









Patterns of Interactive and Motor Behavior: Animal-Assisted Intervention in Inclusive Education

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A Mexican man in pre-Hispanic Aztec costume eludes the ball during a traditional "Juego de Pelota" (in Spanish), called by the Maya "pok-ta-pok" and by the Aztecs "tlachtli". Xcaret eco-park, Mexico
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Abstract

An inclusive education system generates changes in educational teaching practices and opens the need to implement an innovative methodology to offer more opportunities to the student to participate in an inclusive educational system. Animal Assisted Interventions (AAI) bring benefits from human-animal interaction by contributing to the success of inclusive education. This study was conducted through the systematic observational methodology over two case studies of children with disabilities during a school year. The Observational System for Animal Assisted Interventions (OSAAI) has been validated. Observation using the OSAAI system, coding using the LINCE PLUS software and analysis of temporal patterns (t-patterns), using the THEME software, made it possible to obtain behavioral patterns in a systematized way of the interaction and motor behavior between the agents of the triad: the participant, the therapy animal, and the teacher. The results have shown a progressive increase of communicative patterns accompanied by proactive emotional expressions of the participants. These results demonstrate the benefits in cognitive, motor, multisensory, and interactive stimulation reported by the AAI with the student with disabilities of different etiology in an inclusive educational context.

Keywords: Animal-Assisted Intervention (AAI), behavior patterns, functional diversity, Observational System of Animal Assisted Interventions (OSAAI).

Introduction

International educational policies are committed to the creation of an inclusive educational system that is equitable, which promotes justice, social cohesion (Ainscow, 2020; UNESCO, 2008) and eliminates social exclusion (Ainscow, 2020). Thus, the inclusive educational system has been defined as “the process of strengthening the capacity of the education system to accommodate all learners and people, thus enabling schools to service all children, especially those with special educational needs” (UNESCO, 2008, p. 8).

Educational inclusion generates changes in teaching educational practices and the need to apply new methodological strategies to address the diversity and needs of students (Ainscow, 2006; UNESCO, 2008) with the aim of enabling the presence, participation and success of all students in the educational context (Ainscow, 2020; Echeita & Ainscow, 2011). In addition, to promote the generalization of an inclusive educational system, it is necessary to provide evidence on those educational practices focused on social learning processes that take place in particular contexts (Ainscow, 2020).

An effective inclusive pedagogical methodology adapting learning rhythms to the individual characteristics and needs of students is the personalization of learning (Walkington & Bernacki, 2020). This methodology agrees with current pedagogical optimization trends both in formal education (Valero-Valenzuela et al., 2020) and in informal education, where particular contexts promote inclusive education (Ainscow, 2002; Puigarnau et al., 2016) and also from the point of view of educational psychology and, therefore, of the relationship established between motivation and learning (Bernacki & Walkington, 2018).

Animal Assisted Education (AAE) is based on person-centered learning that facilitates social and curricular learning for students. This generation of student interest in the presence of the intervention dog improves performance and educational success in learning reading skills (Renck, 2005; Xinmei & Tardif Williams, 2019), especially in students with special educational needs (Kirnan et al., 2020). Furthermore, some specific studies have observed an improvement in school performance, social and behavioral competence in an AAI group of students with ADHD (Bunford et al., 2019; Castañer et al., 2020; Schuck et al., 2018). Similarly, the interaction established in AAI programs can have a positive impact on improving the behaviors and social skills of students with autism (Becker et al., 2017; Dimolareva & Dunn, 2020), especially an improvement in verbal and non-verbal communication (Hill et al., 2019).

