repertoires that the interns should learn how to teach, were extracted from a manual on ABA interventions (Matos, 2016).

The authors of this research agree that is crucial that learners, to whom principles of ABA are being taught to develop interventions to children with ASD, acknowledge the importance of teaching skills to this population, considering that many of them show impairments in several development domains, thus demanding special teaching tactics. Plus, not everyone show interest in conducting interventions with children in general. If future professionals demonstrate interest in children with atypical development and ABA procedures to teach skills, it is expected that they be concerned about establishing a good rapport with the children, which certainly increases the efficiency of interventions. Plus, future professionals need to be aware of the scientific literature, regarding procedures based in ABA to learners with atypical development. Intervention manuals, such as the one developed by Matos et al. (2016), describe evidence-based procedures, which need to be well known by practitioners and learners, who show interest in ABA and ASD. Good practices demand constant study.

2.2 Environment

Data collection was conducted in the Assessment, Research and Intervention in Autism Spectrum Disorder Laboratory (LAPITEA) from a private University in Brazil (CEUMA University). The room where procedures were held was equipped with a table and two chairs. In moments during which a modeling component from the BST was applied, an

experimenter demonstrated the teaching of verbal and nonverbal repertoires, through discrete trial teaching (DTT - an intervention format based on ABA), to an adult confederate, who pretended to behave like a child with ASD. During these moments, they occupied the chairs and remained seated facing each other through the table. In moments during which behavioral rehearsals were held, a given undergraduate Psychology intern had to teach the targets to the confederate and they should sit facing each other. During the conduction of generalization probes, the intern had to replicate the teaching to a real child with ASD, so in these moments, they seated in the chairs, facing each other.

2.3 Instruments

In moments during which a given intern had to teach targets to an adult confederate, or real child with ASD for generalization purposes, an experimenter took data on the intern's performance, regarding the fulfillment (or not).

In moments during which a given intern had to teach targets to an adult confederate, or real child with ASD for generalization purposes, an experimenter took data on the intern's performance, regarding the fulfillment (or not) of up to 13 components of discrete trials. Each time a given intern tried to teach targets to a confederate or child with ASD, he/she administered 12 teaching trials related to four repertoires (two verbal and two nonverbal). After each trial presented by the participant, the experimenter took data on the components of the trial. These represented important behaviors that the participant could emit. Increase in the emission of these behaviors represents improvement in the accuracy of teaching. All of them are listed in Table 1 and are based on a proposal developed by Lerman et al. (2008).

Table 1. Components of discrete trial teaching based on Lerman et al. (2008).

Components of discrete trial teaching
1. Organize materials before teaching
2. Present the instruction after getting student attention
3. Provide the instruction in a consistent manner
4. Provide prompts, when necessary, appropriately
5. Allow access to a reinforcer after a correct response
6. Pair reinforcers with praise
7. Use a variety of reinforcers
8. Allow access to reinforcers when the child pays attention to the teacher
9. Allow access to a reinforcer under the emission of an appropriate response
10. Remove distractions, if they exist
11. Manage problem behaviors in an appropriate manner
12. Manipulate intervals between trials
13. Take data on performance in an appropriate manner

Source: Lerman et al. (2008).

As it can be seen in Table 1, the 13 components of discrete trial teaching listed represent possible behaviors, which each participant could emit during the teaching of targets through DTT to a confederate or child with ASD. Not all components apply to every trial administered by a participant. During the teaching of a trial in which the child had to demonstrate motor imitation contingent to a model provided by the participant, if the child emitted a correct response, that would represent, for example, an opportunity to verify whether access to a reinforcer was allowed under the emission of an appropriate response or not (component nine). In that case, the provision of prompts appropriately (component four), for example, would not be possible to observe, since a correction procedure for the child would not be needed.

