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Development and learning center: An interdisciplinary case study in applied behavior analysis

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Abstract

Autism spectrum disorder (ASD) affects different areas of development. The application of behavior analysis by an interdisciplinary team of professionals has shown promising results. The aim was to describe an interdisciplinary case study, involving an intervention with a child with ASD, designed using the principles of behavior analysis. The procedure involved five phases: evaluation of the child's repertoire, interdisciplinary meeting, curriculum implementation, parent training, and weekly interdisciplinary meetings. The results section presents the evaluation data, organization of the curriculum, and analysis of the case study, drawing on the notion of interlocking behavioral contingencies. Each team member in their specific area of expertise played an important role in designing a structured, individualized, varied curriculum. This experience provides an initial reflection on the design and implementation of interventions for children with ASD, involving their parents and professionals.

Keywords: autism; Applied Behavior Analysis; curriculum; development; interdisciplinary team.

CENTRO DE APRENDIZAGEM E DESENVOLVIMENTO: ESTUDO DE CASO INTERDISCIPLINAR EM ABA

Resumo

O transtorno do espectro autista (TEA) acomete as diferentes áreas do desenvolvimento. A aplicação da Análise do Comportamento Aplicada (ABA) por diferentes profissionais tem demonstrado resultados promissores. O objetivo foi descrever um estudo de caso interdisciplinar delineado nos princípios analítico-comportamentais, a partir de uma intervenção aplicada com uma criança com TEA. O procedimento envolveu cinco fases: avaliação do repertório da criança com TEA, reunião interdisciplinar, aplicação do currículo, formação dos pais e novamente reunião interdisciplinar. Os resultados apresentam os dados de avaliação da criança com TEA, a organização do currículo e uma análise do estudo de caso, a partir do entrelaçamento de contingências comportamentais. Cada profissional da equipe, em sua área de atuação, colaborou para a construção, aplicação e análise do currículo de ensino estruturado, individualizado e diversificado, o que gerou reflexões, ainda que embrionárias, sobre esse tipo de organização de intervenção, envolvendo os profissionais, pais e a criança com TEA.

Palavras-chave: autismo; Análise do Comportamento Aplicada; currículo; desenvolvimento; equipe interdisciplinar.

CENTRO DE APRENDIZAJE Y DESARROLLO: ESTUDIO DE CASO INTERDISCIPLINARIO EN ANÁLISIS APLICADA DE LA CONDUCTA

Resumen

El trastorno del espectro del autismo (TEA) acomete las diferentes áreas del desarrollo. El Análisis Aplicada de la Conducta (ABA) por diferentes profesionales ha demostrado resultados prometedores. El objetivo fue describir un estudio de caso interdisciplinario delineado en los principios analíticos-comportamentales, a partir de una intervención aplicada con un niño con TEA. El procedimiento involucró cinco fases: evaluación del repertorio del niño, reunión interdisciplinaria, aplicación de los currículos, capacitación de los padres y nuevamente reunión interdisciplinaria. Los resultados presentan los datos de evaluación del niño, la organización del currículo y un análisis del estudio de caso, a partir del entrelazamiento de contingencias comportamentales. Cada profesional del equipo, en su área de actuación, colaboró para la construcción, aplicación y análisis del currículo de enseñanza estructurado, individualizado y diversificado, lo que generó reflexiones, aunque embrionarias sobre ese tipo de organización de intervención, involucrando a los profesionales, padres y el niño con TEA.

Palabras clave: autismo; Análisis Aplicada de la Conducta; currículo; desarrollo; equipo interdisciplinario.

1. Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental disorder and presents these defining characteristics: impairment in reciprocal social communication and restricted and stereotyped interests (American Psychiatry Association [APA], 2013). Idiosyncratic development triggered by ASD causes specific changes in the sequence and quality of development, which hinders the implementation of effective interventions. Due to deficits in language and difficulties related to social behavior, teaching students with ASD in mainstream classrooms is perceived as a challenge by teachers (Rodrigues, Moreira, & Lerner, 2012).