The International Association of Human-Animal Interaction Organizations (IAHAIO) (2018) clearly states that “Animal Assisted Education (AAE) is a goal oriented, planned and structured intervention directed and/or delivered by educational and related service professionals included within animal assisted interventions (AAI) together with animal assisted therapy and animal assisted activities” (IAHAIO, 2018, p. 5). Fine (2015) considers AAI as “an intervention that intentionally includes or incorporates animals as part of a therapeutic process” (Fine, 2015, p. 15) where the animal acts as a stimulus or facilitator in this process (Bachi & Parish Plass, 2016; Rodrigo et al., 2017) and as social support for people (Fine, 2018). That is, it is based on the fact that humans promote natural contact with animals, thus facilitating social interaction.

The intervention animal in an AAE session acts as a facilitator to achieve the pedagogical objectives established from the human-animal interaction and communication that is reinforced by the link established between the species (Fine, 2015). This bidirectional relationship is demonstrated by mean of the change of the dog’s communication skills towards humans, specifically in relation to the animal’s ability to initiate and learn communicative interactions and social routines and recognize human visual gestures (Soproni et al., 2001). The fact that the social competence of dogs can be considered similar in its functioning to that of humans (Miklósi & Topál, 2013) may be an important factor in the development of communicative intervention objectives in AAE programs. Other authors point out that the dynamic human-animal relationships influence the emotions and cognition of the animal and, for this reason, the ability to experience emotions and interact with humans may be essential for the development of benefits in AAI (Fine et al., 2019).

Today there is a claiming need to evaluate benefits of AAI in the natural contexts of inclusive scholars’ institutions and the present study offers a consistent methodology to pattering interactive behaviors on AAI during inclusive education.

Methods

Participants

An AAI was carried out for three months to two participants who presented special educational needs and attended an ordinary public school. Both were in primary education

and received specific support from ISIS (Intensive Support for Inclusive Schooling) professionals who facilitated their participation and learning in the ordinary educational environment. Participant 1, female, 12 years old, had multiple disabilities without a clear etiology, and participant 2, male, 10 years old, had Autism Spectrum Disorder (ASD). Given the specificity of its individual characteristics, this study is a unique case studied from the follow-up of the evolution of the participants during a certain time that provided the necessary information for its analysis. According to the education inclusion's criteria, the sessions were conducted individually with each participant in the ordinary context of the school and, at the same time, it preserved the eventual reactions to the camera of other students.

The inclusion criteria followed to select the two participants were having a certification of Special Educational Needs (SEN) and a disability. The participants presented a polarized level of abilities, a fact that offered the possibility of being able to contrast the results of the study in a broader spectrum.

The ethical considerations for conducting the study complied with ethical protocols. Regarding animal welfare: a) zoonosis prevention protocol, and b) animal welfare protocol. Regarding the study on participants, the following were obtained: c) information to the families and informed consent for participation in the study, and d) the certificate of the Ethics Committee for Clinical Research of the Sports Administration of Catalonia (reference number 23/2018/CEICEGC).

Design

We used systematic observation to observe regular behaviors in a natural setting (Anguera et al., 2017). Observational methodology offers eight types of observational designs. This study is a Nomothetic/Follow-up/Multidimensional (N/F/M) design because our study focused on different participants (nomothetic) within different sequences (follow-up) and addressed multiple criteria and responses included in an *ad hoc* observation instrument (multidimensional).

Procedure

The sessions of 50 minutes of duration were carried out in a classroom of the educational center where the participants are students. The space allowed the AAI sessions to be held, placing the participants, the team of professionals and the

intervention animal in different positions depending on the pedagogical needs that arose, either on a table or on a mat. The sessions included activities related to cognitive stimulation by means of enhancing the executive functions of memory, attention and tasks organization.

The team of professionals who participated in the sessions was made up of the teacher in charge of the Intensive Support of Inclusive Education (SIEI, Generalitat de Catalunya, 2017), who performed the functions of AAI technician and participant observer, and by the Special Education Educators, who assumed the development and acquisition of the educational objectives set out in a coordinated way in the Individualized Plan for each participant.

Two intervention dogs, a golden retriever and a toy poodle from the Ilerkan Association participated in the AAI sessions.