As to the intervention materials, which were used with the confederate and children with ASD, some stimuli were presented in cards, measuring 6 X 3 cm. The pictures depicted several categories, such as animals and transportation. Differential consequences for the learners, each programmed to be delivered contingent to correct responses in four different tasks, consisted of praise and access to games, toys and other preferred activities. The psychology interns used data sheets to map learner performance. An experimenter also used data sheets to measure the number of components completed correctly in each trial (performance accuracy to teach repertoires) by a given intern.

2.4 Procedure

Considering the role of BST in training staff to implement socially important procedures, and the goal of the current research as to teach Psychology interns in developing ABA interventions to a confederate and children with ASD with accuracy, this study was conducted in five steps (described as follows). The main dependent variable consisted of the percentage of components completed correctly during each of several discrete trials administered by a given intern (see Table 1). Data collection on components of trials occurred whenever a given intern tried to teach verbal and nonverbal repertoires to a confederate or child with ASD.

First step. Probe of performance accuracy. A week before the beginning of data collection, all of the interns had access to part of an ABA manual (Matos, 2016), which gives directions regarding the teaching of nonverbal and verbal repertoires to learners with ASD (for more information, the reader may consult the original book). The directions, which the participants needed to study, were related to the teaching of four repertoires: 1) audiovisual pairing (e.g., in an array with three different pictures, and after the instruction "show me dog", the learner touches the corresponding picture); 2) motor imitation (e.g., when the adult presents the model of the motor action consisting of touching the head, the child should replicate the model, by touching his/her own head); 3) tact/labeling (e.g., when the adult presents the picture of a car and asks "what is this?", the child verbally answers "car" out loud); 4) intraverbal/verbal interaction (e.g., when an adult asks "what flies in the sky?", and the child verbally answers "airplane").

After first week, during which access to the ABA intervention manual (Matos, 2016) was allowed, the interns had contact with a research assistant, a confederate who was going to pretend to act like a child with ASD. This happened throughout the entire study. Each intern had to teach the four already mentioned repertoires. The confederate followed a predetermined script of actions, so that, in some discrete trials administered by each intern, he responded correctly to demands and, in other trials, he responded incorrectly or did not respond, demanding correction procedures. The participants (interns) received data sheets with the purpose of collecting data on the confederate correct and prompted responses. They also received relevant materials for the interventions and reinforcers.

In the first step of probing, a participant tried to teach the four repertoires, by administering 12 discrete trials. Each of the repertoires was taught in three of the 12 trials and

the instructions were presented randomly. In each trial, the experimenter took data on the completion of up to 13 components, which served to measure the accuracy with which the teaching was implemented. During this step, the experimenter did not provide any kind of feedback regarding participant performance.

Second step. Baseline. The difference from previous step was the fact that participants taught the targets to the confederate through more than a block of trials. The experimenter also took data on participant performance accuracy. Like in a probe session, no feedback was given. Baseline condition was terminated once performance remained low in more than a block of trials.

Third step. BST training with immediate feedback. First, the experimenter sat with the confederate, pretending to teach targets through a block of 12 discrete trials, and each participant could observe them (modeling component). After that, the behavioral rehearsal component commenced. Each participant, as it happened in probe and baseline sessions, had to organize the necessary materials to teach targets to the confederate. Nevertheless, when teaching began, the experimenter, after each discrete trial, interrupted the participant to provide feedback as to his/her performance (behavioral rehearsal with immediate feedback). The participant was praised when conducted a given trial without any methodological flaws, but when flaws were observed, the experimenter explained them and, after this, demonstrated the correct way with the confederate (modeling component). Later, the intern had to administer the trial again with the confederate. The criterion to terminate this step of the study consisted of teaching a block of discrete trials with at least 90% of performance accuracy, that is, with minimal methodological flaws. It is important to emphasize that, besides all that was done so far, the experimenter also verbally oriented the interns how to teach all target repertoires, and also gave information on basic processes involved.

