# Comparação entre Três Procedimentos de Ensino de Recontar Histórias e Responder Perguntas*

## Comparison of Three Procedures for Teaching Retelling Stories and Answering Questions

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**Resumo:** Recontar histórias lidas previamente (um tipo de intraverbal) representa demanda acadêmica comum no contexto escolar regular e familiar. Esse repertório pode ser desafiador para crianças com transtorno do espectro autista (TEA), que apresentam dificuldade na aquisição de intraverbais e de interação com seus pares. O objetivo foi comparar a eficiência de três procedimentos (encadeamento para frente - FCP; encadeamento de trás para frente - BCP; esvanecimento de roteiro - SFP) no estabelecimento de intraverbais na forma de recontar histórias curtas em criança com TEA de 6 anos. Cada história compreendeu quatro partes com cena e frase (SFP com frases apenas). No ensino com FCP, cada parte podia ser recontada de forma independente desde o princípio e, quando necessário, correções eram aplicadas. No caso de BCP, as três primeiras partes eram apresentadas para a criança e, a última parte, podia ser recontada sem pista. Com o tempo, pistas da terceira, segunda e primeira parte (nessa ordem) eram também removidas. No caso de SFP, a criança deveria ler cada frase da história e, com o tempo, as palavras eram gradativamente omitidas. Todos os procedimentos foram eficazes, mas o FCP foi mais eficiente, pois 14 sessões de treino foram suficientes para o estabelecimento do recontar a história sem erros. No entanto, foram necessárias 16 e 19 sessões nos casos de BCP e SFP, respectivamente. Foi discutida influência de história anterior com o FCP, ao qual a criança era exposta antes da pesquisa em ambiente clínico e domiciliar de intervenção. Paralelamente, o ensino de responder perguntas sobre as histórias foi realizado com manipulação de um diferente tipo de pista para cada caso (tato; ecoico; tato e ecoico combinados). Todas as pistas foram eficazes e eficientes em medida semelhante.

**Palavras-chave:** Transtorno do espectro autista; responder perguntas; recontar histórias.

**Abstract:** Retelling stories previously read (a type of intraverbal) represents common academic demand in regular school and family context. This repertoire may be challenging for children with autism spectrum disorder (ASD), who show difficulty in intraverbal acquisition and interaction with peers. The goal was to compare the efficiency of three procedures (forward chaining - FCP; backward chaining - BCP; script fading - SFP) in establishing intraverbals in the form of retelling short stories in a 6-year-old child with ASD. Each story involved four parts with scene and sentence (SFP with sentences only). During the teaching with FCP, each part could be retold independently from the beginning and, when necessary, corrections were applied. In the case of BCP, the first three parts were presented to the child and the last part could be retold without cues. With time, cues related to third, second and first part (in this order) were removed as well. In the case of SFP, the child had to read each sentence of the story, and, with time, the words were gradually omitted. All procedures were effective, but the FCP was the most efficient because 14 training sessions were needed for the establishment of retelling stories without errors. However, 16 and 19 sessions were necessary for BCP and SFP, respectively. It was discussed the influence of a previous history with FCP, to which the child was exposed before the onset of the research in clinic and home setting. In parallel, the teaching of answering questions about the stories was conducted with manipulation of a different type of prompt for each case (tact; echoic; tact and echoic combined). All cues were similarly effective and efficient.

**Keywords:** autism spectrum disorder; answering questions; story retelling.

# Introduction

Many children with autism spectrum disorder (ASD) show impairment in language and communication. Skinner (1992) conducted a behavioral analysis of language, defining it as verbal behavior, which is a special type of operant behavior shaped and maintained by a mediated reinforcing consequence. This stimulus (reinforcing consequence), during a verbal episode, is delivered to a speaker by a listener.

An important case of verbal behavior is called intraverbal, which is present in many verbal interactions between a speaker and a listener. The teaching of intraverbal relations involves the establishment of these repertoires under varying degrees of complexity. Simple intraverbal forms are established through the implementation of simple discrimination processes (e.g., a learner says "Felipe" under control of the verbal question "what is your name?"). In this case of arbitrary relation, the expected critical controlling variable is solely the word "name", which sets the occasion for the emission of the verbal response "Felipe" and, once this happens, differential reinforcement is provided (Matos et al., 2021; Pérez-González, 2020; Sundberg, 2016).

More complex forms of intraverbal relations are established under multiple stimuli control (e.g., a learner would say "strawberry" if the verbal instruction is "tell me the name of a red fruit"). In this case, the expected critical controlling variables are two related words, which are "red" and "fruit". The learning process involved is called a verbal conditional discrimination because one word changes the evocative function of the other word, and both exert joint control over the emission of the verbal response "strawberry". This kind of joint control is also called convergent, since two or more elements of the instruction are necessary for the emission of a correct verbal response (DeSouza et al., 2019; Matos et al., 2021; Pérez-González, 2020; Sundberg, 2016).

However, the case of multiple control also extends to relations in which a single verbal stimulus evokes the emission of multiple intraverbal responses (e.g., saying "strawberry, banana and mango" under the instruction "tell me the names of fruits"). In this case, the name "fruits" represents the only critical controlling variable. The process involved is also called divergent. Intraverbal relations may also be established under both divergent and convergent control (e.g., saying "strawberry, cherry and apple" under the instruction "tell me the names of red fruits"). Considering this example, two elements of the instruction, that is the words "red" and "fruits", jointly control the emission of multiple verbal responses (DeSouza et al., 2019; Matos et al., 2021; Pérez-González, 2020; Sundberg, 2016).