All sessions were recorded using a digital camera and a tripod fixed at the same angle, to ensure the habituation of the participants. Specific criteria were followed to ensure the reliability of the sample:

- Control of external interruptions during intervention sessions. In sessions where the interruptions were too significant, the recordings were discarded for analysis.
- The distribution of stable criteria in all sessions (initiation and activation routines, professionals involved in the sessions, therapy animal, duration of the sessions and their timing). The duration of the sessions was established following pedagogical criteria (taking into account the characteristics of the participants and their needs) as well as the animal welfare criteria. The prior habituation of the participants to the technical elements for recording (tripod and video camera) was necessary to avoid the participants' reactance bias.

Instruments

Observational tool

We have designed an *ad hoc* observational tool, OSAAI –(Observational System of Animal Assisted Interventions) to conduct a systematic and objective observation on AAI. It was based on two specific observational tools: a) one specific for motor skills observation, OSMOS (Observational System of Motor Skills) (Castañer et al., 2011), and another one which is specific for communication skills observation SOCIN (Kinetic Observational System) (Castañer et al., 2016). OSAAI was validated by a panel of three expert pedagogues (two in motor skills and communication and one in AAI).

Table 1
OSAAI (Observational System of Animal Assisted Interventions).

Criterion	Category	Code	Description
1. Motor-space interaction	Postural changes	POS	The body positioning of the students changes level, for example: sitting upright, lying on the mat, seated, etc.
	Locomotion	LOC	The positioning of the students is standing and in locomotion.
	Combination of the above	CEM	Any of the above options combined.
2. Kinetic	Stereotyped movements	EST	Students perform repetitive motor movements with no end or apparent significance.
	Segmental movements	SEG	Students perform upper or lower limb movements.
	Combination of the above	CC	Any of the above options combined.
3. Interactive facial behavior	Expression of emotions of pleasure	PLA	Students express pleasure through verbal or non-verbal communication (guttural sounds, laughter, body movements associated with well-being...).
	Expression of emotions of displeasure	DES	Students express displeasure through verbal or non-verbal communication (guttural sounds of displeasure, crying...).
	Neutral	NEU	Students show a neutral behavior, they remain balanced from the emotional point of view, they do not show any of the two emotional extremes previously described.
4. Animal-participant interaction	Distance from the animal	DIS	Students take the action of separating from the animal or rejecting its contact.
	Approach to the animal	APR	Students do the action of intentionally approaching the animal.
	Contact with the animal	CON	Students do the action of touching/caressing the animal.
	Manipulation	MAN	Students do the action of manipulating the animal. It is considered the highest gradient of intentionality on the part of the students.
5. Participant emits to the animal	Participant emits to the animal	PAN	Students issue information, slogans or refer to the animal. Whether on a verbal or paraverbal level.
6. Adult-participant interaction	Participant emits information	PAR	Students issue information addressed to the adult. Whether on a verbal or paraverbal level.
	Adult emits information	ADU	The adult provides information addressed to the students. Whether on a verbal or paraverbal level.
	Combination of the above	CAP	Any of the above options combined.
7. Animal-adult interaction	Relocation of the animal	REC	The adult relocates the animal following pedagogical or animal welfare criteria.