Fourth step. BST training with delayed feedback. The difference from the previous step was the fact that now each intern, when teaching target repertoires to the confederate, received feedback on his/her performance only after administering an entire block of trials. The experimenter praised the intern for the completion of components of discrete trials correctly during the teaching of repertoires, and explained possible methodological flaws committed. Then, the experimenter demonstrated the correct way by administering the trial to the confederate. As it happened in previous step, this one was terminated when the participant was able to teach a block of trials, exhibiting at least 90% of performance accuracy.

Fifth step. Probing generalization with a real child with ASD. Each participant taught the target repertoires to a real child with ASD, through one or more blocks of 12 discrete

trials. This was similar to the first step of the research, considering that the experimenter did not provide performance feedback to the participants during the teaching of targets. In case that performance accuracy for any participant was below 80% after teaching a child, BST training would be implemented, but that was not necessary.

2.5 Experimental design

A variation of multiple baseline design, multiple probe design (Cooper, Heron & Heward, 2006), was used to ensure experimental control of BST training on the completion of components of discrete trials correctly by the interns, during the teaching of the target repertoires to the confederate. Experimental control was established through pairs of participants. For each pair, the process was initiated with a probe to measure accuracy for both participants of a given pair. After that, a baseline condition was established for the first participant and, after observing that accuracy was kept low, an intervention condition consisting in BST with immediate feedback started. After the establishment of an arbitrary criterion to increase performance accuracy, the condition was terminated and another BST training with delayed feedback was established. Once the criterion of the new condition was achieved, a new probe was conducted with the second participant of the pair, with whom nothing else had been done so far. After that, all conditions that were programmed to the first participant (baseline, BST training with immediate feedback, and BST training with delayed feedback) were also established to the second participant of the pair. All conditions so far involved the participation of an adult confederate, who pretended to act like a child with ASD. After this whole process, a final probe to assess generalization of teaching target repertoires to a real child with ASD was conducted for both participants of the pair.

2.6 Ethical procedures

The undergraduate Psychology students, to whom BST training was implemented, signed an informed consent form for their participation in the research. The parents of the children, with whom generalization of teaching targets with accuracy was assessed, also signed a form for their participation. The study was approved by an ethics committee in research with humans (authorization No. 3.584.016) from CEUMA University, Brazil, São Luís-MA.

3. Results

The results of the study were organized for pairs of participants. They are presented in the following order: 1) first pair (P1 and P2); and 2) second pair (P3 and P4). Figure 1 shows the percentage of discrete trial components completed correctly (performance accuracy) by participants from first pair.

As it can be seen in Figure 1, both participants (P1 and P2) showed low percentage in accuracy in both probe and baseline sessions, when tried to teach nonverbal and verbal targets to a confederate. Until de end of baseline, P1 demonstrated 4.55% accuracy, and P2, 9.73%. During BST training with immediate feedback, P1 and P2 needed to administer five trial blocks to achieve the accuracy criterion. Until the end of this condition, P1 completed 97.44% of discrete trial components correctly and, P2, 91.62%. During BST training with delayed feedback, both participants needed only a block to reach criterion, but they had the opportunity of administering one or more trial blocks. Until the end of condition, P1 completed 98.83% of components correctly and, P2, 100%. In the end of data collection, a generalization probe of the teaching targets to a real child with ASD showed that both P1 and P2 completed 100% of discrete trial components correctly. Figure 2 shows the percentage of components completed correctly by P3 and P4 from second pair.