Another kind of complex intraverbal is involved in tasks in which children have opportunities to retell stories previously read to them or by them. If a given story is composed of several related parts for instance, it is expected that a learner describes each of these parts, one after another sequentially and logically. Each part of the story could be composed of a scene (e.g., a picture of a boy stretching his arms up after waking up in the morning) and a written script, that is, a phrase related to the scene (e.g., "Joseph stretched his arms up after waking up early in the morning"). Although this skill may not be challenging for many typically developing children, it may be very difficult for children with ASD, who demand special interventions for its establishment. Research in Applied Behavior Analysis (ABA) focused on procedures, which were successful in children with ASD and other cases of learning disabilities (Matos, Araújo, et al., 2019; Matos et al., 2021; Matos, Guimarães, et al., 2019; Matos et al., 2017; Valentino et al., 2015). It is worth describing some of their characteristics since the establishment of story retelling in children with ASD represented a focus of this research.

Valentino et al. (2015) assessed the effects of a modified backward chaining procedure (BCP), combined with visual and textual cues and differential reinforcement, on the establishment of intraverbal story retelling in three children with ASD. Stories were structured in a manner like what has been described in the previous paragraph. The authors created fourteen books. Each of them represented a story. Five stories were assigned to two children and, four stories, to the remaining child. Each part of each story was composed of a scene and written phrase about it. The number of words and pages was different across participants. The de-

pendent variable consisted of vocally retelling all parts of the stories logically and sequentially.

First, in Valentino et al. (2015), a baseline condition was implemented to ensure that the children were not familiar with the stories (they were demanded to describe the stories without ever being exposed to them). Thereafter, a reading condition was established. In this case, an experimenter read each story with each child, and all relevant pictures and textual stimuli were presented. After 30s, each child had the opportunity to retell each story, but none of them was able to do it successfully.

When the BCP was implemented in Valentino et al. (2015), at first, all the visual components of each part of a given story (except the last part) were presented by an experimenter and read to each child. When it was time for the last part, the visual components were covered with a sheet of white paper, so that each child had the opportunity to retell the last part without visual cues and to produce differential reinforcement. When needed, the experimenter removed the sheet to prompt a response. An arbitrary learning criterion was established in the sense that it was expected that learners were able to respond without being prompted. When this happened, in the next opportunity to respond, the experimenter covered the last and penultimate part of each story, so the learners were able to retell more parts independently. When needed, cues were provided. This logic was applied to all parts of the stories (from the last to the first), so that the learners were able, at some point, to retell all parts of the stories sequentially without cues. The procedure proved to be successful for all children.

Matos et al. (2017) conducted a similar study with four children (two with ASD and two with language impairment). However, during treatment, a forward chaining procedure (FCP) was used instead of a BCP. Each child had the opportunity to retell each part of the stories without being prompted by the experimenter. In each opportunity, if an incorrect response was emitted before 5s elapsed (or no response was emitted during this interval), an experimenter presented the visual components of the corresponded part and read the textual script for that part along with the child. Data collection ended for each child whenever retelling the stories without cues occurred. The FCP proved to be effective for all learners.

Two recent studies (Matos, Araújo, et al., 2019; Matos et al., 2021) sought to compare FCP and BCP as to their efficiency in teaching story retelling in two children with ASD. In both studies, two stories were structured for each learner. One of the stories was taught with FCP and, the other one, with BCP. Since an alternating treatments design was employed in both studies, the two stories were taught concurrently. It was established that the case in which the story was retold without cues first would represent the most efficient procedure.

In Matos, Araújo, et al. (2019), the learners had no previous experience with teaching of story retelling, FCP and BCP before the study had started. Both procedures were effective and efficient in a similar manner for both children. For one of them, the BCP successfully established errorless story retelling in 25 sessions, while a learning criterion was achieved for the story taught through FCP in 27 sessions. Regarding on the other child, both BCP and FCP procedures established errorless story retelling in six sessions.

In Matos et al. (2021), the learners were familiar with the FCP before the onset of the study because behavioral intervention services (outside the context of research) were systematically provided. One of the goals was to teach intraverbal story retelling through FCP. During the research, it was noticeable that the FCP was more efficient for both learners. For one of them, a criterion was achieved after 22 sessions with the FCP and, for the other story with BCP, 36 sessions were needed. The same to the other learner, where 11 sessions were needed for the story with FCP and 17 sessions with BCP. Data were discussed in the sense that the relative efficiency of a procedure may be influenced by a learner's reinforcing history with that procedure (Roncati et al., 2019).

Matos et al. (2021) extended their investigation with the inclusion of tasks during which the children had to, intraverbally, answer questions related to the stories they learned to retell. For each story, a specific prompt was used when corrections were needed. Tact prompts were established for one of the stories and, for the other one, echoic prompts. In each of several trials to respond, the children had up to 5s to emit a response without prompt. If an incorrect response was emitted be-

fore 5s elapsed (or no response after this interval), a prompt was provided (either tact by showing a scene related to the question or echoic with the response modeled by an experimenter). Results suggested that tact prompts were more efficient for one participant and, for the other, echoic prompts were more efficient. Data were also discussed in the sense that a previous learning history with a type of prompt may influence its relative efficiency (Roncati et al., 2019).