As a disorder that affects various areas of development, ASD requires comprehensive programs that teach different behaviors to enhance autistic children's development (Bagaiolo et al., 2017; Carvalho, Paula, Teixeira, Zaquero, & D'Antino, 2013; Higbee, 2012). In this sense, joint working between different professionals brings a greater breadth of knowledge to interventions (Velloso et al., 2011), par-

ticularly when it involves interdisciplinary collaboration in the evaluation and definition of teaching programs for each area of development. In this respect, it is important to stress that Article 2 of Brazil's national policy for the protection of the rights of people with ASD (Brasil, 2012) provides that students with ASD have the right to multiprofessional services. An interdisciplinary approach fosters collaborative working (Curtis et al., 2006). The involvement of different professionals, including regular and special education teachers and specialists from different areas (psychology, speech therapy, occupational therapy, physiotherapy, among others) facilitates the inclusion of students who have special educational needs (Smith, 2008), particularly those with ASD. Moreover, it provides the opportunity to involve a range of interlocking behavioral contingencies that comprise a cultural practice (Glenn, 1988).

Joint working is essential for elaborating individualized curriculums that address the specific needs of each student with ASD. Through the application of the principles of behavior analysis (Cooper, Heron & Heward, 2007), interdisciplinary teams can propose systematic and gradual procedures for teaching pre-verbal and verbal skills that identify the controlling variables of specific behaviors and classes of socially significant behavior (e.g. functional use of language over aggressive behavior). From this perspective, it is possible to identify the skills that need to be taught and those that could be minimized from the repertoire of each person with ASD.

Concerning people with ASD, using the Applied Behavior Analysis (ABA) has produced promising results in the treatment of these people, using procedures derived from scientifically proven principles of behavior (Cooper et al., 2007). These principles are applied to teach specific behaviors and assess possible behavioral changes, in order to verify whether the procedures employed were responsible for the improvement in behavior. The term "applied" refers to the teaching of behaviors which are socially important in their usual verbal community (Baer, Wolf, & Risley, 1968).

A growing body of evidence suggests that early intensive behavioral intervention using ABA catalyzes intellectual and verbal development in children with ASD, with particularly promising results for children under three years of age (Cooper et al., 2007; Maurice, Green, & Luce, 1996). Dating back to the 1980s, various studies have shown that intensive behavioral intervention is an effective treatment

for students with ASD, being capable of teaching specific behaviors that enhance various aspects of autistic children's development. This requires 16 to 40 hours of one-to-one instruction – i.e. a teacher-child ratio of 1:1 – per week, for at least two consecutive years (Gomes, Souza, Silveira, & Oliveira, 2017; Lovaas, 1987).

For ABA interventions to be effective they should start early, be intensive (frequency of sessions), carried out systematically, with a focus on generalization and individually tailored goals, promote parent participation and training, and be focused on social and communication domains (Cooper et al., 2007; Maurice et al., 1996). Studies have shown that using ABA with students with ASD can promote improvements in behavior even when early intensive behavioral intervention is not possible. By offering the opportunity to teach specific behaviors, it can reduce behavioral excesses, improving the quality of life of both the children and their carers (Brasiliense, Flores, Barros, & Souza, 2018; Campbell, 2003; Gomes et al., 2017; Guimarães et al., 2018).

The US National Research Council (2001) recommended that children with ASD should receive a minimum of 25 hours of intervention per week, which is similar to regular school hours. Furthermore, it is recommended that programs should provide instruction on a one-to-one basis or in very small groups with personalized curriculums.