Figure 1. Percentage of discrete trial components completed correctly by P1 (upper graph) and P2 (lower graph).
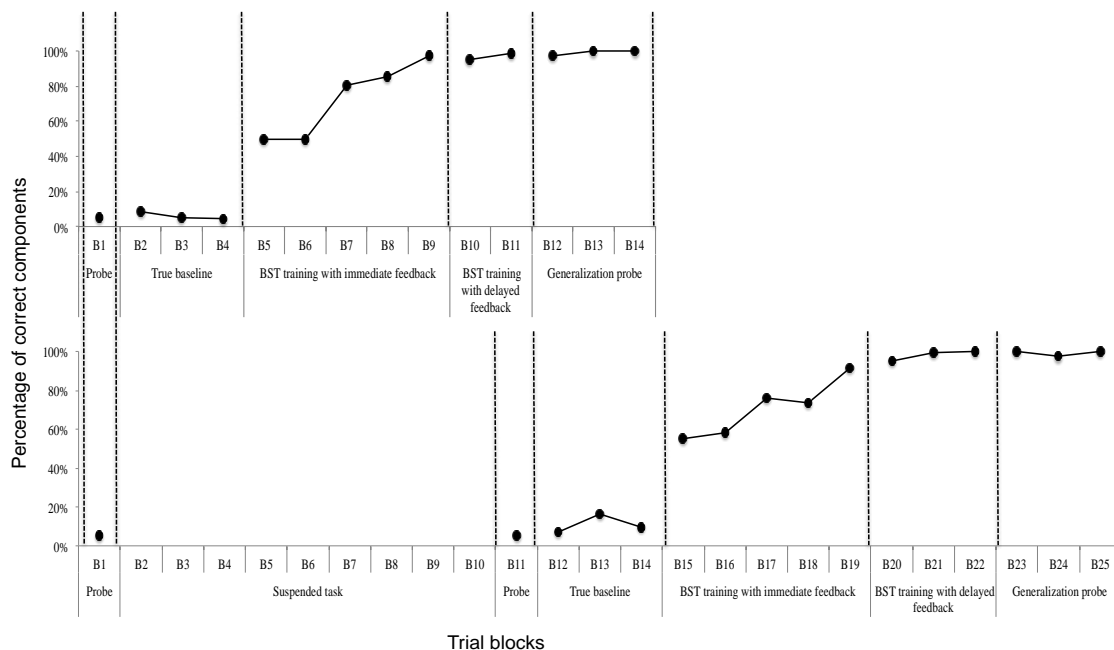
Source: Authors (2020).

Figure 2. Percentage of discrete trial components completed correctly by P3 (upper graph) and P4 (lower graph).
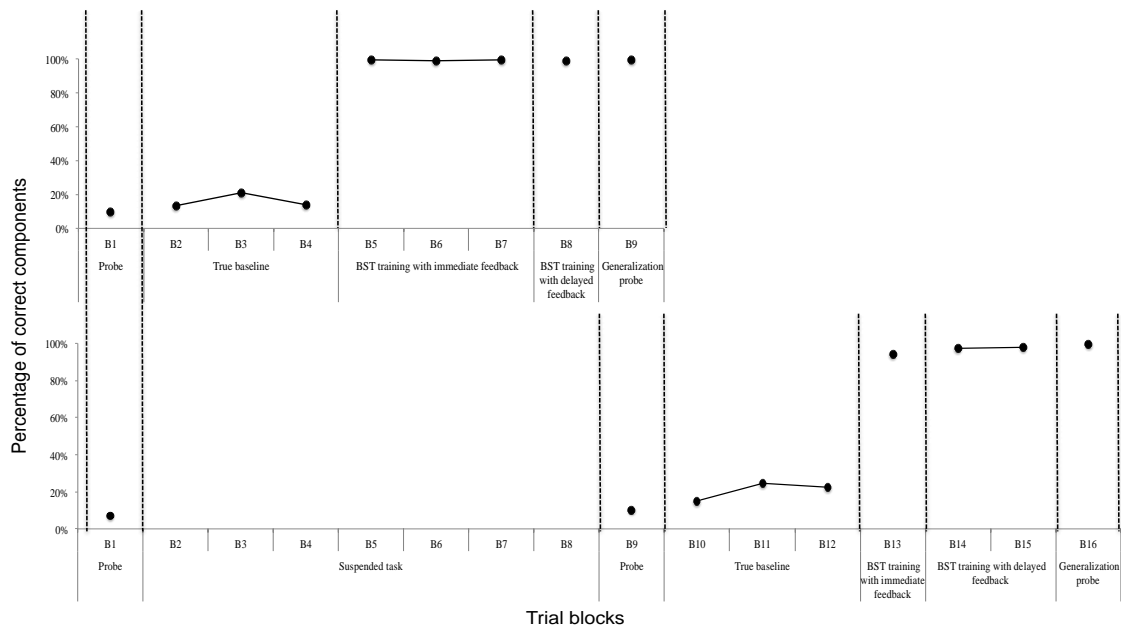
Source: Authors (2020).

