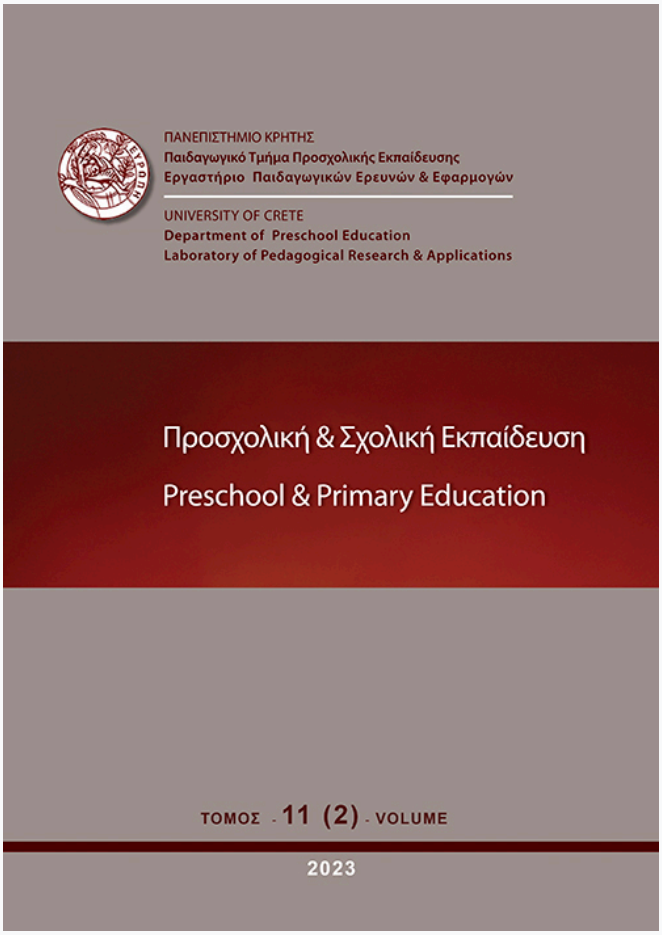
Preschool and Primary Education

Τόμ. 11, Αρ. 2 (2023)

Νοέμβριος 2023



The impact of a therapy dog program on children's with ASD social skills, communication, and behavioral difficulties

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doi: 10.12681/ppej.32430

Βιβλιογραφική αναφορά:

Καρπουτζάκη Χ., Μαρκοδημητράκη Μ., Κυπριωτάκη Μ., & Χαριτάκη Γ. (2023). The impact of a therapy dog program on children's with ASD social skills, communication, and behavioral difficulties. *Preschool and Primary Education*, *11*(2), 284–317. https://doi.org/10.12681/ppej.32430

Preschool & Primary Education
2023, Volume 11, Issue 2, pp. 284-317
e-ISSN: 2241-7206

Laboratory of Pedagogical Research & Applications
Department of Preschool Education, University of Crete
doi: https://doi.org//10.12681/ppej.32430

The impact of a therapy dog programme on students with Autism Spectrum Disorder social skills, communication, and behavioural difficulties

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Abstract. Recent research findings confirm the mediating role of animals, especially dogs, between a therapist and a child during therapy sessions. The presence of dogs has been studied in clinical studies. In cases of children with disabilities dogs facilitate the therapeutic session as they distract children from their real problems and make them feel relaxed. However, there is a research gap on the impact of a therapy dog in a school setting. The present study aims to explore the effectiveness of therapy dogs' presence in an intervention programme for students with Autism Spectrum Disorder (ASD). Three primary school students with ASD, their teachers and parents, and a therapy dog with its attendant were enrolled in the study. Data collection was based on teachers' and parents' observations of students' social responses and behavioural difficulties before and after the intervention, on teachers' diaries, and on the micro-analysis of the six videotaped therapeutic sessions. Results show that the dog's presence increased student response to social stimuli and reduced the symptoms of ASD, not only during the intervention but also in the post-intervention phase. No aggressive or self-injurious behaviours were exhibited during the sessions. The study highlights the healing impact for children with ASD when a dog is incorporated in a school setting.