This type of intervention requires a team of professionals with a mutual goal and knowledge and experience of curriculum evaluation, design, implementation, and analysis. To ensure the conditions necessary for effective interventions, such as the minimum number of intervention hours and generalization of teaching, a number of strategies have been developed to involve significant others in interventions, notably providing parents and teachers with the necessary knowledge and skills to become effective agents of education. Using a multiple baseline design, Guimarães et al. (2018) carried out an evaluation of a training initiative for carers of children with ASD, covering a range of teaching procedures (video modeling, written instruction and role play with immediate feedback etc.) aimed at minimizing inappropriate behavior in children with ASD. The findings showed that the initiative was effective due to the number of sessions needed by the carers to meet the learning criterion in each stage of the proposed education program. A study conducted by Gomes et al. (2017) evaluated the effect of an intensive behavioral intervention with children with ASD implemented by carers and professionals with 15 intervention hours per week,

making comparisons before and after the intervention. The post-test data showed that the children made significant gains in developmental areas.

Considering that behaviors vary greatly across the autism spectrum (APA, 2013), and the need to guarantee the right to multiprofessional services (Brasil, 2012), in order to produce effective interventions that enhance the quality of life of children with ASD, and the effectiveness of teaching procedures derived from behavior-analytic principles, this account of professional experience describes an interdisciplinary case study based on an intervention implemented with a child with ASD applying the principles of behavior analysis.

2. Method

2.1 Participants

The interdisciplinary team consisted of three psychologists (one with a degree in pedagogy and doctorate degree, and the other one was a specialist in educational psychology), one occupational therapist with a master's degree, and a speech therapist, also a specialist in educational psychology. All professionals had knowledge of ABA, enabling the joint design, implementation, and analysis of curriculums to be tailored to the specific needs of the participating child. The intervention was implemented with a three-year old child diagnosed with ASD.

2.2 General procedure of the case study

The intervention was planned on a weekly basis, in team meetings. The case study was conducted in five phases, as follows. First, the team met to evaluate the child's repertoire using two evaluation instruments (phase 1). A meeting was then held to analyze the assessment data and plan the personalized curriculum (phase 2). The curriculum was then implemented by the team (phase 3), simultaneously with parent training (phase 4). Finally, an interdisciplinary meeting was held on a weekly basis during the course of the case study to analyze the curriculum (phase 5).

2.2.1 Phase 1: Evaluation of the child's initial repertoire (baseline)

A systematic evaluation was conducted to establish a baseline for each target behavior to be taught using the following two instruments:

- The Verbal Behavior Milestones Assessment and Placement Program – VB-MAPP (Sundberg, 2008): conducted to assess the child's initial performance on a set of verbal and social skills to provide data to track the acquired skills and to create a model for curriculum planning.
- The Portage Inventory Operationalized (PIO): used to evaluate five areas of development: language, cognition, socialization, self-care skills, and motor development (Williams & Aiello, 2001).

2.2.2 Phase 2: Interdisciplinary meeting for the planning of personalized curriculum for the target child of the study with ASD

A team meeting was held to analyze the data obtained from the above evaluations and to plan the curriculum. The intervention encompassed five areas of development: learner readiness skills, language, socialization, self-care skills, and motor development. In this way, the teaching program addressed the child's individual needs based on the data obtained from the evaluations.

2.2.3 Phase 3: Implementation of the curriculum by the team

The family decided that the child would attend the intervention program 20 hours per week, with the agreement that the parents would also implement the curriculum at home, thus, ensuring a minimum of 30 hours of intervention per week.

In the sessions, the child was taught one or more of the skills from the different areas of development outlined above by the same professional, thus, adopting an interdisciplinary approach, rather than a multidisciplinary approach, in which one professional teaches a single specific area of development.

The following materials were used: recording forms for each of the curriculums, a pencil, blank sheets of paper, books, a computer, learning games (memory games, dominoes, modeling clay, painting materials, etc), and other materials used for specific tasks on the curriculum.

2.2.4 Phase 4: Parent training

Phase 4 and phase 3 occurred simultaneously. The aim of this phase was to engage the parents in the intervention, so that the activities could also be applied at home, thus, ensuring that the minimum number of intervention hours was achieved. At the end of each activity, parents were instructed to fill in a form

containing instructions on how to apply the activity and two fields: Y, meaning yes, which was marked if the child did the activity correctly without any help; and N, meaning no, which was marked when the child gave incorrect responses. When N was marked, parents were instructed to help the child.

