Implementation of PECS Associated with Point-Of-View Video Modeling in Early Childhood Education for Children with Autism[1]

Implementação do PECS Associado ao Point-Of-View Video Modeling na Educação Infantil para Crianças com Autismo[2]

Viviane RODRIGUES[3]
Maria Amélia ALMEIDA[4]

ABSTRACT: This study aimed to analyze the effects of the Picture Exchange Communication System (PECS) associated to Point-of-view Video Modeling (POVM) in communicative skills of three children diagnosed with Autistic Spectrum Disorder (ASD) and Complex Communication Needs. The experimental design of multiple probe combined with the design the alternate treatments was used, being PECS associated to POVM the independent variable and the communication skills were the dependent variables. Data were analyzed considering aspects such as: the percentage of non-overlapping, participants' performance percentage of correct responses and Likert scale data on social validity. The results showed that from the beginning of the intervention, the data levels and trends changed, all the participants obtained the criterion, reaching 100% *non-overlapping.* In all phases of PECS associated to POVM the participants had an average percentage above 90%. The study was considered by those responsible for the child, the trainees and the teachers. It was concluded that the participants with ASD indicated a change after the intervention, when comparing baseline condition with intervention and follow-up, demonstrating a possibility in Augmentative and Alternative Communication for children with ASD.

KEYWORDS: Special Education. Augmentative and Alternative Communication. Autistic Spectrum Disorder. Picture Exchange Communication System. Video Modeling.

RESUMO: Este estudo teve por objetivo analisar os efeitos do *Picture Exchange Communication System* (PECS) associado ao *Point-of-view Video Modeling* (POVM) nas habilidades comunicativas de três crianças diagnosticadas com Transtorno do Espectro Autista (TEA) e Necessidades Complexas de Comunicação. Empregou-se o delineamento experimental de múltiplas sondagens combinado ao delineamento de tratamentos alternados, sendo o PECS associado ao POVM a variável independente e as habilidades de comunicação a variável dependente. Os dados foram analisados considerando aspectos como: a porcentagem de *non-overlapping*, a porcentagem de respostas corretas quanto ao desempenho dos participantes e os dados da escala Likert quanto à validade social. Os resultados mostraram que a partir do início da intervenção, os níveis e as tendências de seus dados mudaram, todos os participantes obtiveram o critério, atingindo o *non-overlapping* de 100%. Em todas as fases do PECS associado ao POVM, os participantes obtiveram porcentagem média acima de 90%. O estudo foi considerado pelos responsáveis, pelas estagiárias e pelas professoras como socialmente válido. Conclui-se que os participantes com TEA indicaram uma mudança após a intervenção, ao comparar a condição de linha de base com a intervenção e *follow-up*, demonstrando uma possibilidade em Comunicação Suplementar e/ou Alternativa para as crianças com TEA.

PALAVRAS-CHAVE: Educação Especial. Comunicação Suplementar e/ou Alternativa. Transtorno do Espectro Autista. Sistema de Comunicação por Troca de Figuras. Videomodelação.

[1] https://doi.org/10.1590/1980-54702020v26e0092

[2] This paper features a part of a doctoral dissertation entitled Effects of PECS associated with Point-of-view Video Modeling on the communication of children with Autism Spectrum Disorder (Rodrigues, 2018). Financial Support: Coordination for the Improvement of Higher Education Personnel (CAPES).

[3] PhD in Special Education. Professor at the Department of Human Sciences at Unisagrado. Bauru/São Paulo/Brazil. E-mail: viviane_reb@hotmail.com. ORCID: http://orcid.org/0000-0002-9351-5454

[4] PhD in Special Education from George Peabody College for Teachers, Vanderbilt University, Nashville, Tennessee, USA. Professor at the Department of Psychology at the Federal University of São Carlos. São Carlos/São Paulo/Brazil. E-mail: ameliama@terra.com.br. ORCID: https://orcid.org/0000-0002-8919-2330

1 Introduction

The beginning of schooling is a time for the child's adaptation to a new environment, which will require communication, academic and social skills that are important for insertion into school. The first stage of Basic Education, Early Childhood Education, seeks to ensure "accessibility of spaces, materials, objects, toys and instructions for children with disabilities, global developmental disorders and the gifted" (Resolution no. 1, 1999, p. 19).

Thus, children diagnosed with Autistic Spectrum Disorder (ASD), enrolled in Early Childhood Education, need their needs to be met, support and services to be guaranteed. According to the proposals of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), the deficit in social communication is one of the domains of diagnostic criteria of ASD, being characterized as a decrease in the ability to use verbal and non-verbal communication during an interaction with other people, in addition to limitations in sharing ideas and interests or negotiating in a positive and friendly way (American Psychological Association [APA], 2014).

Given these needs and the demands that are required by society, specifically in the process of schooling in Early Childhood Education, the intervention in Supplementary and/or Alternative Communication is a possibility to be implemented in the school to support the communicative limitations of children who have complex communication needs. Thus, an evidence-based practice in Supplemental and/or Alternative Communication is the Picture Exchange Communication System (PECS), developed in a training protocol format by Bondy and Frost (1994) while working with children in the Delaware Autism Program in 1985.

The authors applied PECS training to 85 children in Early Childhood Education, noting that 85% of children learned to make requests using at least two pictures. The researchers pointed out that 76% of the children who used PECS started using speech concomitantly. Only in 1994, the authors developed the PECS training manual in order to guide professionals and parents in understanding the approach and apply it in a safer and more reliable way. Initially, the program was applied to children with ASD who could not use speech as a primary means of communication. Currently, it has been applied to people of different ages and diagnoses to increase their communication skills within the social context.