Another research on teaching children with ASD to retell stories assessed the effects of another procedure besides FCP and BCP. Matos, Guimarães, et al. (2019) taught two children with ASD to retell stories through script fading procedure (SCP) (Krantz & Mcclannahan, 1993). Scripts consist of words or phrases for reading, pictures, or recordings, which are used to prompt the development of communication. In the past, Krantz and Mcclannahan, for instance, used textual scripts to improve communication skills among four children with ASD during recreational activities. At first, the children were prompted to read textual scripts related to past, present, and future events (e.g., "did you enjoy playing on the swing yesterday?").

As soon as the children became fluent in the task of reading, SFP was implemented. The fading was conducted through word removal from all sentences the children learned to read. The removal process was conducted in a gradual and progressive manner until the children were able to communicate among themselves without cues. The procedure was effective for all participants and generalization was also demonstrated in new environments and in the presence of new communication partners (Krantz & Mcclannahan, 1993).

As to the research by Matos, Guimarães, et al. (2019), two stories containing four parts were structured for each of two children with ASD. Each part of the two stories was composed of a sentence. One of the children was able to read sentences and, during a first training condition, he had to read all sentences fluently. The other child lacked reading skills, but he was able to echo sentences provided by the experimenter. Because of this, the first goal for this specific child was to echo all sentences without errors. After both children became fluent in the task of reading or echoing the sentences, SFP was

implemented in four steps in which the words were gradually omitted. In the end, both children were able to retell the stories without cues.

The current study had the purpose of extending the investigations, conducted by Matos, Araújo, et al. (2019) and Matos et al. (2021), on the efficiency of teaching procedures (FCP and BCP) to establish intraverbals in the form of story retelling in children with ASD. Matos, Guimarães, et al. (2019) demonstrated that another procedure (SFP) was also effective in teaching these repertoires. Nevertheless, no studies to date compared SFP with other procedures directly. To address this gap, therefore, three procedures (FCP, BCP and SFP) were compared this time as to the efficiency in producing story retelling in a child with ASD. A second purpose of the research was to compare three types of prompts (tact; echoic; tact and echoic combined) as to the efficiency in establishing intraverbals in the form of answering questions related to the stories.

## Method

### Participant

This study was conducted with just one participant, a 6-year-old girl with ASD. By the time the study was conducted, she was able to tact hundreds of nonverbal stimuli, such as pictures and objects. The child also discriminated these stimuli as listener. She was also able to select as listener over 100 nonverbal stimuli under the control of verbal instructions specifying function, feature, and class to which they belonged. Over 100 intraverbals in the form of answering questions were demonstrated by the girl. She successfully read a great variety of words and sentences without errors.

Nevertheless, the girl was unable to retell new stories independently after they were read by her or with her. This statement is based on data from baseline tests conducted with the girl for participation in this study and, also, based on intervention data derived from the child's individualized curriculum in clinical and home setting. Procedures, such as FCP combined with different cues and differential reinforcement, were consistently necessary for acquisition of the retelling skill. Outside the context of

research, intensive behavioral interventions based on ABA are consistently provided to the girl and intervention goals are systematically reviewed, following recommendations from the Verbal Behavior Milestones Assessment and Placement Program (Sundberg, 2008).

## Environment, interobserver agreement (IOA) and treatment integrity (TI)

Data collection took place in the child's home. Assessment and treatment tasks were conducted in a room with a table and two chairs. The child and an experimenter (second author) sat on the chairs facing each other. The experimenter was responsible for the presentation of stimuli and took data on the child's relevant intraverbal responses (story retelling and answering questions about the stories) along assessment and treatment sessions.

Plus, in approximately 20% of the study, a second observer unfamiliar with the research goals, also took data on the child's performance. Regarding the repertoire of retelling stories, IOA was established for four out of 22 sessions (one baseline and three intervention sessions). Specifically, this represented 18% of the sessions. As to the repertoire of answering questions about the stories, IOA was determined for four out of 16 sessions (one baseline and three intervention sessions). Specifically, this represented 25% of the sessions.

Agreements and disagreements were established using a trial-by-trial basis. Whenever the experimenter and second observer recorded the child's response in the same way (e.g., correct, incorrect or prompted response) in a trial, that represented an agreement on that trial. A formula was used to determine the percentage of agreement, and it consisted of the following: number of trials with agreement divided by the total number of trials in each session. The result was multiplied by 100 to determine a percentage. Overall, IOA was 100% across all research conditions.

Also, in approximately 20% of the study, the second observer took data on the experimenter's TI. As in the case of IOA, TI was determined for four out of 22 sessions related to the repertoire of retelling stories and four out of 16 sessions regarding the repertoire of answering questions about the stories. For each type of repertoire, TI was calculated based on one baseline session and three intervention sessions.

To determine the experimenter's TI, it was used a checklist on the emission of behaviors/components by the experimenter (e.g., manipulation of relevant stimuli during tasks; correct presentation of instructions; waiting 5s for the emission of a response by the child in each trial; appropriate use of reinforcers; appropriate use of correction procedures), which represented performance accuracy. A formula was used to determine the degree of integrity: for each session, the total number of components concluded correctly was divided by the total number of components. The result was multiplied by 100 to produce a percentage. In this study, treatment integrity was 100%.