2.2.5 Phase 5: Interdisciplinary meeting to analyze the curriculum

A weekly team meeting was held to analyze the data and replan the curriculum as necessary. An interdisciplinary approach was taken, in which decisions were made jointly with each professional playing an important role in identifying appropriate goals and teaching techniques according to their area of expertise. In this way, it was possible to develop a varied curriculum that met the child's specific needs and weaknesses.

Based on the performance of the child in the weekly interventions, one of three decisions were taken: 1. to increase the difficulty level of the skill taught, when the child met the learning criterion; 2. to decrease the difficulty level, when the child failed to respond to the task; and 3. to maintain the same level of difficulty when there was a wide variability of responses. This method allowed the team to adapt the curriculum, on a weekly basis, to the child's own pace of learning for each area of development.

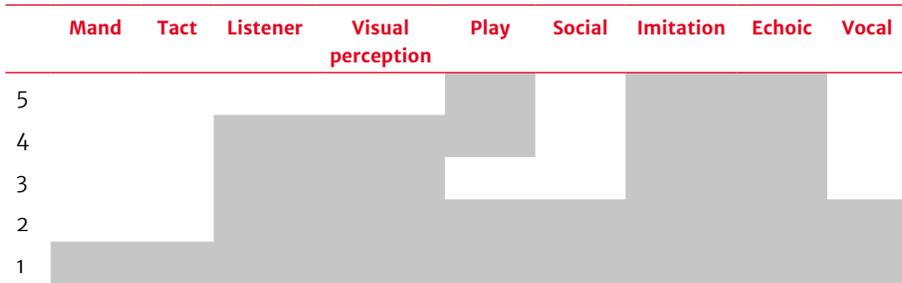
2.3 Data analysis

A descriptive analysis of the data was performed, specifying each stage of the case study and the curriculum design based on the child's performance in the VB-MAPP PIO.

3. Results and discussion of the professional experience

The target of data analysis was the interdisciplinary case study model based on analytical-behavioral principles. Considering the behavioral variability of the diagnosis of ASD (APA, 2013) and the right of the public with this disorder to multi-professional care (Brazil, 2012), it is justified the involvement of different professionals, from the same perspective of action, following the analytical-behavioral principles. The first phase of the case study referred to the application of two evaluations by the professional team mentioned. The application and analysis of data from VB-MAPP (Sundberg, 2008) and OPI (Williams & Aiello, 2001) were the first

steps of the intervention and the main theme of the first interdisciplinary meeting. The results of the assessment conducted using the VB-MAPP are shown in Figure 3.1.



Subtitle: Mand: item 1 – emits two words, signs, or PECS, but may require echoic, imitative or other prompts, but no physical prompts. Tacts: item 1 – tacts two items with echoic or imitative prompts. Listener: item 1 – attends to speaker’s voice by making eye contact with the speaker five times, item 2 – responding to hearing his own name five times, item 3 – looks at, touches, or points to the correct family member, pet or other reinforce when presented in an array of two for five different reinforcers, item 4 – performance of four different motor actions on command, without a visual prompt. Visual perception: item 1 – visually tracks moving stimuli for two seconds, five times, item 2 – grasp small objects with thumbs, index finger, and middle finger (pincer grasp) five times, item 3 – visually attends to a toy or book for 30 seconds (not a self-stim item), item 4 – places three items in a container, stacks three blocks or places three rings on a peg for two of these or similar activities. Play: item 1 – manipulates and explore objects for one minute, item 2 – shows variation in play by independently with five different items, item 4 – independently engages in movement play for two minutes, item 5 – independently engages in cause-and-effect play for two minutes. Social: item 1 – makes eye contact as a type of mand five times, item 2 – indicates that he wants to be held or physically played with two times. Imitation: item 1 – imitates two gross motor movements with prompt, item 2 – imitates four gross motor movements with prompt, item 3 – imitates eight gross motor movements, item 4 – spontaneously imitates the motor behavior of others on five situations, item 5 – imitates 20 motor movements of any type (fine motor, gross motor or imitation with objects). Echoic: item 1 – immediately echo two vowel and consonant phonemes, alone or in simple combinations, item 2 – immediately echo five vowel and consonant phonemes, alone or in simple combinations, item 3 – immediately echo ten vowel and consonant phonemes, alone or in simple combinations, item 4 – immediately echo 15 vowel and consonant phonemes, alone or in simple combinations, item 5 – immediately echo 20 to 25 vowel and consonant phonemes, alone or in simple combinations. Vocal: item 1 – spontaneously emits an average of five sounds each hour, item 2 – spontaneously emits five different sounds, an average of 10 total sounds each hour.