From the international literature referring to the PECS, it was verified in three meta-analysis studies (Flippin, Ruzka, & Watson, 2010; Hart & Banda, 2010; Tincani & Devis, 2011), covering the years 1994 to 2009, that of the 19 studies analyzed that applied the PECS only two managed to complete the six phases of the program. In the systematic review of national literature, carried out by Mizael and Aiello (2013), the starting date was not defined because there was no systematic review on the subject; however, the year 2011 was set as the deadline when the study ended. Thus, the authors found six studies, but none applied the six phases of the PECS. Tincani and Devis (2011) point out some factors in relation to the non-application of all phases of the PECS and the delay in its completion. One of them was the criterion of phase change of 80% of correct answers, which could prevent researchers from completing all phases of the system until the conclusion of the research. Another limitation refers to the participants' cognitive skills that could have influenced learning, this being a hypothesis, since most studies did not have enough descriptions of the participants' cognitive

functioning levels for this skill to be considered a variable that influenced the acquisition of the PECS. However, empirical data from Phases V and VI of the system are scarce.

Literature has shown that children with ASD are characterized by severe attention deficits, in addition to not being prone to learning skills by observing the behavior of others. This deficit puts them at an intense disadvantage when trying to maintain the educational, social and functional pace of their peers. Even if the acquisition of an imitative repertoire is proposed by explicit instruction, children with ASD do not necessarily acquire an observational learning repertoire (Bandura, 1977; Greer, Dudek-Singer, & Gautreaux, 2006; Plavnick & Hume, 2014).

In this perspective, based on Bandura's theory (1969), Video Modeling (VM) is a technique that has been widely used and researched. Studies point to the effectiveness in acquiring and developing different skills for people with ASD, such as: social skills, communication skills, vocational skills, games, physical activities, everyday life activities, imitation, team training, academic and attention skills (Bellini & Akullian, 2007; Huang & Wheeler, 2006). Video Modeling is characterized by Shukla-Mehta, Miller and Callahan (2010) with the following procedure: a) a person is invited to watch the video; b) the skill to be developed is modeled by an adult or peer in an activity context; c) the instructor provides stimuli and reinforcement for the person to respond to relevant stimuli; d) the person imitates the model's behavior with the opportunity to perform the skills shown in the video.

There are three types of VM: VM with others as a model (VMO), Video Self-Modeling (VSM) and Point-of-view Video Modeling (POVM). The VMO uses an adult or peer as a model, who the learner may or may not know; VSM is a specific form of video modeling that uses the learner as a model to offer learning opportunities, in which he/she visualizes him/herself performing a task (Rodrigues & Almeida, 2017). And finally, Point-of-view Video Modeling (POVM), which consists of footage shot from the perspective of the first person. The video is made as if the camcorder were at shoulder height and as if it were viewing the target behavior to be performed through the person's eyes (Shukla-Mehta, Miller, & Callahan, 2010).

Given the nature of the visual perspective, external stimuli are not included in the video, naturally directing the viewer's attention to the necessary steps to complete the desired task or demonstrate appropriate behavior. Despite the greater efficiency and focus on the task, POVM has received less empirical attention than other types of videos. POVM is highly effective for participants with ASD and developmental disabilities, although the results indicate significant effects for those with ASD. As already noted, participants with ASD are typically more responsive to visual stimuli, and interventions based on VM benefit from this preference (Bellini & Akullian, 2007). POVM has a differential aspect in relation to other videos, since irrelevant external stimuli are significantly reduced due to the nature of the footage, allowing the viewer to focus on the relevant stimuli (Mason, Davis, Boles, & Goodwyn, 2013).

Due to the effectiveness of Video modeling in teaching various skills, studies focusing on its association with PECS have shown that learning becomes faster because, when observing someone performing the target behavior in the PECS phases, the student needs less help, reaching the necessary adjustments for phase changes in less time.

The studies that carried out the association between PECS and Video modeling were performed by Cihak, Smith, Cornett and Coleman (2012); Smith, Hand and Dowrick (2014); Rodrigues, Campos and Almeida (2015). The study conducted by Cihak et al. (2012) evaluated the increase in independent initiatives for communication through a combination of Phase I of PECS associated with video modeling in children with autism at preschool ages. The authors concluded that students were able to learn Phase I of PECS and increased independent initiations for communication in that phase. However, students learned Phase I of PECS faster when they used it associated with VM. Smith, Hand and Dowrick (2014) examined the effectiveness of VSM for teaching PECS up to Phase IV. The participants were two boys (9 and 11 years old) with autism and a man with Down Syndrome (36 years old). All three participants were non-verbal and had no functional communication system; the two boys had a long history of PECS failure. All participants showed rapid learning of their target behaviors when VSM was introduced; moreover, the effects were generalized without the need for further intervention.

Rodrigues, Campos and Almeida (2015) applied the PECS associated with the VMO to a child with Down Syndrome of nine years old, in all phases of the PECS. The results indicated that the participant's performance was satisfactory, both in relation to each phase, and in relation to the learning of the entire intervention process. The participant learned the PECS in a few sessions and it was observed that the use of the picture was a support for the increase of vocabulary present in the formulations of words and phrases, both through the pictures and through speech. The authors demonstrated an intervention possibility that favored the participant's communicative skills.

According to the studies outlined in the literature on this subject, this study aims to analyze the effects of the Picture Exchange Communication System (PECS) associated with Point-of-view Video Modeling (POVM) on the communication skills of children enrolled in Early Childhood Education and diagnosed with Autistic Spectrum Disorder (ASD) and Complex Communication Needs.

2 Method

The study was submitted and approved by the Research Ethics Committee of the Federal University of São Carlos (UFSCar), under the Opinion no. 45113615.4.0000.5504. Thus, the participants' communication skills were the dependent variable and the PECS alone and the PECS associated with the POVM were the independent variables. For this purpose, it was conducted through the Multi-mode Survey Design combined with the Alternating Treatment Design (Gast & Ledford, 2010).

The Multi-mode Survey Design is similar to the Multiple Baseline Design, since the independent variable (in the case of this study, initially there were two independent variables: PECS alone and PECS + POVM) is systematically and sequentially introduced, at different times, behaviors, environments or subjects. However, it differs from the multiple baseline design with respect to the baseline that is not collected continuously in behaviors that are not under intervention conditions. On the contrary, the baseline is conducted intermittently in the behaviors that will be subjected to the intervention (Gast & Ledford, 2010).

The Alternating Treatment Design allows comparing interventions. In this study, intervention 1 (PECS alone) and intervention 2 (PECS associated with POVM) are alternated in their application to compare which intervention is most effective. There should be at least five interventions from each. After comparing the interventions, the study may be concluded once there is stability of the results or remain with the most effective intervention until its conclusion (Wolery, Gast, & Hammond, 2010).