According to Figure 2, P3 and P4 also presented low percentages in accuracy in probe and baseline sessions. Until the end of the condition, P3 completed correctly 13.66% of discrete trial components and, P4, 22,29%. During BST training with immediate feedback, both participants needed a single trial block to reach criterion, but P3 had the opportunity to administer two more blocks of discrete trial teaching to the confederate. Until the end of the condition, P3 completed 99.40% of components correctly and, P4, 94.23%. During BST training with delayed feedback, both participants also needed a single block to reach criterion. P3 completed 99.03% of components correctly and, P4, 98.08%. When probing generalization of teaching targets to a real child with ASD occurred, P3 and P4 completed correctly 99.52% and 100% of components, respectively.

4. Discussion

Data from the current research suggest that BST training was an effective approach in increasing performance accuracy for all participants, the four undergraduate Psychology students. Accuracy was low in probe and baseline sessions for all, but it increased considerably during BST training with both immediate and delayed feedback. Increases in

accuracy with which the teaching of targets was implemented to a confederate and a real child with ASD represented increases in number of discrete trial components completed correctly.

The research corroborated and extended what was produced in the literature, in the sense that the BST training resulted in increasing levels of performance accuracy for different populations (Sarakoff & Sturmey, 2004; Lerman et al., 2008; Lerman et al., 2013; Barnes, Mellor & Rehfeldt, 2014; Faggiani, 2014; Barboza et al., 2015; Lerman et al., 2015; Shireman, Lerman & Hillman, 2016; Ferreira, Silva & Barros, 2016; Barkaia, Stokes & Mikiashvili, 2017; Martone, 2017; Aureliano, 2018; Guimarães et al., 2018; Matos et al., 2019). It is important to consider that in the present research, none of the Psychology interns were familiar with ASD and Applied Behavior Analysis (ABA) to ASD, like the participants from the study conducted by Matos et al. (2019). It is believed that the initial probes to measure performance accuracy represented their first experience trying to teach nonverbal and verbal repertoires through discrete trial training (DTT).

Previously, Matos et al. (2019) conducted a study to assess the effects of BST training on undergraduate Psychology interns during the teaching of verbal repertoires to a confederate and a child with ASD. They were unfamiliar with ASD and ABA applied to ASD. However, since they were enrolled in a curricular internship in the laboratory where data collection happened, the first month was observational, and the participants were able to watch ABA sessions conducted with children with ASD by well-trained voluntary interns, under supervision practice. This variable was possibly responsible for high baseline levels, regarding the accuracy with which the participants taught verbal targets to a confederate.

In the current research, an effort was made to control this variable. In the very beginning of the internship, the conditions of the study were conducted with the four undergraduate Psychology students who participated. During this time, they were not allowed to watch sessions conducted with children with ASD in the laboratory. Baseline levels regarding performance accuracy, in teaching nonverbal and verbal targets to a confederate, were low probably because of this and were different when compared to the previous study. When BST training with both immediate and delayed feedback was implemented, all participants showed considerable higher levels of performance accuracy, reaching the established arbitrary criteria of the research. The design implemented in the study suggested establishment of experimental control by the BST training components. Not only did BST increased levels of performance accuracy during the teaching of targets to a confederate, who pretended to behave like a child with ASD, but it also produced generalization of teaching

targets with accuracy to a real child with ASD, which represents the most important result of the research, replicating the previous one, conducted by Matos et al. (2019).