## Materials and instruments

Three different stories were structured by the experimenter. Each story consisted of four parts and each part was depicted by a scene/picture and sentence about it. Datasheets were organized to record the child's correct, incorrect, and prompted responses related to the repertoire of retelling stories and answering questions about them. Table 1 presents each of the programmed stories (scenes were not shown).

**Table 1. The Three Stories of the Research with their Respective Parts**

| First story | Second story | Third story |
| --- | --- | --- |
| After dinner, Ana took off her shoes | John woke up in joy in the morning | Jennifer ate the lunch prepared by her mom |
| She put on her sandals and pajamas | He went to the bathroom to wash his face | Then she did some schoolwork |
| She brushed her teeth in the bathroom | He changed his clothes and put on a jacket | Later, she played with a friend outdoors |
| And she slept in her warm bed | He had some breakfast in the end | At night, Jennifer went home to sleep |

## Independent variables (IV) and dependent variables (DV)

In the case of the repertoire of retelling stories, there were three main IV: FCP, BCP and SFP procedures (depending on the story). Descriptions about each of these procedures are presented in the next section. Moreover, differential reinforcement (e.g., praise, access to games and other preferred activities during breaks) and correction procedures (e.g., the provision of visual and echoic cues) also served as additional IV during the teaching of story retelling. The vocal emission of sentences sequentially, and under intraverbal control, represented the DV. As to the tasks of answering questions about the stories, there were three main IV: tact cues, echoic cues, and tact and echoic cues combined. An additional IV was the differential reinforcement (the same reinforcers as those used during tasks of story retelling) of independent intraverbal responses. These independent responses were the DV.

## Procedure

Next, the research phases are presented, regarding assessment and treatment for both repertoires (story retelling and answering questions). The phases of story retelling (baseline; teaching with forward chaining – FCP, backward chaining – BCP and script fading – SCP) are described first. Then, the phases of answering questions about stories (baseline; intervention phase with tact prompt, echoic prompt and tact and echoic prompt combined) are shown.

## Phases concerning the repertoire of retelling stories

**Baseline (repertoire of retelling stories).** This phase was established to ensure that the child was unable to retell each of the three programmed stories without direct teaching. First, in each baseline session, an experimenter read each of the stories with the child, showing her all their visual components (scenes and textual scripts) one by one on the table. During this process, the experimenter physically prompted the child to point to each component as the parts of the story were presented. Thereafter, all visual components were removed from the table. When 30s elapsed, the experimenter presented the verbal antecedent "tell me the story about...", followed by the theme to which the story

was related. After this, the child had up to 15s to emit a response. If she was able to retell the first part of the story, the experimenter said "ok. What else?". This served as a general prompt for the emission of the next part of the story. If this happened, the prompt would be given again to evoke the emission of the next part and so on, until the story was over. Responses did not produce differential consequences. In fact, the child was unable to retell any part of the stories. In view of this first result, an intervention phase was established.

**Intervention phase (repertoire of retelling stories).** This phase was established to teach the repertoire of retelling each of three stories by the child. A specific procedure was implemented for each story. A FCP allowed the opportunity to retell the first story from the first to the last part from the very beginning. In other words, after the experimenter said, "tell me the story about..." followed by the theme to which the story was related, the child had up to 5s to retell the first part intraverbally. If she emitted an independent response, verbal praise was delivered. If an incorrect response (or no response after 5s) occurred, the visual components (scene and corresponding sentence) regarding the first part of the story were presented as a correction procedure. Thereafter, the experimenter asked, "what else?" and an opportunity was provided for retelling the second part of the story. Differential consequences for correct and incorrect responses (or no response) were applied as in the case of the previous part. This same procedure was applied to the other parts until the end of the story. An arbitrary learning criterion was reached when the child retold the entire story without cues in two consecutive sessions.

A **BCP** was applied for the teaching of the second story. After the experimenter said, "tell me the story about..." followed by the theme to which the story was related, the visual components of the first three parts of the story were presented and the sentences were read with the child. Before showing the visual components of the last part of the story, the experimenter retained them for up to 5s, so the child had the opportunity to retell this part intraverbally. Differential consequences were provided as in the case of the first story.

After the child responded without errors in two consecutive sessions, the goal was updated and now she needed to retell the last two parts of the story. The visual components of the first and second part of the story were presented to the child. Thereafter, visual components related to both penultimate and last part of the story were retained, so independent responses could be emitted. When the same arbitrary learning criterion previously described was achieved, the goal was again updated. This procedure was applied until the child could retell all parts of the story without cues. In other words, the retelling of the second story was taught from the last to the first part. The story was considered learned after the child retold all parts independently in two consecutive sessions.

A **SFP** was applied for the teaching of the third story. After the experimenter said, "tell me the story about..." followed by the theme to which the story was related, the visual components (only textual stimuli in the case of third story) of all parts of the story were presented to the child and the sentences were read with her. After this, all visual components were again showed, but this time the child had the opportunity to read each of the sentences alone. During this process, the experimenter physically guided the child, making her point to the words of each sentence while reading. The child had up to 5s to read each sentence independently. If this happened, verbal praise was delivered. If an incorrect response (considering at least one word) was emitted (or no response in 5s), the experimenter read the entire sentence so the child could repeat it. After the child read all sentences without errors in a single session, the **SFP** was established in four steps. The first step involved the omission of the last one or two words related to each sentence of the story.