Keywords: Autism Spectrum Disorder; ASD; dog; school setting; social skills; communication; behavioural difficulties

Introduction

Over the last decades, Animal-Assisted Activities (AAA) and Animal-Assisted Therapy (AAT) have been incorporated in therapeutical practice with beneficial results for human physical and mental health (Friedmann et al., 2010). They are based on the idea that an animal which does not belong to, or has no previous relationship to a person, can be used to reduce symptoms of an illness or condition. More specifically, according to Kruger and Serpell (2010), Animal-Assisted Interventions (AAI) refer to a wider field of interventions where animals are used as a part of the therapeutical procedure aiming to improve the physiological and psychological health of the individual. AAT and AAA are placed under this

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e-publisher: *National Documentation Centre, National Hellenic Research Foundation*
URL: http://ejournals.epublishing.ekt.gr/index.php/education

umbrella. Their common feature is the use of animals that meet certain criteria in interventions. On the other hand, their basic difference is that AAT is a goal-directed intervention that has to be performed by properly trained professionals and focuses on specific, measurable goals, while AAA are interventions that incorporate animals in various activities giving people in need motives to learn and enjoy themselves with a focus on a quality of life (Delta Society, n.d.; Kruger & Serpell, 2010). In literature, based on the pioneering work of the psychiatrist Boris Levinson (1962) on animal assisted psychotherapy, it has been suggested that it is the innate characteristics of the animals, their physical characteristics, their spontaneous and selfless reactions to human calls and their unlimited availability that function as a stress relief aid for humans in need (Kruger & Serpell, 2010). The presence of an animal during a therapy session can offer a friendly, non-stressful topic for discussion which accelerates and increases the development of therapist-patient communication and collaboration, especially in cases of emotionally stressful or embarrassing sessions for the patients.

In the case of children with an illness or a disability, research has shown that animals, especially dogs, are good mediators between the therapist and the child for the success of a target in a therapeutic setting, and they play the role of a "social lubricant" as Levinson characteristically stated (1969). Children seem free to express their feelings as dogs do not judge them, they are a good company for them and show their empathy and their readiness for social and emotional support (Friesen, 2010; Mallon, 1992). Taking care of a dog while being in a therapeutic session functions as a distraction from the child's real problems. At the same time, it gives the therapist a chance to gain the child's trust and choose the best practice in each case. Moreover, a therapeutic dog can be available 24 hours a day if needed, and as a living being can have quicker and greater results than toys in play therapy (Levinson, 1978). Also, the child seems to take advantage of having, apart for the main therapist, a "co-therapist" in the shape of the dog (Mallon, 1992, p. 54). Dogs have been used in individual counselling in cases of children with behavioural problems, learning disabilities, emotional disorders, and sexually abused children and their beneficial interaction with all children in the above categories have been confirmed (Kogan et al., 1999; Limond et al., 1997; Prothmann et al., 2006; Reichert, 1998). In therapeutic centres, like the Green Chimneys Children's Services in New York (Mallon, 1994), where children lived apart from their families, the 24-hour presence of a dog was found to be beneficial not only for the children living there, but for all the staff engaged in their treatment. It is particularly important to examine these cases of children because the love, companionship and affection from their parents and close relatives are complicated by the physical distance, so that their emotional needs have to be met by substitutes (e.g., professionals, child care workers, dogs, etc.). In Mallon's study (1994), the therapeutic dog was by common conception the one who developed a special bond with the children based on a mutual sharing of beneficial comfort and understanding that healed the wounds of the children. The interviews with the professionals, the social workers and the children that took place in Mallon's study (1994) also highlighted all the positive elements of an unconditional friendship between the children and the dog, confirming the results of previous studies for children in treatment centres (Ross, 1981, 1984, 1989). The importance of physical proximity and intimacy between children and animals has been also confirmed in studies where dogs are used for therapeutical reasons in social interaction therapy (Fung & Leung, 2014) and in therapies of children with neurological problems (Elmaci & Cevizci, 2015). Animals' intuitive ability to deeply understand children's real needs gives them great comfort (Bradshaw & Nott, 1995; Brucks et al., 2017; Szetei et al., 2003). Additionally, increased mutual gazes in child-dog interactions is another qualitative characteristic of their physical proximity (Grandgeorge et al., 2020; Jalongo, 2018). Finally, not only the quality but the quantity of child therapy-dog interaction has been found to be better among children with autism as their mutual gazes last a longer time (Grandin et al., 2015; Jalongo, 2018; Silva et al., 2011). The

extended mutual gaze is crucial for children with ASD when one thinks of their deficits in social interactions (Warreyn et al., 2014).