2.1 Participants with ASD

For the selection of participants, the researchers established contact with the person responsible for the Special Education sector in the municipality, who provided a list of students with Autism Spectrum Disorder and Complex Communication Needs, containing a total of 12 students. Then, participants who had approximate age groups were selected. Thus, only three children with ASD and complex communication needs were selected to participate in the study: P1, P2 and P3. P1 was a 4 years and 4 months old girl at the beginning of the study, enrolled in 2016 in a Municipal School of Early Childhood Education in Kindergarten I (penultimate stage of Early Childhood Education). She had limited communication skills, when there was speech (grouping sounds and syllables repeated with intonation), which was not intelligible, she spoke some words like: no, mom (to refer to grandmother) and *Didi* (to refer to aunt). People did not understand what she wanted, showing irritability in the face of the situation. Few vocalizations were understood by the communication peers, she did not speak a single sentence, she seldom maintained eye contact with the people around her.

Regarding P2, a boy aged 6 years and 6 months old at the beginning of the study, who had attended the Municipal School of Early Childhood Education since the age of four. At the time of the research, he was enrolled in Kindergarten II (final stage of Early Childhood Education). As for communication skills, the participant frequently used echolalia, repetition of words, phrases he heard on television programs and children's songs, he never initiated communication. He had stereotyped behavior (hand flapping) and repetitive behaviors (head and shoulder movement), olfactory hypersensitivity (he smelled all the objects he took in his hand). Non-verbal, he did not communicate with adults and peers, mainly not answering basic questions.

P3 was 6 years and 7 months old at the beginning of the study, started attending regular school in 2016 - previously attended special school. At the time of the research, he was enrolled in Kindergarten II (final stage of Early Childhood Education). At the beginning of the study, the participant was non-verbal, used a diaper, had no initiative for communication. When he wanted something, he pulled people and took him to the item he wanted. He displayed tantrum behavior (he got angry, threw himself on the floor, shouted and cried); unarticulated vocalizations, just babbled; stereotyped behavior (hand flapping) and rarely used echolalia (only with the expression "and then").

2.2 Location

The study was carried out on the premises of a Municipal School of Early Childhood Education, located in a medium-sized city in the hinterlands of the state of São Paulo. This school had a total of 205 students enrolled, of which only four were target groups for Special

Education. The study was conducted in the classroom, in the Specialized Educational Service (SES) room and in the schoolyard. Some sessions were conducted at the participants' homes with their guardians (according to their availability).

2.3 Models for video elaboration

The models that performed the target behavior were selected for the research through an indication made by the teacher. The teacher was asked to indicate a classmate who most identified with the participants, although the participants often did not show preference, there were peers who were more concerned and approached the participants more. Three children with ages similar to those of the participants were selected, one boy and two girls.

The model children exchanged pictures from the PECS phases with adult models who played the role of Communication Partners in the videos. All models were taught to perform the PECS phases through role-plays. The videos were then edited. No data was collected regarding the participation of the models, as they only performed the behavior to be filmed.

2.4 Procedures

After establishing the times and days, the experimental procedures started. The experimental procedure adopted was intermittent baseline, intervention and follow-up. All sessions were conducted four times a week with an approximate duration of 40 minutes, on the premises of the school and the participants' home.

Baseline. Before starting the intervention, baseline sessions were conducted intermittently to stability in three consecutive sessions by the first participant. When the first participant reached the criterion of 60% correct answers, the intervention started with the second who was in the baseline. When the second reached the criterion of 60% correct answers, the intervention started with the third who was in the baseline. Thus, the baseline condition of the study was completed. Baseline sessions were characterized by the presentation of a favorite item and the corresponding picture of that item, and the participant was not asked to request the item. At that moment, it was only observed how the participant made his/her request and how he/she did it, in addition to his/her posture before the picture. Therefore, the participant's vocabulary was then observed during the baseline sessions.

Intervention 1 - application of PECS alone - and **Intervention 2** - application of PECS associated with POVM. Example: in Phase I, in the first session, the PECS is applied separately and the student's performance is evaluated; in the second session of Phase I, PECS is also applied separately; in the third session of Phase I, the PECS associated with the POVM is applied; thus, the intervention alternates and the participant's performance is observed. It will not always be the same sequence, interventions will be alternated randomly, respecting the design used. As a criterion for changing the PECS phase, the participant must reach 100% in three consecutive sessions, or reach an average equal to or greater than 80% in five sessions. The intervention will be explained in detail below.

Three videos were made for each phase of the PECS, with Phase III divided into A and B, totaling 21 videos, each of which lasted from 8 to 44 seconds and were presented before beginning each session of application of the six phases of the PECS (Bondy & Frost, 2002). The videos were edited using the Wondershare Filmora software. The participant watched the video of the model performing the target behavior in each PECS session.

Before showing the videos, participants were invited to sit down to watch a video of a classmate doing an activity. After sitting down, the video was shown; if the participant looked away, he/she was invited by the researcher to look again at the video. She would say: "Look how cool is what the model (model name) is doing". After the video, applications of the PECS phases were initiated according to the Bondy and Frost (2002) protocol, considering the presence of a physical stimulator in Phases I and II, as well as the error corrections, aids and tips provided for in the program as shown in Chart 1. The sessions took place four times a week.