During a session under this condition, after reading the first available words of the first sentence, the child could intraverbally say the last part of the sentence whose words were omitted. If she did so, verbal praise would be provided. If she was not able to say one or more missing words in up to 5s, the original sentence was showed as correction procedure, so the child could read it. This same logic was applied for the remaining sentences. After two consecutive sessions elapsed without errors, the second step of the **SFP** would be applied. More words would be omitted from the sentences. As in the case of the first fading step, the child could read the first available words of each sentence and intraverbally emit the remaining words removed from the script.

After two sessions without errors, the third fading step would be applied with the omission of more words. After two sessions without errors, the fourth and last fading step would be applied. This time, all textual stimuli would be omitted, that is, the child would be able to retell all parts of the story without cues. Verbal praise was provided for retelling each part of the story independently. Whenever an error occurred, or no response was emitted in 5s, the corresponding sentence was presented to evoke textual responding. After two consecutive sessions without errors, the final goal of the **SFP** would be considered achieved.

## Phases concerning the repertoire of answering questions about stories

Next, the phases for answering questions about each of the three stories are presented. It is important to mention that baseline and intervention phases concerning this repertoire commenced at the same time as the case of story retelling. In general, irrespective of the phase, each session was initiated with the presentation of each story separately by the experimenter. Then, after 30s elapsed, four questions related to each story were presented (e.g., "what did Ana do after dinner". The child could say "she took off her shoes"). The difference between baseline and intervention concerned the absence or presence of differential consequences for correct and incorrect responses (or no response).

**Baseline (repertoire of answering questions about stories).** This phase was established to ensure that the child was unable to answer questions about the stories she was learning to retell in parallel. The baseline phase of answering questions was administered at the same time as the one of retelling stories. Each session of one repertoire type (retelling stories) was followed by a session of the other repertoire type (answering questions about the stories).

In each baseline session of answering questions, after a given story was presented to the child, four

questions were administered separately. After each question, 5s were allowed for the emission of a response. Correct and incorrect responses (or no response) did not produce differential consequences. Once it was established through visual data analysis that the child would not be able to demonstrate the skill without direct teaching, the intervention phase was implemented.

**Intervention phase (repertoire of answering questions about stories).** The intervention phase of answering questions was administered at the same time as the one of retelling stories. Each session of one repertoire type (retelling stories) was followed by a session of the other repertoire type (answering questions about the stories). In each session of teaching the repertoire of answering questions, when a question was presented, the child had up to 5s to respond. A correct response produced verbal praise. When an incorrect response was emitted (or no response in 5s), a prompt was administered. For each of the three stories the questions were related to, a specific prompt was used when necessary.

In a question about the first story, an echoic prompt (echoic to intraverbal) was used, that is, the experimenter modeled the child's response by providing her the verbal response so she could repeat it. In a question about the second story, a tact prompt (tact to intraverbal) was delivered, that is, the scene to which the question was related, so the child could emit a verbal response under its control. Finally, in a question about the third story, both tact and echoic prompts (tact and echoic combined to intraverbal) corresponded to the question were delivered at the same time, that is, the experimenter provided a scene and a verbal response model. The intervention phase ended when no incorrect responses were emitted, considering the repertoire of answering questions related to all research stories.

During baseline and intervention phases for each repertoire type (retelling stories and answering questions), the child had access to preferred activities (e.g., videos and games) after each session.

## Experimental design

An alternating treatments design with initial baseline (as recommended by Cooper et al., 2007) was used to ensure experimental control of IV (FCP;

BCP; SFP) over story retelling. After a baseline showed that the child could not demonstrate targets, each mentioned procedure was assigned to teach a story. The teaching occurred in an alternated fashion (each procedure was administered once in each session). The procedure, which established story retelling in less sessions, would be considered the most efficient.

The alternating treatments design logic was also applied to ensure experimental control of prompts (echoic prompt; tact prompt; echoic and tact prompt combined) over answering questions about stories. After a baseline showed that the child was unable to demonstrate targets, the intervention phase began. Each of the mentioned prompts was assigned to a story. The teaching occurred in an alternated fashion (as in the case of story retelling). The prompt, which demanded less sessions to establish targets, would be considered the most efficient.

## Ethical procedures

This study is derived from a project, which was approved by an ethics committee in research with humans (authorization No. 4.284.271) from Federal University of Maranhão, Brazil, São Luís-MA. The child's parents signed an informed consent form. The child also signed an informed consent form for participation. The child's identity was kept confidential, and her participation could be terminated at any time she wished without any harm.

## Results

Next, the participating child's data are presented. They were organized considering the following: 1) the child's performance in the repertoire of retelling three different stories along baseline and treatment conditions; 2) the child's performance in the repertoire of answering questions about the three stories along baseline and treatment conditions. Figure 1 represents these data. Table 2 shows the number of sessions necessary to achieve the learning criterion during the teaching of each repertoire type.