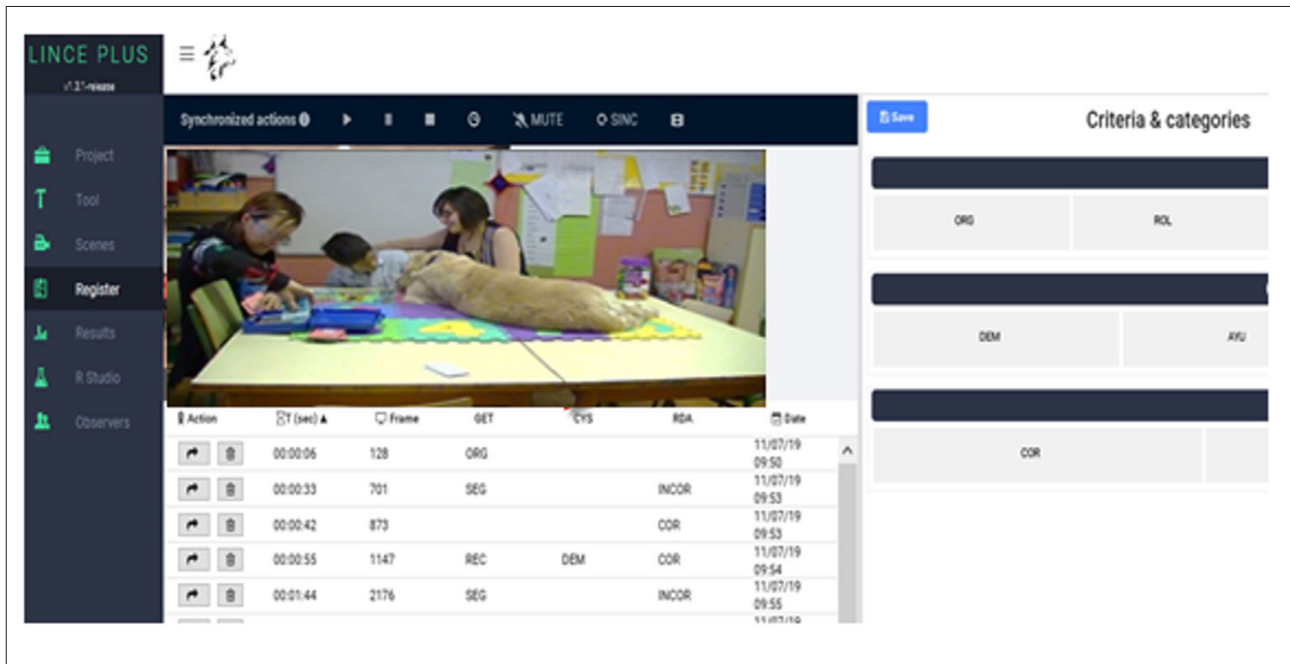


Figure 1

Screen of LINCE software. Right box: criteria and categories of behavior to be selected when they appear in the video. Left box: video image; below: rows of data obtained in vvt (variable and value table).

Recording instrument

The free software program LINCE PLUS (Soto et al., 2019; 2022) was used to implement the instrument OSAAI and record the behaviors. LINCE PLUS integrates a wide range of functions, such as coding, recording, data quality check between observers, and exporting data to different data analysis applications (figure 1). Thus, LINCE PLUS software is versatile and easy to use as it was designed to facilitate the observation of spontaneous behaviors in diverse contextual situations (Castañer et al., 2013, 2020). This software also allows the data quality check between the two observers, one expert in motor behavior and the other one in Animal-Assisted Intervention. The Cohen's Kappa coefficient (K) obtained was of .93 for interobserver agreement and .96 for intraobserver agreement.

Data analysis

Data analysis was conducted applying the THEME software package (Magnuson, 2017) to detect t-patterns (TPA) in behavior records. T-pattern detection is a technique that recognizes recurrent patterns such as behavior events over time capturing variability in timing and defines occurrences of patterns based on statistical probabilities (Magnusson, 2017).

This technique allows to compare all behavioral patterns and retains only the most complete ones as several studies have shown (Castañer et al., 2016, 2020). The following search criteria were applied: a) presence of at least 3 given t-pattern b) redundancy reduction setting of 90% for occurrences of similar t-patterns, and c) significance level of .005.

Results

The THEME software detected temporal patterns in all 19 sessions recorded; (a) the total number of events, the combinations of animal assisted interventions, analyzed in the 19 sessions, corresponding to the two participants; and (b) 2,253 events, but only 132 event types were repeated in both the first and the second participant; (c) a minimum of 49 and a maximum of 12,398 different patterns.