Phase I- The participant watches the model's video picking up the picture, handing it over to the communication partner (CP) and receiving the desired item. At the beginning of the video, the model appears in full body; then, when picking up the picture, the camera approaches so that only the hands of the model appear making the exchange. After watching the video, the stages of the PECS Protocol begin (Bondy & Frost, 2002). At that moment, there are two people present, one is the CP and the other is the physical stimulator, and, during the sessions, the positions are exchanged, the CP becomes a physical stimulator and vice-versa. The physical stimulator offers physical assistance and gradually withdraws this assistance until the child independently makes the exchange. This phase is called a sequence of objectives: to pick up, to carry and to deliver. As soon as the participant delivers the picture, the CP reinforces, in half a second, delivering the desired item referring to the picture.
Phase II- The participant watches the model's video walking to the communication folder; then, the camera is zoomed in to capture only the model's hands to pick up the picture. The model walks to the CP and the camera is zoomed in again to focus the exchange. After watching the video, the stages of the PECS Protocol begin (Bondy & Frost, 2002), in which a picture of an item must be placed on the cover of the communication folder. The student and the communication partner are seated facing each other, either on the floor or in a chair (optional). The item corresponding to the picture must be available. A physical stimulator must be present. It is important that the folder and the communication partner are distant from the participant so that he/she walks towards the folder and the CP.
Phase III-A- The participant watches the video of the model's hand discriminating the picture of the preferred item and ignoring the uninteresting item, takes the picture of the preferred item and delivers it to the CP. After watching the video, the stages of the PECS Protocol begin (Bondy & Frost, 2002). The participant and the CP are seated facing each other. Pictures of interesting and uninteresting items should be available, as well as their respective items. A discrimination between highly interesting and uninteresting items will be carried out.
Phase III-B- The participant watches the video of the model's hand making the correspondence of the picture with a preferred item, that is, he/she picks up the picture, hands it to the CP, the latter says: "You can take it", the model selects the item corresponding to the picture and delivers it to the CP. After watching the video, the stages of the PECS Protocol begin (Bondy & Frost, 2002), in which the discrimination between pictures of two highly attractive items will be carried out in order to verify whether the participant is making the correspondence between the picture and the item he/she selected.
Phase IV- In this phase, only the model's hands appear in the video, the model places the picture "I want" and the picture of the item on the sentence strip, removes the strip from the communication folder and delivers it to the CP, the CP secures his/her index finger and reads the strip to the model. After watching the video, the stages of the PECS Protocol begin (Bondy & Frost, 2002). In this sense, the participant must learn to build sentences using pictures that represent verbs, for example: I want. Removes the picture "I want" from the communication folder and places it on the sentence strip (a space on the specific communication board for the construction of the sentence), then chooses the picture representing the desired item and places it on the sentence strip, forming a sentence.
Phase V- The CP asks the model the question: "What do you want?". The model fixes the pictures "I want" and the picture of the item on the sentence strip, removes the strip from the communication folder and delivers it to the CP, the CP holds his/her index finger and reads the strip to the model as the latter points for the pictures on the strip. After watching the video, the stages of the PECS Protocol begin (Bondy & Frost, 2002). In this sense, the same sequence as Phase IV is followed, the difference is that the participant answers the question: "What do you want?".

Phase VI- The CP asks the model the question: "What do you see?" or "What do you hear?", among other questions. The model fixes the pictures "I see", "I hear" and the picture of the items on the sentence strip, removes the strip from the communication folder and delivers it to the CP, the CP holds his/her index finger and reads the strip to the model as the latter points to the pictures on the strip. After watching the video, the stages of the PECS Protocol begin (Bondy & Frost, 2002). In this sense, the same steps as in Phase V are followed, with the addition of other initiators such as: "I see", "I hear", "I am", "My name is", "My birthday is", "The weather is" , "I don't want", among others.

Table 1. Summary of the PECS Intervention associated with Point-of-view Video Modeling.
Source: Research database.

Follow-up. The Follow-up took place one month after the end of the intervention and aimed to demonstrate whether there was learning, and whether it was maintained over time or not. This condition was identical to the baseline sessions without any assistance or encouragement being provided, in order to verify whether, with the absence of the intervention, the participants would be able to establish communication by exchanging pictures with their communication partners.

2.5 Data analysis

The data were analyzed from the Visual Analysis of Graphical Data (Spriggs & Gast, 2010). First of all, a visual analysis was carried out between adjacent conditions, to observe and calculate the performance of the participants during the application of the two conditions, in order to determine what is the effect on the dependent variable, remaining with the most effective. Thus, the percentage of non-overlapping was calculated, which consists of the measure that determines the minimum and maximum point of the baseline in quasi-experimental and experimental studies, considering the number of points of the second condition that were above the baseline, divided by the number of points in the second condition, multiplied by 100 (Scruggs & Mastropieri, 1998).

After determining the most effective condition, possible changes in the data are calculated through percentages, considering the tendency and level properties. Thus, to determine the calculation of percentages referring to the performance of participants with ASD, they had 10 to 20 attempts to perform each phase of the PECS. In this sense, the score for each attempt was 0 to 3 points, being 0 - Unsuccessful, when there is no exchange of pictures; 1 - Total physical assistance, when the participant needs assistance from the physical stimulator in the whole process or when he/she needs tips from the communication partner; 2 - Partial physical assistance, when the participant only needs assistance in some moments of the process, for example, to start the exchange or to pick up the picture; 3 - Independence, when the participant performs the entire process of exchanging pictures alone. Thus, the total points of the session were divided by the total of possible points and then the percentage of communication by exchange of pictures in each session was calculated. Social validity was analyzed using the Likert scale questionnaire delivered to parents, trainees, and guardians. The variables were analyzed: degree of importance and degree of satisfaction of these people regarding the entire intervention process, considering the average percentage of responses.

2.6 Inter-observers' agreement

The reliability index was carried out by an observer, with a Master"s degree in Special Education. The expected objectives for each phase were explained to the observer through video modeling, as well as the error corrections and teaching strategies present in each phase. The observer analyzed 25% of the sessions in each phase. All sessions were filmed; her choice, therefore, was random. Data with at least 75% agreement were considered reliable.

The reliability index was calculated by the number of agreement, divided by the number of disagreement added to that of disagreement. The result of this calculation must be multiplied by 100 (Hersen & Barlow, 1982). Thus, in relation to the performance of P1, the scores reached an average of 95% reliability in all study conditions (baseline, intervention and follow-up). Regarding the performance of P2, the average was of 97% reliability in all conditions of the study (baseline, intervention and follow-up). As for the performance of P3, it reached an average of 98% reliability in all conditions of the study (baseline, intervention and follow-up).

3 Results and discussion

The results of the participants regarding the implementation of the PECS associated with the POVM are represented in Figure 1, which shows the number of correct responses during the intermittent baseline, intervention and follow-up conditions for participants P1, P2 and P3.