It is important to mention some limitations of the study. First of all, although the participants were not allowed initially to watch ABA sessions to children with ASD in the beginning of their internship, it is possible that they talked about ABA procedures among them and to the well-trained interns who conducted discrete trial teaching in the laboratory regularly. Anyway, these voluntary interns were told to not comment anything about the BST training and procedures to the children. Even if this contact was established, baseline levels of accuracy remained low. Another limitation refers to the probes conducted with children with ASD to measure generalization. From an experimental point of view, it would be important to conduct probes before and after the implementation of BST training. However, just like what happened in previous research (Matos et al., 2019), probes with real children with ASD were only conducted after training and this happened because, from an ethical point of view, it would not be appropriate to let a person, who was a beginning learner, conduct discrete trial teaching to someone with atypical development.

Although generalization probes were conducted more than once by two of the participants (P1 and P2), they did not have the opportunity to continue the teaching of targets to the child with ASD thereafter. This was also the case in the study conducted by Matos et al. (2019). Future research could assess the acquisition of new repertoires in learners with ASD, through the teaching implemented by undergraduate students who were participants in BST training conditions.

In this research, only one experimenter collected data per session. Since there was not a second observer to take data as well, and sessions were not videotaped, inter-observer agreement measures were not possible. However, people who collected data were well-trained students with high accuracy levels in ABA procedures applied to learners with ASD. Despite this and other methodological limitations discussed, data in the current study highly suggest BST training effectively increased participant performance accuracy and ensured generalization of DTT with learners with ASD. Like in the previous study (Matos et al., 2019), it is undeniable that BST training is socially relevant. Brazil demands more qualified professionals to implement evidence-based procedures to favor acquisition of important repertoires in learners with ASD. The University is the ultimate institution to produce science and train future professionals in socially relevant evidence based procedures (Faggiani, 2014; Matos & Matos, 2017; Aureliano, 2018; Hübner et al., 2018).

The authors of the current research agree with the previous literature, regarding the efficacy of a BST package to especially train undergraduate Psychology students in implementing the teaching of non-verbal and verbal repertoires, through DTT to learners with ASD. The literature demonstrated that BST was effective with different populations, and experimental control was demonstrated. Data from the current study replicated and extended previous literature, regarding the training of interns through DTT. Besides the demonstration of experimental control, this study was also socially relevant, since Brazil is a country with many children diagnosed with ASD, and to whom ABA teaching procedures may be very beneficial. Although methodological limitations are reality for experimental research in general (the current one was no exception), the data suggested the relevance of BST in the context of a University. Since it represents an institution were learners have the opportunity to develop skills to produce socially relevant behavior changes, it is believed that, through the University, students interested in ABA applied to ASD will possibly attenuate, in the future, the issue of the lack of well-trained professionals.

5. Final Considerations

The contribution of this article refers to the development of teaching skills in undergraduate Psychology interns through BST, who may in the future become well-trained professionals to conduct interventions based on ABA to learners with ASD, who demand special teaching procedures. Becoming a good practitioner in the field demands effective training, and a significant body of research strongly recommend the BST components as the best way to develop skills to teach. Plus, the University plays an important role in the training process. The two learners with ASD involved in the study were also greatly benefited, since two of the undergraduate interns who were trained through BST in the study, became volunteers later, helping developing the children in several domains. This also had implications to the children's families, since the quality of relationship among them tended to improve.

The objectives of the study were achieved: the BST training package increased performance accuracy beyond 90% in all of the four participants, when they were teaching targets to a confederate. Besides, accuracy beyond 90% was also verified during the teaching of targets to real children with ASD (generalization). It is important to remind that, baseline levels of accuracy were extremely low for all participants in the beginning, and that a multiple

probe design strongly suggested the establishment of experimental control of the IV, the BST components, over the teaching of targets accurately.