The analysis of t-patterns demonstrated the combination of interactive behaviors in the triad –participant, animal and educator– represented visually by the dendrogram graphs. These graphs (figure 1 and 2), for each of the two participants, allowed us to visualize a chronological succession of all these interactive and motor behaviors patterns or t-patterns, selected as the most representative, and which occurred according to a chronological order.

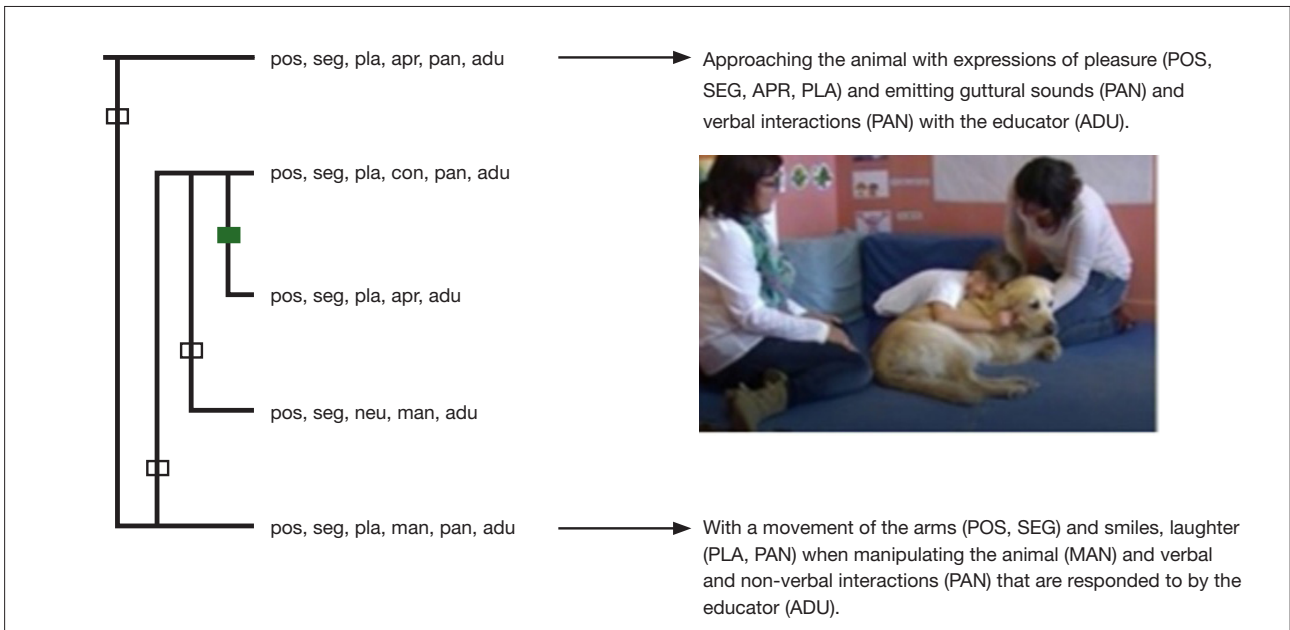


Figure 2
T-pattern detection of Animal Assisted Interventions in participant 1.