In a school setting, as captured through case studies in the existing literature (Fine, 2010; Fine & Eisen, 2016), pets enhance the emotional stability of students with a disability and this is reflected in better academic achievement, while pets also enhance children's positive attitude towards school (Berry et al., 2013; O'Haire et al., 2014). In their work on how animals support the learning process, Gee and Schulenburg (2017) suggest that children's social ability and their method of meeting academic challenges have an impact on their general ability to adapt to social requirements and their learning trajectory. That is why they recommend measuring children's skills and abilities in the learning process using scales of their verbal and non-verbal abilities, executive functions and reasoning, and they base the effectiveness of each intervention on the assessment of children's academic learning outcomes. In early and middle childhood, dogs have been used in reading programmes at schools as a means to enhance the academic engagement of small groups of children with emotional and behavioural problems (Barton-Atwood et al., 2005; Bassette & Taber-Doughty, 2003; Esteves & Stokes, 2008; Fung, 2019; Kotrschal & Ortbauer, 2003; Lane & Wright, 2007; Wehby et al., 2003), Down syndrome (Limond et al., 1997) and emotional disabilities (Kogan et al., 1999). Gee et al. (2017) suggested that mastering the mechanism of reading is essential for school success, and failure to do so leads to limited academic performance and professional achievement. One of the first dog-assisted literacy programmes (DLPs) was Reading Education Assistance Dogs (R.E.A.D), during which children exercised their reading abilities once a week for 30 minutes in a dog's presence (Kirnan et al., 2018). Results from the growing body of literature based on dog reading visitation programmes at schools have confirmed improvements in children's emotional, social and cognitive development. More specifically, during such programmes and afterwards children were less aggressive and hyperactive, more focused on the ongoing activities, more positive in their social interactions and more empathetic (Hergovich et al., 2002; Kogan et al., 1999; Kotrschal & Ortbauer, 2003; Limond et al., 1997), excited (Kirnan et al., 2018), responsible and respectful (Anderson & Olson, 2006). Children also were found to be more confident, more motivated to engage with the dog, teachers and peers (Bueche, 2003; Friesen, 2009; Jalongo, 2005; Jalongo et al., 2004; Lane & Zavada, 2013; Newlin, 2003; Shaw, 2013) and they were more willing to follow daily routines (Esteves & Stokes, 2008). Finally, children read more fluently to the dog, without shyness and fear (Snider, 2007) as it had gained their interest and trust.

In children with Attention Deficit Hyperactivity Disorder (ADHD) the therapeutical impact of a dog's presence has been also confirmed. Children were found to be more motivated when a dog was present in a classroom and their attitudes and emotions were also more positive. Moreover, students exhibited increased levels of joint attention and learning (Busch et al., 2016). Also, it has been found that the presence of a dog in a school setting helps children with ASD. Levinson (1964) suggested that using dogs in the psychotherapy of children with autism strengthens their contact with reality. Some decades later Levinson's suggestion was confirmed as research data showed improvement of children's verbal abilities while a dog was present. Fung and Leung (2014) studied the impact of dogs in the verbal abilities of children with ASD in a social context. Ten children aged from 7 to 10 years old completed 14 sessions with social interactions in the presence of a dog in a Special School in Hong Kong. It was found that dogs helped children with ASD to verbally respond and imitate, speak spontaneously, maintain eye contact, follow instructions, increase their patience and physical contact. Additionally, in O' Haire et al.'s study (2014) both parents and teachers mentioned improvement of social behaviour in children with ASD, a decrease in externalizing their behavioural problems and a more positive attitude towards school. However, the study by O' Haire et al. was based on parents' and teachers' responses to a questionnaire while Fung and Leung's study was based on observation of the elicited therapist-directed play therapy

(intervention phases) and the phases before and after it. Silva et al.'s study (2011) was also based on observation in canine-assisted therapy provided for a 12-year-old girl who was reported to smile longer, be less sensitive to physical contact and friendlier when the dog was present.

The different methodological approach in the studies conducted until now, the small number of participants, the rarity of similar studies on children with ASD, and the structured, therapist-oriented interventions, despite their encouraging findings, make necessary new methodological designs and further investigation of dogs as facilitators for children with ASD. In Greece such data are even rarer. To the best of our knowledge published scientific work is limited to the study of Loukaki and Koukoutsakis's (2014) who introduced a rabbit in a pre-primary school class with 39 pre-school-aged children, 2.5-4 years old. The results showed significant improvement in children's social abilities and the way they communicated and expressed their feelings in the presence of the rabbit. However, it has been suggested that it is easier for children with ASD to get the benefits from dogs compared to other animals, and more easily understand dogs, as their worlds are based on similar aspects of communication with people and things surrounding them, pictures, smells and sounds instead of words (Fung & Leung, 2014; Grandin & Johnson, 2005; Grandin et al., 2010; Melson, 2005). Following this line of reasoning, an intervention programme for children with ASD in primary school was designed.

Our main purpose was to investigate how effective the presence of a therapy dog is on the social behaviour and communication of three students with ASD in daily life at school and at home. Individual sessions took place in the special primary school that they attend. We hypothesized that: (1) according to the parents and teachers of children with ASD, there would be differences in the pre- and post-intervention phase in their social abilities, communication, behavioural problems and stereotypical behaviour, (2) from the first to the sixth session of the intervention phase, there would be an increase in the duration of the children's social behaviour, communication, physical proximity, eye contact and physical contact (touch) with the dog, the teacher and the dog attendant, and (3) from the first to the sixth session of the intervention phase, there would be a decrease in the duration of children's behavioural problems and stereotypical behaviour.