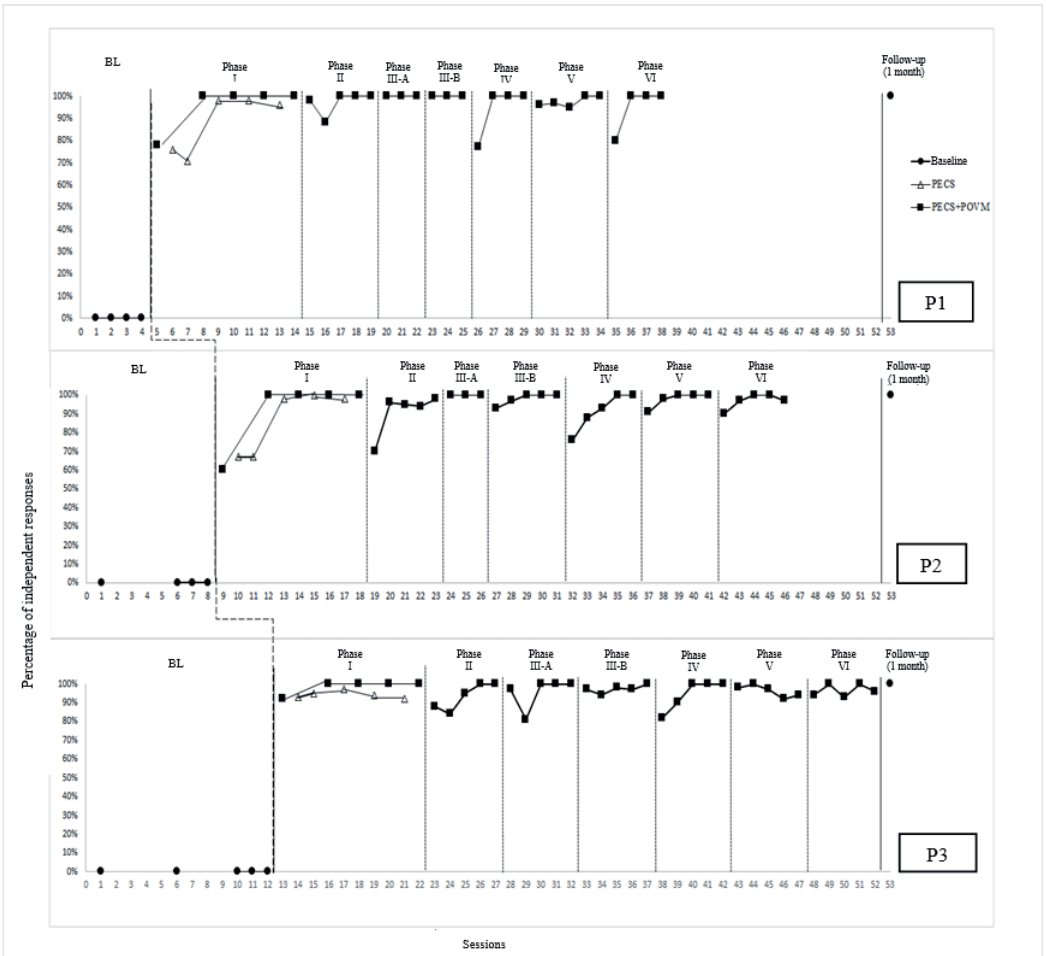

Figure 1. Performance of participants.
Source: Research database.

From the data presented in Figure 1, none of the participants obtained correct answers regarding the target behavior during the baseline sessions. From the moment that interventions with PECS alone and PECS associated with POVM began, the levels and tendencies of their data changed - all participants obtained the criterion, reaching a 100% non-overlapping. The scores show that there was an immediate and abrupt change in the dependent variable after the introduction of the independent variable. The fact that the intervention includes stimuli, tips, reinforcement organization, provides a high probability of an increase in correct responses and an abrupt level change.

When comparing Phase I, with regard to the conditions of PECS alone and PECS associated with POVM, the average percentage of correct answers was calculated for each condition. In this perspective, for all participants, PECS associated with POVM was more effective than PECS alone, since 100% of participants had a higher number of correct answers

with PECS associated with POVM, with an average of 89.3% (variation: 86% to 94.2%) for PECS and 95.1% (range: 92% to 98.4%) for PECS associated with POVM. Thus, respecting the parameters of the design used, the intervention was continued with the condition that proved to be most effective: the PECS associated with the POVM.

In Phase II, based on the information in Figure 1, the PECS intervention associated with POVM remained. All participants were able to reach the goal of the phase, which was to walk to the communication folder, pick up the picture, walk to the communication partner, deliver the picture and receive the item. The phase change criterion was reached in five sessions for all participants, with an average of independent responses for the exchange of pictures from 97.2% (range: 88% to 100%) to P1, 90.6% (range : 70% to 98%) for P2, 93.4% for P3, with an average of 93.7% (range: 84% to 100%) of independent responses.

In Phase III-A, P1 and P2 needed a minimum number of sessions to reach the phase change criterion, with the average of the independent responses for both being 100% (M: 100%; variation: 100%); thus, in three consecutive sessions, they obtained the largest number of independent responses and met the criterion for phase change. For P3, it took five sessions to reach the phase change criterion; in the last three consecutive sessions, obtained 100% of independent responses (M: 95.6%; variation: 81% to 100%). In this phase, everyone managed to discriminate between the interesting item picture and the uninteresting item picture. Thus, P1 and P2, at no time, took the picture of the uninteresting item, demonstrating great ability to discriminate pictures. Although P3 needed five sessions to reach the criterion, he/she also demonstrated many hits in discriminating the pictures.

In Phase III-B, all participants were able to match the picture to the item. At that time, even though there were five pictures of interesting items, participants were able to select the picture of the item they wanted and pick up the item corresponding to the picture, demonstrating their ability to discriminate. For P1, three sessions were necessary; in all of them, it obtained 100% (M: 100%; variation: 100%), reaching the criterion for the phase change. For P2, five sessions were necessary; in the last three consecutive sessions, obtained 100% (M: 98%; variation: 93% to 100%), reaching the criterion for phase change. For P3, five sessions were held; he/she reached the criterion for phase change from the average of the sessions (M: 97.2; variation: 94% to 100%).