Results of the current study corroborate the findings in the previous literature, on training staff through BST to implement the teaching of nonverbal and verbal repertoires to learners with ASD. Data also suggested that BST training influenced a generalization process of the teaching with high accuracy, involving real children with ASD.

Although the research involved some methodological limitations, its social relevance represents an important aspect, considering that training future professionals accurately in university context is an appropriate way to favor the provision of high quality services for learners with ASD and all society.

Finally, it is important to mention that, although data from the current research strongly suggest that BST effectively increased performance accuracy during the teaching of targets to a confederate, and that accuracy generalized during the teaching to real children with ASD, a very limited number of sessions were conducted with the children. In that sense, it was not possible to measure appropriately skill acquisition by the children with ASD. Future research could evaluate the acquisition of repertoires by the children, along several maintenance teaching sessions conducted by undergraduate interns.

References

American Psychiatry Association (2013). *Diagnostic and statistical manual of mental disorders - DSM-5 (5th.ed).* Washington: American Psychiatric Association.

Allen, K.D., & Cowan, R. J. (2008). *Naturalistic teaching procedures.* In: Luisell, J. K., Russo, D.C., Christian, W. P., & Wilczynski, S. M. (Eds.). Effective practices for children with autism (pp. 240-270). New York: OXFORD.

Aureliano, L. F. G. (2018). *O uso da análise de sistemas comportamentais para o aprimoramento dos serviços prestados pelo Centro para o Autismo e Inclusão Social (CAIS-USP).* Tese (Doutorado em Psicologia Experimental) – Universidade de São Paulo.

Baer, D. M., Wolf, M. M., & Risley, T. R. (1968). Some current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis, 1,* 91-97.

Barboza, A. A., Silva, A. J. M., Barros, R. S., & Higbee, T. S. (2015). Efeitos de videomodelação instrucional sobre o desempenho de cuidadores na aplicação de programas de ensino a crianças diagnosticadas com autismo. *Acta Comportamentalia, 23,* 405-421.

Barbera, M. L. (2007). *The verbal behavior approach: how to teach children with autism and related disorders.* London and Philadelphia: Jessica Kingsley Publishers.

Barkaia, A., Stokes, T. F., & Mikiashvili, T. (2017). Intercontinental telehealth coaching of therapists to improve verbalizations by children with autism. *Journal of Applied Behavior Analysis, 50,* 582-589.

Barnes, C. S., Mellor, J. R., & Rehfeldt, R. A. (2014). Implementing the verbal behavior milestones assessment and placement program (VB-MAPP): Teaching assessment techniques. *The Analysis of Verbal Behavior, 30,* 36-47.

Cooper, J.O., Heron, T.E., & Heward, W. L. (2006). *Applied behavior analysis.* Second edition. New Jersey: Pearson Merry Prentice Hall.

Deleon, I.G., & Iwata, B.A. (1996). Evaluation of a multiple-stimulus presentation format for assessing reiforcer preferences. *Journal of Applied Behavior Analysis, 29,* 519-533.

Faggiani, R. B. (2014). *Análise de componentes de um tutorial computadorizado para ensinar a realização de tentativas discretas.* Tese (Psicologia Experimental) – Universidade de São Paulo.

Ferreira, L. A., Silva, A. J. M., & Barros, R. S. (2016). Ensino de aplicação de tentativas discretas a cuidadores de crianças diagnosticadas com autismo. *Perspectivas em Análise do Comportamento, 7,* 101-113, 2016.

Greer, R. D., & Ross, D. E. (2008). *Verbal Behavior Analysis: Inducing and expanding complex communication in children with severe language delays.* Boston: Allyn & Bacon.