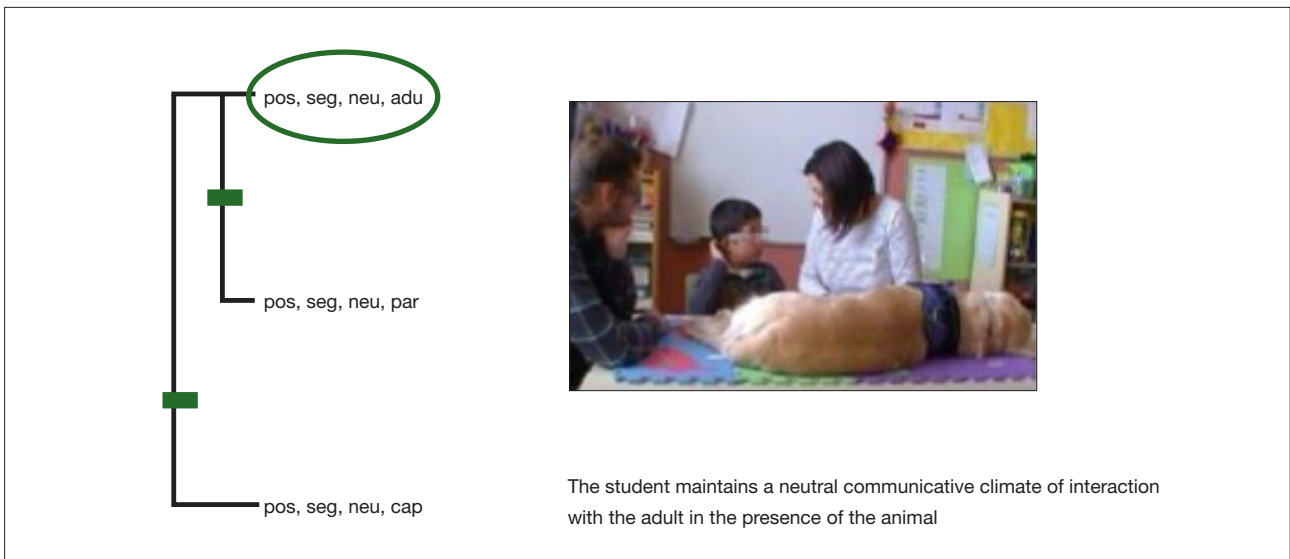


Figure 3
T-pattern detection of Animal Assisted Interventions in participant 2.

First participant

The interactive behaviors in 8 sessions of the first participant revealed t-patterns we consider the most representative (Figure 2):

- Approaching the animal with expressions of pleasure (POS, SEG, APR, PLA) and emitting guttural sounds (PAN) and verbal interactions (PAN) with the information provided by the educator (ADU).
- With a movement of the arms (POS, SEG) and smiles, laughter (PLA, PAN) when manipulating the animal (MAN) and verbal and non-verbal interactions (PAN) that are responded to by the educator (ADU).

In this behavior pattern, it is considered that there is an increase in intentionality in the participant’s communicative interaction and expression of positive emotions with the animal. The fact that a greater frequency of manipulation of the animal is observed implies a higher level of motor intentionality.

The analyzed t-patterns confirm a causal and relational relationship between the interaction with the therapy animal and the increase in the participant’s expressions of pleasure. An increase in the motor and communicative initiative of the participant towards the animal and the educational professional is observed together with the multisensory stimulation that the manipulation of the animal provides.

Second participant

The interactive behaviors in the 11 sessions of the second participant revealed t-patterns among which we expose the most representative (Figure 3):

- Change of segmental position of the participant with neutral facial expression (POS, SEG, NEU) with communicative exchange of the educator's verbal stimulus (ADU).
- Change of position without facial expression changes (POS, SEG, NEU) to answer the educator's communication (ADU).
- With motor movements, he continues with an interactive and neutral attitude (POS, SEG, NEU) but with an interactive learning exchange with the educator (ADU) and in the presence of the animal.

The t-pattern that is displayed in this configuration of behaviors highlights the dyadic interaction between the educator and the participant in the presence of the animal that favors the communicative climate between the two, a fact that is interpreted as the creation of a situation of bidirectional communicative interaction between both interlocutors.

We can observe that it is the participant who maintains the communicative initiative during the sessions, making numerous demands on the adult in a neutral communicative climate but favoring the communicative teaching-learning interaction.

This confirms that the educator guides and provides information and instructions to the participant, thanks to the encouraging and mediating presence of the animal. Therefore, it encourages the stimulation of the communicative situation in a teaching-learning situation from the interaction with the therapy animal, where there are curricular situations in which the educator introduces knowledge, offers instructions to start or change activity and/or redirects them.