In Phase IV, the participants obtained an average of independent responses of 93.4% (range: 91.4% to 94.4%). For P1, four sessions were necessary and, in the last three consecutive sessions, obtained 100% (M: 94.3%; variation: 77% to 100%) of independent responses, reaching the criterion for phase change. For P2, five sessions were necessary, in which, in the last three, obtained 100% (M: 91.4%; variation: 76% to 100%) of independent responses. For P3, five sessions were carried out and, in the last three consecutive ones, obtained 100% (M: 94.4%, variation: 82% to 100%) of independent responses. At the beginning of this phase, participants demonstrate a drop in the number of independent responses, as it involves many new skills such as taking the sentence initiator "I want", putting it on the sentence strip, picking up the picture of the item, putting it on the sentences, removing the sentence strip and giving it to the communication partner to read the message. Due to this large number of new steps, the participants needed more physical assistance to complete the sequence, but in the subsequent sessions, they learned the entire sequence and reached the criterion for the phase change.

In Phase V, the overall average of the participants was 97.2% (range: 96.2% to 97.8%). For P1, five sessions were necessary, reaching an average greater than 80% for the phase change (M: 97.6%; variation: 96% to 100%). For P2, five sessions were necessary, in which the average was greater than 80% (M: 97.8; variation: 91% to 100%). For P3, five sessions were necessary in which the average was greater than 80% (M: 96.2%; range: 92% to 100%). In this phase, all participants were able to answer, through the pictures, the question: "What do you want?".

In Phase VI, the participants used, in addition to the phrase initiator "I want", other initiators. This phase encourages the increase of spontaneous comments, its continuity is permanent. The overall average of the participants was 96.1% (range: 95% to 96.8%). For P1, four sessions were held and in the last three sessions obtained 100% (M: 95%; variation: 80% to 100%) of responses independently, reaching the criterion for phase change. For P2, five sessions were necessary and the average of the sessions was greater than 80% (M: 96.8%; variation: 90% to 100%). For P3, five sessions were necessary, the average of which was greater than 80% (M: 96.6%; range: 93% to 100%).

The Follow-up was collected for all participants. The data showed that everyone maintained the target behaviors (exchanging pictures to communicate independently) with 100% of independent responses one month after the end of the intervention, demonstrating that they are able to use PECS independently, without any need for assistance.

In this study, the effect of using PECS associated with Video Modeling proved to be effective in facilitating the learning of participants with ASD and complex communication needs. In Phase I, in the PECS intervention alone, the participants demonstrated 86% to 94% of correct answers, which characterizes a good performance. However, in the sessions in which PECS was associated with Video Modeling, the successes ranged from 92% to 98%, considering that this second condition favored a faster learning and with a greater number of correct responses than PECS alone.

In the subsequent phases (II to VI), considering the most satisfactory performance with the use of PECS associated with POVM in Phase I, the intervention with POVM continued. Thus, the performance of the participants remained above the baseline condition, considering that no session was below 58%. Thus, in all phases, participants reached the criterion of phase change in a maximum of five sessions, requiring an average of 43 intervention sessions to complete the six phases of the PECS. According to the international literature, only one study presents the six phases of PECS for children with ASD (Charlop-Christy, Carpenter, Le, LeBlanc, & Kellet, 2002). In the national literature, only two studies applied the six phases of PECS associated with Video Modeling (Rodrigues, 2015; Rodrigues, Campos, & Almeida, 2015); however, they involved participants with Down Syndrome. In this sense, the results of the present study can confirm that POVM assisted the learning of children with ASD in all six phases, contributing to the completion of training in a short time, in a few sessions and with most attempts with independent exchanges.

These results were similar to those found in the study by Cihak et al. (2012), in which the participants, two with autism and two with three years of development delay, had more independent initiatives in Phase I of PECS when they used it associated with Video modeling with others as a model. In the study performed by Smith, Hand and Dowrick (2014),

the authors demonstrated that the use of PECS associated with self-modeling (Video Self-Modeling) can provide an accessible and easy-to-use alternative for teaching supplementary and alternative communication for two 11-year-old boys with ASD and a 36-year-old adult with Down Syndrome. The study conducted by Plavnick and Vitale (2016) demonstrated that video modeling was more effective than live modeling in teaching verbal operants (exchanging pictures for the desired item).

A limitation of the study is related to aspects such as number of participants. In this sense, the designs of single subjects, such as the multi-mode survey design, suggest more replications. Further studies may be carried out so that the results can be compared.

Future research may replicate studies with people with ASD of the most diverse ages and diagnoses, in addition to involving other levels of education. The results of this study may enable the use of video modeling in clinical and educational practice in teaching PECS, in addition to enabling its use for teaching other strategies in supplementary and/or alternative communication, as in the study performed by Mason et al. (2013), in which they used Video Modeling to develop visual contact skills, facial expressions, shift changes and shared emotions of two participants with autism. Considering the Brazilian reality, this intervention may be a possibility in schools, given its low cost, as well as bringing contributions to students with complex communication needs.

3.1 Social validity

The results of the social validity questionnaire (Figure 2) are presented below, which aimed to verify the degree of satisfaction and importance of the people directly involved with the participants and the study.