According to Figure 1 (upper graph), the child did not emit any correct responses of retelling the three stories along three baseline sessions. When
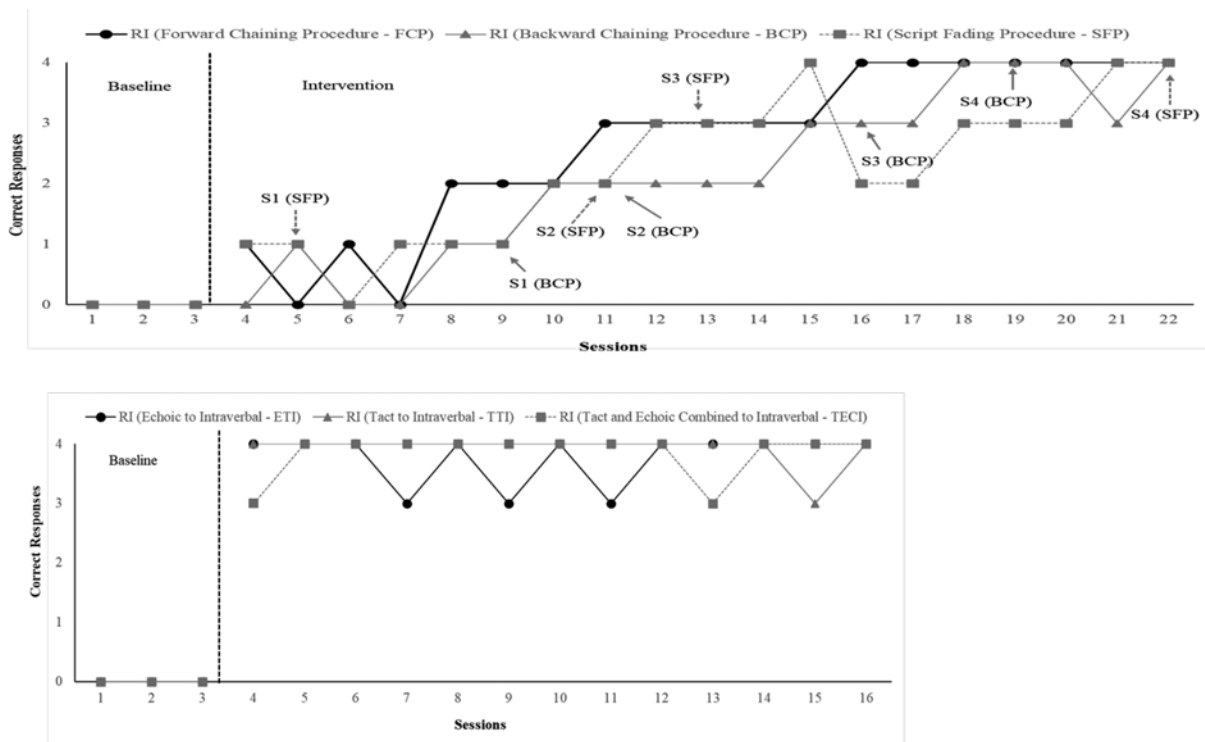
**Figure 1.  Number of Correct Responses of Retelling Stories and Answering Questions**

Note. The upper graph represents the repertoire of retelling three different stories. During intervention, a specific teaching procedure (Forward Chaining Procedure – FCP; Backward Chaining Procedure – BCP; Script Fading Procedure – SFP) was applied for each story. In the cases of BCP and SFP, the teaching occurred in four steps (S1-S4) and data points, which represent the achievement of criterion are indicated by arrows. The lower graph represents the repertoire of answering questions related to the stories. For each story, a specific type of prompt was used. Echoic to Intraverbal – ETI was used for the story of the FCP procedure. Tact to Intraverbal – TTI was used for the story of the BCP. And Tact and Echoic Combined to Intraverbal was used for the story of the SFP.

treatment phase was established (see Table 2 as well), 14 sessions in total with the FCP were needed to reach the criterion of retelling all the story parts without errors in two consecutive sessions. As to the case of the story to which the BCP procedure was applied, 16 sessions in total were needed to achieve the criterion of retelling all the story parts without errors. During the process, considering that the repertoire of retelling the story was being taught from the last to the first part (S1-S4), the first step (S1 - criterion to retell the last story part without errors) was achieved after six intervention sessions. S2 was finished after eight sessions; S3, after 13 sessions; and S4 (last step), after 16 sessions.

As to the case of the story to which the SFP procedure was applied, 19 sessions in total were necessary for the achievement of the criterion of retelling

all the story parts. During the process, considering that the fading of the words from the sentences was being administered in four steps (S1-S4), the first step (S1 - of saying the last words which were omitted from each of four sentences) was achieved after two sessions. S2 was achieved after eight sessions; S3, after ten sessions; and S4 (which represented the repertoire of retelling all story parts without any textual scripts), after 19 sessions. Overall, all three procedures (FCP, BCP and SFP) were effective in the establishment of targets for the child.

Still regarding Figure 1 (lower graph), the child was not able to answer any questions related to the three research stories along three baseline sessions. When intervention phase initiated (see Table 2 as well), all prompts effectively established the verbal targets (answering questions about all stories). Each

**Table 2. Number of Sessions to Achieve Learning Criterion**

| | Number of sessions to criterion | |
|---|---|---|
| Retelling stories | First story (forward chaining procedure - FCP) | 14 |
| | Second story (backward chaining procedure - BCP) | 16 |
| | Third story (script fading procedure - SFP) | 19 |
| Answering questions | First story (echoic to intraverbal - ETI) | 1 |
| | Second story (tact to intraverbal - TTI) | 1 |
| | Third story (tact and echoic combined to intraverbal - TECI) | 2 |

direct teaching procedure sought to establish a change in stimulus control. In the case of first story (the same whose repertoire of retelling was taught with FCP), echoic prompts were used to establish the repertoire of answering questions under intraverbal control (echoic to intraverbal). A single session was enough for the achievement of the learning criterion of responding without errors.