Discussion

The results obtained through the analysis of t-patterns show us that AAIs in the educational field promote and intensify the interactive behavior patterns between the triad composed of the educator, the participant and the intervention animal. These are behavior patterns that agree with scientific contributions that suggest that humans and animals have the ability to establish an emotional bond between species (Fine, 2018) and that this natural relationship with animals provides health benefits (Barker & Wolen, 2008;) to people with disabilities (Friedman & Krause-Parello, 2018), and also emotional, physical and psychosocial well-being (Fine, 2018). We have

also found an increase in social skills and, therefore, a better functioning of social interaction.

Regarding the frequency of appearance of behaviors from the OSAAI observational instrument, we highlight that of interactive facial behavior, specifically the expressions of pleasure of participant 1 in the presence of the intervention animal, coinciding with other studies carried out with participants with disabilities, where the variables related to happiness and relaxation were progressively increased in the AAI sessions and therefore reflected a greater emotional well-being of the students (Rodrigo et al., 2017, 2018). These positive emotional expressions are accompanied by non-verbal language (sounds) and intentional manipulations towards the intervention animal.

The increase in the communicative intentionality of the participants in the educational context is interrelated with the manipulation and interaction with the animal from the planning of the AAI sessions carried out by the educator, promoting multisensory stimulation. It is for this reason that we agree with Hill's et al. (2019) studies when they find that AAIs improve verbal and non-verbal communication. Other studies carried out with participants with special needs suggest that AAI can improve cognition and emotional competencies based on multisensory stimulation (verbal, visual and tactile) provided by interaction and manipulation with an intervention animal (Menna et al., 2016).

In observing this same criterion in participant 2, we highlight the category of neutral expression since the student shows a balanced behavior in the communicative and learning situation while interacting with the educator and the intervention animal. Fung (2015) states an increase in social communication, especially in joint attention and waiting times. Regarding this aspect, Stevenson et al. (2015) also found that students with autism improved at the communicative level, especially in significant vocalizations in those sessions where they interacted with the teacher and the dog.

The AAI sessions analyzed highlight this improvement in social behaviors, coinciding with the research carried out by authors such as Becker et al. (2017), Dimolareva & Dunn (2020), and in the systematic review carried out by O'Haire (2017), where a significant increase in the social interaction of the participants was observed in 22 of the 28 studies analyzed.

We note the creation of a neutral communicative climate where the communicative triangle that is established between the educator and the student is positively reinforced by the guided interaction with the intervention animal. In this aspect, the presence and intervention of the animal exerts a protective factor and therapeutic alliance between the educator and the participant (Fine, 2018) that facilitates the achievement

of the educational objectives set. In the AAI sessions in the inclusive educational field we observe that the educator guides and brings knowledge and skills to students from positive interaction with the animal.

This communicative situation that is established between the student and the educator promotes teaching-learning situations and therefore also addresses the diversity of students presenting special educational needs. Authors such as Kirman et al. (2020) and Schuck (2018) highlighted the positive impact of AAIs on the development of social, behavioral and school competencies especially in children with special educational needs (Kirman et al., 2020), largely because AAI sessions improve student interest and thus academic performance (Renck, 2005; Xinmei & Tardif-Williams, 2019). In relation to this aspect, the results obtained in the t-patterns analysis show that the animal enhances motivation (Fine, 2018) in the face of the acquisition of the learnings that the educational plan enhances and it facilitates a greater commitment to learning since resistant behaviors are reduced by generalizing an improvement in participation within the class (Dearden et al., 2016).

Authors such as Martin & Farnum (2002) suggest a significant decrease in the communicative intentionality of the student with autism towards the professional as they consider that he spends more time talking to the animal. Contrary to these studies, there has been an increase in the capacity for coherent and meaningful dialogue between participant 2 and the teacher at the AAI sessions.