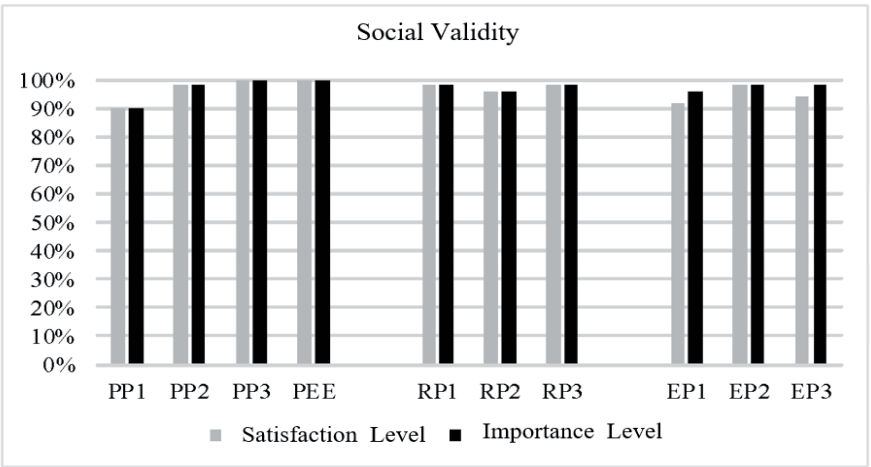

Figure 2. Result of the social validity questionnaire.
Source: Research database.
*PP1 = Teacher of P1, PP2 = Teacher of P2, PP3 = Teacher of P3, PEE: Teacher of Special Education, RP1 = Responsible for P1, RP2 = Responsible for P2, RP3 = Responsible for P3, EP1 = P1 trainee, EP2 = P2 trainee, EP3 = P3 trainee.

Then, some responses from the people who participated in the social validity questionnaire were selected. Those involved were asked to spontaneously talk about their perceptions about the study.

> P3 teacher: *"He's smart, he knows, he understands, but sometimes he couldn't say what he understood. Wow, I loved it so much, it was an opportunity, thankfully he had that opportunity, I´d say that helped at school, will help at home, will help in his life, very good, I thank you".*
>
> Responsible for P3: *"As there are people who think that PECS is a very repetitive thing, that the child is robotic and that will not stimulate speech, as in the case of P3, who does not speak at all, will he only stick to the picture exchange? I do not agree. It worked very well and if his mind works with images, his mind, we notice that it is a disorganized arcade; in this case, PECS helped to organize thought and he will only speak with his thought organized. (...). He distinguishes one picture from the other, this is excellent for brain work. It shows that he has a reasoning and that his vision is good, because there were people who even said that he was not blind, so I see beyond that, I see not only PECS, because even if he does not speak, he communicates perfectly through the pictures, one day he may let a word out. Like he dropped spoons, a cart, it didn't happen anymore, but it may happen. The autistic person needs several repetitions, it is a daily routine of repetition, and in a few attempts, he succeeded, he is already achieving it faster than before, you model once, you do a modeling and it is enough. That's why I think it works".*
>
> Responsible for P2: *"It's really good (laughter), he goes to bed and takes the folder with him, he puts it aside, I take it out, I put it in another way, he doesn't, it's like that, that way there. I said, I can't stand this folder anymore (laughter), where I go this folder is also there, here is the place for the folder, you sit somewhere else, go for it, it's like that (laughter). If we are talking to him, anywhere, he assembles the sentence, he takes it everywhere he goes, you have no idea, if he goes to the kitchen he takes it with him. Excellent, very good".*
>
> P2 trainee: *"I think it was very important, in his communication, everything, I think he evolved a lot. At first, I thought that, for me, I thought it was going to be difficult at first, but from the first time he started, wow, it was excellent".*
>
> P1 teacher: *"I think it was very important for her development, for communication, right, her with us because until then we did not understand what she expressed, right, and now, through the folder, we already understand better what she wants to express, what she wants".*

The comments were illustrative as to the perception they had of the intervention performed, demonstrating positive aspects for participants with ASD and Complex Communication Needs: alternative communication enabled participants to demonstrate their communication skills that had not yet been manifested, increased vocabulary, support for speech intelligibility and improvement in social interaction.

4 Final considerations

The PECS associated with POVM proved to be effective in teaching communication skills to children with Autistic Spectrum Disorder and Complex Communication Needs. Therefore, the participants had a large number of independent responses, characterizing the learning of the PECS. As for communication skills, there were gains in the skills predicted by the PECS and in skills not predicted.

One aspect that deserves discussion involves the application of PECS associated with POVM in the educational context. Considering the nuances present in this environment

such as: number of students, presence of a single teacher, curriculum planning to be carried out; applying an individualized program in a collective environment is a challenge. However, research that takes place in natural environments, such as school, benefits the training and learning of all those involved, in line with the notes shown by Schirmer and Nunes (2011), considering that on-site research offers greater opportunities for development and participation of all. In this sense, it can be concluded that it is possible to apply the PECS associated with POVM in the classroom environment of regular teaching; however, many factors corroborate for it, in fact, to happen, but these factors are not related to the limitations of the PECS, but, rather, to factors specific to school dynamics.

Finally, providing means of communication is to enable survival, independence and quality of life. Supplementary and/or Alternative Communication must be guaranteed to children, adolescents and adults with Complex Communication Needs, and this guarantee must come mainly from legislation, public policies, with the encouragement of research and the disclosure of its results.

References

American Psychiatric Association (2014). *DSM-5 – Manual Diagnóstico e Estatístico de Transtornos Mentais*. Porto Alegre: Artmed.

Bandura, A. (1969). Social learning of moral judgments. *Journal of Personality and Social Psychology*, *11*, p. 275-279.

Bandura, A. (1977). *Social Learning theory*. Englewood Cliffs, NJ: Prentice-Hall.

Bellini, S., & Akullian, J. A. (2007). Meta-analysis of video modeling and video self-modeling interventions for children and adolescents with autism spectrum disorders. *Except Children*, *73*, 264-287. DOI: https://doi.org/10.1177%2F001440290707300301

Bondy, A. S., & Frost, L. A. (1994). The Picture Exchange Communication System. *Focus on Autistic Behavior*, *9*, 1-19.

Bondy, A. S., & Frost, L. A. (2002). *PECS: The Picture Exchange Communication System*, *Manual de Treinamento do Sistema de Comunicação por Troca de Figuras*. (2nd ed.). New Castle: Pyramid Educational Consultants.