Along subsequent sessions, an errorless performance was maintained in several of them, but in three sessions (sessions number seven, nine and 11), an error occurred. In the case of second story (the same whose repertoire of retelling was taught with BCP), tact prompts were used to establish the repertoire of answering questions under intraverbal control (tact to intraverbal). A single session was also sufficient for the establishment of total correct responding. This performance was maintained along several sessions, but a single error occurred during the penultimate session. Finally, in the case of third story (the same whose repertoire of retelling was taught with SFP), tact and echoic prompts were combined to establish the repertoire of answering questions under intraverbal control (tact and echoic combined to intraverbal). Two intervention sessions were necessary for the establishment of errorless performance. After that, no errors occurred along all the remaining sessions administered. In the last session (16), considering the repertoire of answering questions about all stories, no errors were committed by the child.

## Discussion

In this study, all procedures (FCP, BCP and SFP) to teach the repertoires of retelling stories were effective for the participating child, thus replicating the previous literature concerning children with ASD and other cases of learning disabilities (Matos, Araújo, et al., 2019; Matos et al., 2021; Matos, Guimarães, et al., 2019; Matos et al., 2017; Valentino et al., 2015). All retelling responses were established as intraverbal response chains. Plus, the FCP procedure was the most efficient of all to establish the target repertoire, because 14 training sessions were necessary to reach the learning criterion of two consecutive sessions without errors. The BCP procedure was the second most efficient because 16 training sessions were necessary to reach criterion (a slight difference when compared to the FCP case). Finally, the SFP procedure was considered the least efficient one because 19 training sessions were necessary. The type of investigation in this study helps to determine the best procedure for a learner, which is important for clinical and educational purposes. However, the child of this research already had a previous learning history with the FCP procedure (with different stories) before the onset of the study. This represents a limitation, although there was not a great difference regarding efficiency between two of three procedures to teach story retelling (FCP and BCP).

As to the repertoire of answering questions related to the stories, which the child was taught to retell in parallel, all types of prompts used ef-

fectively established the targets as in a previous study by Matos et al. (2021). The purpose with the prompts was to establish a change in stimulus control. Three cases were investigated: echoic to intraverbal (ETI); tact to intraverbal (TTI); tact and echoic combined to intraverbal (TECI). In all cases, the change to response emission under intraverbal control was successfully established. There was not a great difference in efficiency among the three types of prompts. ETI and TTI established intraverbal targets in a single training session. TECI, after two. Along training, one incorrect response in ETI occurred in three sessions. In the case of TTI, one incorrect response in one session. As to the case of TECI, one incorrect response occurred in two sessions.

It is possible that teaching the repertoire of retelling stories influenced acquisition of answering questions about the stories. Baseline sessions demonstrated that the child was unable to answer any question after the stories were shown to her (she could read them or, if necessary, an experimenter read them with her). When teaching sessions concerning both repertoires began, the child answered several questions about the stories correctly in a single session. In parallel, the repertoire of retelling the stories was being taught. However, it is not clear the extent to which teaching story retelling influenced the other repertoire because differential reinforcement and correction procedures were used to teach the repertoire of answering questions. Thus, this represented a limitation just as in previous research (Matos et al., 2021). One way to address this issue in future studies would be by probing the repertoire of answering questions (without any differential consequences for either correct or incorrect responses) in different moments in which the story retelling is being taught.

It is important to remember that the child always had opportunities to read the stories and, if she had difficulty, an experimenter read them with her. This process always happened before the child could answer questions related to the stories.

Once, in this study, the child with ASD had opportunities to read sentences about the programmed stories, it would be possible to assume an influence of this variable (besides the teaching of retelling the stories) on the acquisition of an-

swering questions about the stories (a type of intraverbal). However, as discussed before, the direct teaching of answering questions made this possibility more difficult. A similar investigation was conducted with typically developing children in a recent study by Pérez-González and Oltra (2021) and should be discussed. The children were exposed to tasks in which they had to read short texts. The effects of reading the texts were assessed on the acquisition of intraverbal responses without direct teaching. The texts contained related three stimuli/elements in two sentences (e.g., "A city in Argentina is Buenos Aires. In Buenos Aires there is a park called El Botánico"). A stimulus "A" represented country (e.g., "Argentina"). A stimulus "B" represented city (e.g., "Buenos Aires"). A stimulus "C" represented park (e.g., "El Botánico"). Probed intraverbals, which involved written stimuli and responses, related these three types of stimuli, that is, country, city, and park. They were referred as ABC intraverbals.

The probed intraverbals, regarding the possible relations among the stimuli, were described by Pérez-González and Oltra (2021) in the following manner: A-B country-city direct (e.g., saying "Buenos Aires" under the control of "name a city of Argentina"); B-C city-park direct (e.g., saying "El Botánico" under the control of "name a park of Buenos Aires"); B-A city-country symmetric (e.g., saying "Argentina" under the control of "name the country of Buenos Aires"); C-B park-city symmetric (e.g., saying "Buenos Aires" under the control of "name a city of El Botánico"); A-C country-park transitive (e.g., saying "El Botánico" under the control of "name a park of Argentina"); C-A park-country equivalence (e.g., saying "Argentina" under the control of "name the country of El Botánico").