Figure 3.1. Target Child’s Performance in VB-MAPP’s Level 1.

Figure 3.1 shows the verbal behaviors evaluated by the VB-MAPP Level 1, which corresponds to the skills expected for children without disabilities or disorders aged between 0 and 18 months of age. At level 1, the child is tested for the following verbal skills: Mand (antecedent: establishing operation; response: vocal or gestural; consequence: specific reinforcer), Tact (antecedent: non-verbal; response: vocal or gestural; consequence: social reinforcer), Echoic (antecedent: ver-

bal (generally auditory); and response: vocal or gestural (topographically identical to the antecedent); consequence: social reinforcer) (Catania, 1999). An example of mand is when a thirsty child asks for water and is given water (specific reinforcer), while an example of tact is when a child names an object in the presence of that object. The echoic refers to the repetition of a vocal or gestural stimulus, immediately after requesting the antecedent stimulus. The child's repertoire of the verbal behaviors mand, tact and echoic corresponded to that of the 0 to 18-month age group. This data was vital for defining teaching programs for readiness skills, such as following instructions, making eye contact when the child's name is called, imitating facial expressions, and using blocks with different shapes and colors.

The results of the PIO showed that the child's development corresponded to that of the 1 to 2-year-old age group in the areas of socialization, motor development, and self-care skills and the 0 to 1-year-old age group in the areas cognition and language. Based on the results of the VBMAPP Level 1 and PIO, the curriculum was designed considering the specific aspects of development that the child needed to learn, and strategies to promote learning, including the selection of appropriate reinforcers. The team decided that the cognition tasks would be initiated once the child demonstrated improvement in readiness skills.

The team prioritized readiness and imitation skills, because they are a necessary prerequisite for learning various behaviors, particularly since imitation is regarded as a higher order behavior (Catania, 1999). Given the importance of these skills, they were taught, not only in programs addressing imitation and readiness skills, but also in those dealing with motor, self-care skills, social, and language skills. The curriculum designed by the team during an interdisciplinary meeting (phase 2 of the procedure), based on the assumptions proposed by Higbee (2012) and Maurice et al. (1996) is shown in Table 3.1.

Table 3.1. Curriculum designed for target child during interdisciplinary meeting.