Charlop-Christy, M. H., Carpenter, M., Le, L., LeBlanc, L. A., & Kellet, K. (2002). Using the Picture Exchange Communication System (PECS) with children with autism: Assessment of PECS acquisition, speech, social-communicative behavior, and problem behavior. *Journal of Applied Behavior Analysis*, *35*, 213-231. DOI: https://doi.org/10.1901/jaba.2002.35-213

Cihak, D. F., Smith, C. C., Cornett, A., & Coleman, M. B. (2012). The Use of Video Modeling with the Picture Exchange Communication System to Increase Independent Communicative Initiations in Preschoolers with Autism and Developmental Delays. *Focus on Autism and Other Developmental Disabilities*, *27*(1), 3-11. DOI: https://doi.org/10.1177%2F1088357611428426

Flippin, M., Reszka, S., & Watson, L. R. (2010). Effectiveness of the Picture Exchange Communication System (PECS) on Communication and Speech for Children with Autism Spectrum Disorders: A Meta-Analysis. *American Journal of Speech-Language Pathology*, *19*, 178-195. DOI: https://doi.org/10.1044/1058-0360(2010/09-0022)

Gast, D. L., & Ledford, J. R. (2010). Multiple Baseline and Multiple Probe Designs. In: D. Gast (Ed.), *Single Subject Methodology in Behavioral Sciences* (pp. 276-328). New York and London: Routledge.

Greer, R. D., Dudek-Singer, J., & Gautreaux, G. (2006). Observational learning. *International Journal of Psychology*, *41*, 486-499. DOI: https://doi.org/10.1080/00207590500492435

Hart, S. L., & Banda, D. R. (2010). Picture Exchange Communication System with individuals with developmental disabilities: A Meta-Analysis of single subject Studies. *Remedial and Special Education*, *31*(6), 476-478.

Hersen, M., & Barlow, D. H. (1982). *Single case experimental designs: strategies for studying behavior change*. New York: Pergamon Press.

Huang, A. X., & Wheeler, J. J. (2006). High-functional autism: An overview of characteristics and related issues. *International Journal of Special Education*, *21*(2), 109-122.

Mason, R. A., Davis, H. S., Boles, M. B., & Goodwyn, F. (2013). Efficacy of Point-of-View Video Modeling: A Meta-Analysis. *Remedial and Special Education*, *34*(6), 333-345. DOI: https://doi.org/10.1177%2F0741932513486298

Mizael, T. M., & Aiello, A. L. R. (2013). Revisão de estudos sobre o Picture exchange communication system (PECS) para o ensino de linguagem a indivíduos com autismo e outras dificuldades de fala. *Revista Brasileira de Educação Especial*, *19*(4), 623-636.

Plavnick, J. B., & Hume, K. A. (2014). Observational learning by individuals with autism: A review of teaching strategies. *Autism*, *18*(4), 458-466. DOI: https://doi.org/10.1177%2F1362361312474373

Plavnick, J. B., & Vitale, F. A. (2016). A Comparison of Vocal Mand Training Strategies for Children with Autism Spectrum Disorders. *Journal of Positive Behavior Interventions*, *18*(1), 52-62. DOI: https://doi.org/10.1177%2F1098300714548800

Resolução nº 1, de 7 de abril de 1999. Institui as Diretrizes Curriculares Nacionais para a Educação Infantil. Retrieved on July 1, 2019 from http://portal.mec.gov.br/dmdocuments/resolucao_ceb_0199.pdf

Rodrigues, V. (2015). *Efeitos do PECS associado ao Video Modeling em crianças com Síndrome de Down.* Master's thesis, Centro de Educação e Ciências Humanas, Universidade Federal de São Carlos, São Carlos, São Paulo, Brasil.

Rodrigues, V. (2018). *Efeitos do PECS associado ao Point-of-view Video Modeling na comunicação de crianças com Transtorno do Espectro Autista.* Doctoral dissertation, Centro de Educação e Ciências Humanas, Universidade Federal de São Carlos, São Carlos, São Paulo, Brasil.

Rodrigues, V., & Almeida, M. A. (2017). Modelagem em Vídeo para o Ensino de Habilidades de Comunicação a Indivíduos com Autismo: Revisão de Estudos. *Revista Brasileira de Educação Especial*, *23*(4), 595-606. DOI: https://doi.org/10.1590/s1413-65382317000400009

Rodrigues, V., Campos, J. A. P. P., & Almeida, M. A. (2015). Uso do PECS associado ao Video Modeling na criança com Síndrome de Down. *Revista Brasileira de Educação Especial, 21*(4), 379-392. DOI: https://doi.org/10.1590/S1413-65382115000400005

Schirmer, C. R., & Nunes, L. R. O. P. (2011). Introdução à comunicação alternativa em classes comuns de ensino. In: L. R. O. P. Nunes, P. L. Quiterio, C. C. de F. Walter, C. R. Schirmer, & P. Braum (Orgs.), *Comunicar é preciso: em busca das melhores práticas na educação do aluno com deficiência* (pp. 81-92). Marília: ABPEE.

Scruggs, T. E., & Mastropieri, M. A. (1998). Summarizing single subject research: Issues and applications. *Behavior Modification*, *22*, 221-242.

Shukla-Mehta, S., Miller, T., & Callahan, K. J. (2010). Evaluating the Effectiveness of Video Instruction on Social and Communication Skills Training for Children with Autism Spectrum Disorders: A Review of the Literature. *Focus on Autism and Other Developmental Disabilities*, *25*(1), 23-36. DOI: https://doi.org/10.1177%2F1088357609352901

Smith, J., Hand, L., & Dowrick, P. W. (2014). Video Feedforward for Rapid Learning of a Picture-Based Communication System. *Journal of Autism Developmental Disorders*, *44*(4), 926-936. DOI: https://doi.org/10.1007/s10803-013-1946-0

Spriggs, A. D, & Gast, D. L. (2010). Visual Representation of Data. In: D. Gast (Ed.), *Single Subject Methodology in Behavioral Sciences* (pp. 166-198). New York and London: Routledge.

Tincani, M., & Devis, K. (2011). Quantitative synthesis and component analysis of single-participant studies on the Picture Exchange Communication System. *Remedial and Special Education*, *32*, 458-470. DOI: https://doi.org/10.1177%2F0741932510362494

Wolery, M., Gast, D., & Hammond, D. (2010). Comparative Intervention Designs. In: D. Gast. (Ed.), *Single Subject Methodology in Behavioral Sciences* (pp. 329-381). New York and London: Routledge.

Received on: 10/12/2019

Reformulated on: 26/01/2020

Approved on: 26/01/2020