For both participants t-patterns are detected that relate to the presence and/or manipulation of the intervention dog with an increase of communication competences. However, t-patterns are interpreted individually for each participant as they have very differentiated communicative capabilities. While participant 1 presents nonverbal communicative expressions (sounds, guttural expressions), participant 2 expresses himself with a functional verbal language and more motor actions in relation to participant 1, with movement limitations.

Both prioritize in the Intervention Plan the development of the communication skills that we observe in the AAI sessions. Thus, it stands out, on the one hand, improving the communicative intentionality of participant 1 while manipulating the animal and maintaining a more active connection with reality. On the other hand, in participant 2, we start from a more complex level of language allowing a more consistent interaction with the teacher towards acquiring curriculum learning.

This increase in the intrinsic motivation of the participants towards the development of a greater communication initiative and teacher learning coincides with research conducted by Stevenson (2015), who believes that school intervention dogs

can be a tool of motivation and generalization that enhances children's participation in school activities and improves social relationships with other schoolmates.

The latest professionalizing currents in the field of AAIs seek a way to demonstrate their efficiency in the different areas of application. Thus, numerous studies are beginning to be published that seek to quantify and validate the benefits they produce in different groups. In this need and desire to create scientific evidence, it is necessary to be careful and make moderate statements about the possible benefits of AAI based on rigorous research (Crossman & Kazdin, 2020) and, therefore, increase research and raise the standard of methodological rigor in research on AAI (O'Haire, 2017). There are studies that endorse this methodology not as an alternative intervention but as an innovative, effective and complementary program (Rodrigo et al., 2018), to the usual interventions (Rodrigo et al., 2020).

In addition, in the educational field it is also essential to establish new evidence in order to promote and validate tools to offer to the inclusive educational system. Case study stands as a useful methodology in this area of research (Nilholm, 2020).

This study proposes the limitation of the number of participants and the duration in time, coinciding with Kasari (2002). We consider that as a prospective future, it would be interesting to be able to implement and evaluate the AAE in a higher number of participants and with longer time duration, even reaching a longitudinal study. The objective of this study in a naturalistic context has had certain technical limitations, since there was not a prepared classroom with microphones and cameras distributed over the entire surface. This fact has not offered the possibility of being able to analyze recordings in groups with a higher number of participants. As a future prospect of this study, it would be interesting to be able to record AAE group sessions from different angles of vision and thus be able to analyze their benefits throughout an entire school year.

Conclusions

The use of the systematic observational methodology and the analysis by means of the detection technique of t-patterns has allowed us to objectively demonstrate the effectiveness of AAI, which could promote the educational and social inclusion of students in the ordinary educational environment and the generalization of the competences acquired in their closest social context. The communication and social skills developed in AAI sessions are a protective factor and trigger of the improvement of the participants' connection with their educational environment.

AAIs provide benefits in cognitive, motor, sensory, communicative, relational and emotional stimulation in children with functional diversity in an inclusive educational context. They are an intensive educational measure that promotes the acquisition of educational and curricular competencies in school and that can be considered one more methodological resource for attention to diversity in ordinary schools.

The validity and usefulness of the OSAAI observational instrument as a tool for systematic observation of the non-verbal behavior of the participants in the AAI sessions is confirmed. From the analysis of the patterns, it is found that AAE sessions influence on the increase of interactive behaviors between the students, the adult and the intervention animal.

These interactive behaviors are materialized in an improvement of the communicative interaction (communicative initiative, spontaneous communicative production, communicative climate, etc.) and the increase of attention and motivation in teaching-learning situations and, therefore, the development and acquisition of educational competencies. In addition to the benefits of multisensory stimulation and the relationship with the immediate environment.

Finally, there is an increase in expressions of pleasure in the interaction with the intervention animal. The participants unequivocally express positive emotions that arise from the emotional bond that is created between the different agents (students, adults and animals). This climate of emotional well-being that is evidenced in AAI sessions provides emotional and relaxation benefits that are the basis for building new learning and skills.

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