	Program's focus	Program description
Pront.	1) Follow Instructions	1) The Trainer shows the favorite item on the table, then asks the child: "Give", "point", "Show"
	2) Teach the child to keep eye contact when his name is pronounced	2) The trainer calls the child's name and keeps eye contact for at least 3 seconds
Imitation	3) Facial expressions reproduction (oral and motor)	3) The trainer makes a facial expression, then asks the child to reproduce it
	4) reproduction using building blocks with different shapes and colors	4) The Trainer makes a construction using the building blocks, then asks the child to reproduce it
Language	5) Body's part identification (receptive)	5) The Trainer asks the child to point the target body part
	6) Relatives photos identification (receptive)	6) The Trainer shows three photos of relatives, then asks the child to choose the target photo
	7) House rooms identification (receptive)	7) The Trainer shows three pictures of rooms in their houses, then asks the child to choose the target picture
	8) Picture identification from word dictation (receptive)	8) The Trainer shows three pictures, then asks the child to choose the target word
	9) Echo phrase with one and two words	9) The Trainer asks the child to repeat the target word
	10) Echo favorite songs' phrase	10) The Trainer asks the child to repeat the favorite songs' target phrase
Social	11) Teaching to play with toy manipulation and sounds emission	11) The Trainer shows car or plane toys, then asks the child to play coordinating action and sounds
	12) Say "Hi" and "Bye"	12) The Trainer says "Hi" or "Bye", then asks the child to repeat
Self-care	13) Unfurl: peeing in the toilet	13) The Trainer drives the child to the bathroom every 40 minutes
	14) Undress the underwear	14) The Trainer wears the underwear on the child, then asks him/her to undress
	15) Undress the pants	15) The Trainer wears the pants on the child then asks him/her to undress
Motor	16) Make draw on a paper sheet	16) The Trainer asks the child to draw horizontal and vertical lines, and circles on a paper sheet
	17) Hold the ball	17) The Trainer throws a ball to the child then asks him/her to hold it
	18) Throw the ball	18) The Trainer holds the child's hands while him/her holds a ball then asks him/her to throw it to someone else

Imitation skills were addressed by teaching programs in the areas of language (echoic), socialization (imitate playing with objects), and motor development (imitating simple lines on paper). By imitating, the child acquires a repertoire for responding to different environmental demands. As a differentially reinforced response class, generalized imitation is regarded as a higher order behavior (Catania, 1999). This variety of imitations, involving different areas of development, was programmed in the weekly team planning meetings. Each professional, in their specific area of expertise, plays an important role in designing a structured, individualized, varied curriculum.

Once the team had designed the curriculum and teaching programs, the child's responses were recorded and analyzed weekly. Once the child met the learning criterion, the team designed new programs, which were introduced into the curriculum. When the child demonstrated slow progress (three consecutive sessions in which the child failed to meet the learning criterion or with less than 30% correct responses), the team analyzed the factors that may be contributing to the child's poor progress in behavior acquisition and made the necessary adjustments to the teaching program. The dynamic of the weekly analysis of the curriculum and the child's responses resulted in faster and more effective teaching. It is important to stress that the child showed delayed development and, therefore, the development of a curriculum that permits the fast and effective acquisition of skills was of paramount importance.

Apart from the benefits for the child's learning and development, the team meetings allowed the professionals to enhance their technical, theoretical, and intervention skills, which enhanced the effectiveness of teaching programs. During the weekly meetings, the team also designed the teaching programs implemented by the parents. The programs were designed to promote the generalization and maintenance of skills and to strengthen parent-child bonding. The parents received training on how to implement the teaching programs during the intervention sessions and provided the team with the responses of the programs they implemented on a weekly basis. These responses were also analyzed at the weekly team meetings.

Interdisciplinary team working fosters collaborative working (Curtis et al., 2006) and values the specific experience and expertise of each professional. Usually, a multidisciplinary team organizes its work around the specific expertise of each

professional, meaning that the speech therapist is responsible for the language program, the occupational therapist is responsible for the motor development and self-care skills program, the psychologist is responsible for the social skills program, and the education specialist is responsible for the cognitive, or more particularly, academic tasks. This logic is superseded in the interdisciplinary team, as each team member can contribute to and implement teaching programs that involve tasks from different areas of development outside their specific area of expertise.

Interdisciplinary working may be regarded as a cultural practice involving a range of interlocking behavioral contingencies (Glenn, 1988). Examples of this include the behavior of the professionals who design the curriculum, the child who responds to the teaching programs, the parents who continue intervention at home in a natural context, and other promising behaviors that determine the child's learning. In this way, it is possible to understand the behavior of each educational agent in this context, maintained by individual contingencies, which, taken together, comprise the cultural practice described by Glenn (1988) (Martone & Todorov, 2007; Naves & Vasconcelos, 2008).