In the first experiment, cycles of reading texts/probing ABC intraverbals (AB, BC, BA, CB, AC and CA relations) were conducted. Three of six children demonstrated emergence of all intraverbals. The three remaining demonstrated the emergence of some intraverbals. This was revealed through intraverbal probes related to texts about two countries (Argentina and Uruguai). In a second experiment, a new information was added to the texts regarding "A" stimuli (e.g., "Argentina is a country. A city in Argentina is Buenos Aires. In Buenos Aires there

is a park called El Botánico"). Previously, the experimenter did not mention that Argentina, for example, is a country. So, the new information was added to see if it would increase the emergence of intraverbals. This was the only difference from the previous experiment. As a result, four of six children demonstrated the emergence of all relations. The remaining two demonstrated the emergence of some relations (Pérez-González & Oltra, 2021).

In a previous study (Pérez-González et al., 2008), the emergence of ABC intraverbals involving auditory stimuli and vocal responses was demonstrated after exemplars and categories (more basic intraverbals according to the authors) were taught. This study also focused on establishing ABC intraverbals involving relations among country, city, and park. Pérez-González and Oltra (2021) supposed that a similar effect could occur in the case of intraverbals involving written stimuli and responses. Therefore, in a third experiment, two types of intraverbals (exemplars and categories related to two countries) were taught before the texts were presented for reading and ABC intraverbals were probed. Exemplars corresponded, for example, to the emission of the verbal responses "Argentina", "Buenos Aires", and "El Botánico" under the verbal instructions "tell me the name of a country", "tell me the name of a city" and "tell me the name of a park", respectively. Categories corresponded, for example, to the emission of the verbal responses "a country", "a city", and "a park" under the verbal questions "what is Argentina?", "what is Buenos Aires?", and "what is El Botánico?", respectively. All six children who participated in third experiment demonstrated emergence of all possible ABC intraverbals.

Finally, Pérez-González and Oltra (2021) conducted a fourth experiment, which was a replication of third experiment. The difference was that two new sets of stimuli (involving new countries) were used. All five children who participated in fourth experiment demonstrated emergence of all possible ABC intraverbals.

The ABC intraverbals, as described by Pérez-González et al. (2008) and Pérez-González and Oltra (2021), derive from the stimulus equivalence paradigm (Sidman & Tailby, 1982). Untaught stimuli relations emerge after a few other stimuli relations are taught. If a learner is taught to relate a stimulus "A" to a stimulus "B" and a stimulus "B" to a stimulus "C" in conditional discrimination tasks, other relations may emerge without direct teaching, that is, the learner relates A to A, B to B, C to C, B to A, C to B, A to C, and C to A. Originally, the investigations on stimulus equivalence were conducted with selection-based responses.

As an example, stimuli A could consist of spoken words (e.g., "dog"). Stimuli B and C could be represented by pictures (e.g., picture of a dog) and printed words (e.g., the printed word dog), respectively. Arbitrary A-B and B-C relations should be taught through a matching to sample procedure. During the process of teaching an A-B relation, a learner should point to a picture under the control of a corresponding spoken word model (e.g., relating the picture of dog to the spoken word "dog"). During the process of teaching an A-C relation, a learner should point to a printed word under the control of a corresponding spoken word model (e.g., relating the printed word dog to the spoken word "dog"). After teaching A-B and A-C relations, other untaught relations among the three stimuli may emerge.

In the study by Pérez-González et al. (2008) with ABC intraverbals, the relations A-B country-city and B-C city-park were taught and other eight relations were probed for emergence in typically developing children. In a first experiment, just one of five children demonstrated emergence of all untaught intraverbal relations. In a second experiment, the teaching of exemplars and categories (more basic intraverbals), before the teaching of A-B and B-C relations, facilitated emergence because emergence of all untaught intraverbal relations occurred for all participants (four typically developing children). In Pérez-González and Oltra (2021), no intraverbal A-B and A-C relations were directly taught and emergence of several relations was probed, after opportunities for reading a text relating three stimuli (country, city, and park) were provided. There was emergence of intraverbal relations, but a greater effect was observed after exemplars and categories were also taught.

The current study may have produced some emergence of intraverbals in a child with ASD. This was hypothesized because the repertoire of

answering questions about three different stories was quickly demonstrated during the teaching of another repertoire in parallel (story retelling). However, the repertoire of answering questions was also taught through differential reinforcement. So, this makes establishing relations between the repertoires difficult. One way of addressing this issue in future studies would be by probing the repertoire of answering questions several times during the teaching of story retelling. This would be like what was done by Pérez-González and Oltra (2021) with typically developing children.

Plus, future studies should extend their investigation to children with ASD with prerequisites for the establishment of ABC intraverbals. The same stimuli regarding texts and relations among countries, cities and parks could be used. The teaching of exemplars and categories should be considered since it may increase the emergence of intraverbals. And the procedures from the current study, used to establish intraverbal story retelling (FCP, BCP and SFP), could be used to teach the repertoire of retelling the content of the texts relating three stimuli (country, city, and park). In other words, the procedures to teach story retelling could be investigated as additional variables to possibly produce the emergence of ABC intraverbals (as described by Pérez-González & Oltra, 2021) in children with ASD.

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