Guimarães, M. S. S., Martins, T. E. M. M., Keuffer, S. I. C., Costa, M. R. C., Lobato, J. L., Silva, A. J. M., Souza, C. B. A., & Barros, R. S. (2018). Treino de cuidadores para manejo de

comportamentos inadequados de crianças com transtorno do espectro do autismo. *Revista Brasileira de Terapia Comportamental e Cognitiva, 20,* 40-53.

Hübner, M. M. C., Sousa, M. V. A. B., Tardem, F., & Hübner, L. (2018). *Terapia comportamental para autismo: Análise do comportamento aplicada* [Behavioral Therapy for Autism: Applied Behavior Analysis]. Em: S.B. Meyer (Ed.), Tratado de Psicologia Clínica. São Paulo: Atheneu.

Lerman, D.C., Hawkins, L., Hillman, C., Shireman, M., & Nissen, M. A. (2015). Adults with autism spectrum disorder as behavior technicians for young children with autism: Outcomes of a behavioral skills training program. *Journal of Applied Behavior Analysis, 48,* 233-256.

Lerman, D.C., Hawkins, L., Hoffman, R., & Caccavale, M. (2013). Training adults with an autism spectrum disorder to conduct discrete trial training for young children with autism. A pilot study. *Journal of Applied Behavior Analysis, 46,* 465-478.

Lerman, D.C., Tetreaut, A., Hovanetz, A., Strobel, M., & Garro, J. (2008). Further evaluation of a brief, intensive teacher-training model. *Journal of Applied Behavior Analysis, 41,* 243-248.

Lovaas, O. I. (2003). *Teaching individuals with developmental delays.* Austin, TX: Pro-Ed.

Martone, M. C. C. (2017). *Tradução e adaptação do verbal behavior milestones assessment and placement program (VB-MAPP) para a língua portuguesa e a efetividade do treino de habilidades comportamentais para qualificar profissionais.* Tese (Doutorado em Psicologia) – Universidade Federal de São Carlos.

Matos, D.C. (2016). *Análise do comportamento aplicada ao desenvolvimento atípico com ênfase em autism.* Porto Velho: AICSA.

Matos, D.C., & Matos, P. G. S. (2017). Assessment, intervention and consulting in school psychology in children with autism: LAPITEA laboratory in Brazil. *Psychology, 8,* p. 1774-1801.

Matos, D.C., Serejo, I. M. O., Araújo, C. X., Souza, D. G. S., Araujo, P. M. S., Rubim, A. L., & Araújo, A. K. (2019). *Capacitação para o ensino de repertories não verbais e verbais em crianças com autismo.* Trabalho apresentado no XXVIII Encontro Brasileiro de Psicologia e Medicina Comportamental. Centro de Convenções de Goiânia.

Pereira, A.S., Shitsuka, D.M., Parreira, F.J., & Shitsuka, R. (2018). *Metodologia do trabalho científico.* Santa Maria: UAB / NTE / UFSM.

Sarokoff, R. A., & Sturmey, P. (2004). The effects of behavioral skills training on staff implementation of discrete trial teaching. *Journal of Applied Behavior Analysis, 37,* 535-538.

Shireman, M. L., Lerman, D.C., & Hillman, C. B. (2016). Teaching social play skills to adults and children with autism as an approach to building rapport. *Journal of Applied Behavior Analysis, 49,* 512-531.

Skinner, B.F. (1957). *Verbal behavior.* New York: Appleton-Century-Crofts.

Sundberg, M. L., & Partington, J.W. (1998). *Teaching language to children with autism or other developmental disabilities.* Danville, CA: Behavior Analysts, Inc.

Sundberg, M. L. (2008). *The verbal behavior milestones assessment and placement program: the VB-MAPP.* Concord, CA: AVB Press.

Percentage of contribution of each author in the manuscript

Daniel Carvalho de Matos – 40%

Flor de Maria Araujo Mendonça Silva – 15%

Wellyson da Cunha Araújo Firmo – 15%

Pollianna Galvão Soares de Matos – 30%