Using this perspective, Figure 3.2 outlines the interlocking behavioral contingencies present throughout the case study, from the behavior of the interdisciplinary team in programming the curriculum, assessment, and learning criteria, to that of the professional and the parents during the implementation of the sessions, and of the child in undertaking the sessions.

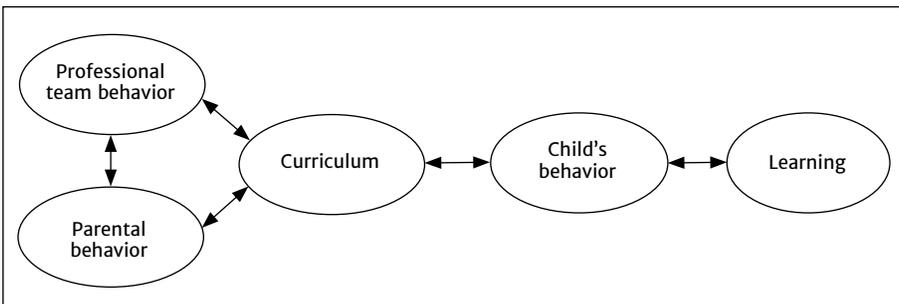


Figure 3.2. Representation of interlocking behavioral contingencies in the interdisciplinary service outlined in analytical behavioral principles.

The participation of the parents made a valuable contribution to the intervention, both from the point of view of the professionals and the child. The activities were applied at home and parents raised their doubts about the correct way of implementing the curriculum on a weekly basis. Common doubts included what reinforcers they should use during tasks. In this respect, studies have shown the importance of teaching in natural environments involving the parents of children with ASD (Gomes et al., 2017; Guimarães et al., 2018).

By using an interdisciplinary approach to intervention underpinned by behavior-analytic principles, it was possible to design and implement a curriculum that was more effective for the child, built on the technical and theoretical skills and knowledge of the professionals involved, and to ensure the active involvement of the parents, thereby creating opportunities for the generalization of learning.

4. Conclusions

The present work as a report of professional experience aimed to describe an interdisciplinary case study outlined in the analytical-behavioral principles, from an intervention applied in a child with ASD. The application of the two assessments, data analysis, curriculum design and implementation, as well as the weekly evaluation of the child's progress, created the necessary conditions for interdisciplinary work, together with the parents as intervention agents in a natural context. The logic behind the organization of this case study can be discussed in the light of interlocking behavioral contingencies as a cultural practice (Glenn, 1988; Martone & Todorov, 2007; Naves & Vasconcelos, 2008).

Another point that warrants highlighting is the professionals' background in behavior analysis. In this respect, behavior analysis is a crosscutting science (Cooper et al., 2007), spanning across many different fields following the same principals of behavior.

The point of departure for decision-making in the organization and implementation of the curriculum was the analysis of verbal operants, in which imitation is understood as a higher order behavior (Catania, 1999) that serves as a foundation for learning other more complex operants. In this way, it was possible to design a curriculum organized in small steps, respecting the child's own pace of learning.

Suggestions for future studies include: increasing the number of children receiving interventions implemented by the professionals; involving other professionals, such as special educational needs teachers, physical therapists, and doctors; comparing the performance of the professionals involved from a multidisciplinary and interdisciplinary perspective; systematizing learning outcomes in the professionals' place of work and at the child's home; and assessing the behavior of each professional, in order to ensure a more standardized and consistent implementation throughout the course of the intervention.

It is hoped that this account of professional experience can help encourage the involvement of other agents of education, besides the parents and the professionals that made up the team in interventions in other spaces occupied by the child, such as the school and park. This experience of joint work provides an initial reflection on interdisciplinary working and home-based behavioral interventions for children with ASD underpinned by the principles of behavior analysis.

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