Method

Participants - Students

Participants consisted of 3 students with ASD, 2 boys and 1 girl, who were enrolled in a Greek-speaking Special Primary School. Their full-scale Intelligence Quotients (IQ) ranged from 56 to 65 assessed using the Wechsler Intelligence Scale for Children-Third Edition (WISC-III, 1991). A set of specific inclusion criteria were established to select the students. Firstly, they should be aged from 7 to 12 years old, should have been diagnosed with ASD and, should have social impairments, accompanied by behavioural problems and stereotypical behaviours. The first student (S1), an 11-year-old boy, had attended the Special Primary School for three years. The second student (S2), a 12-year-old-boy, and the third student (S3), a 10-year-old girl, also attended the same Special Primary School as S1. All three students had difficulties in verbal communication and severe deficiencies in social contact. They could not maintain eye contact and S1 could not respond to verbal communication and had rudimentary oral language skills. The students also exhibited low joint-attention ability and a preference to constantly switch activities. S1 could only engage in structured activities in the daily school programme with frequent breaks necessary so that he would continue to be calm. During breaks he preferred to sit alone or wander in the school yard. The three

students had difficulties dealing with their emotions. S2 was also given support by a psychologist and a speech-therapist. He was assessed to have a good mental dynamic, particularly at the practical level and in problem-solving. He enjoyed remaining alone and following his routine without disturbance. In addition to the above social deficits all three students had, S3 also had a food obsession and intense difficulty in deferring gratification (emotional outbursts). Finally, self-injurious behaviour was often observed (e.g., biting her hand, hitting her head).

Teachers and dog owner

There were two inclusion criteria for the selection of the teachers. Firstly, they should be special education teachers or teachers of general education trained for children with disabilities. Additionally, they should be trained and have previous experience with therapies assisted by dogs. Three teachers and a therapy dog (Pluto) with its owner also participated in the present study. The teachers, one for each child with ASD, were Primary Education teachers trained in special education, serving in the same Special Primary School, in Crete. The teachers also had experience in animal therapy assisted by dogs in special education. They were recruited by convenience sampling, as the teachers who met all the criteria also served in the same school which was advantageous for the research design (Creswell, 2016).

Procedure

In the pre-intervention phase of the present study questionnaires were given to the parents and the teachers of children with ASD measuring the children's social behaviours, their communication and their stereotypical behaviour and behavioural problems. In the intervention phase the three students with ASD participated in six 30-minute individual sessions in the multipurpose hall of the school. The student with ASD, the teacher, the therapy dog and its attendant participated in each session which lasted 30 minutes distributed as following: 5 minutes for learning through play activity, 10 minutes for dog care, 5 minutes for learning through play activity, 5 minutes for motor activity, and 5 minutes for relaxation. Although there was a structure for the course of the sessions, it mainly followed the children's own rhythm, focusing on their free initiative and guidance. Each teacher and the dog attendant reinforced children's social initiatives and gave time and space for spontaneous interactions with the dog. Finally, in the post-interaction phase the aforementioned questionnaires were given once more to measure the children's examined social and stereotypical skills. The present approved research upheld the ethical standards of the Department of Pre-school Education of the University of Crete, Greece (544/18.10.2017). Parents and teachers were all informed about the purpose of the study, and gave their consent for their children's participation, being assured that their children would be safe during the sessions with the therapy dog and any time they wanted to leave the research, they would be free to do so.

Measures

(α) Observations

(1) Video-recording

Each child had 6 individual sessions (3 children with ASD x 6 sessions = 18 sessions) of 540 minutes total duration (18 sessions x 30 minutes=540 minutes). All sessions were videotaped so that the data used would be as accurate as possible. Videotaping helps to record and replay what actually happened (Jewitt, 2012). The sessions took place twice a week during an eight-week period, from March to May 2020. A Sony Handycam HDR-CX405 with 9.2 mega pixels was used for the video recordings. Data were micro-analysed in minutes.

(2) Coding observations

Two coding sheets were structured for the needs of the present study, one to detect the frequency of the behaviours and social responsiveness exhibited by each child (see

APPENDIX I) and one for the duration (see APPENDIX II). More specifically, the physical proximity, touch, and eye contact of each child with the teacher, the dog and the dog attendant and the child's social responsiveness, initiative, and self-injurious, aggressive and stereotypical behaviour were the examined behaviours in each session which was divided into 6 clusters of 5-minute periods. During each period a behaviour's frequency was assessed on a 0-5 Likert scale (0=it did not occur, 5=very often occurred). The duration coding sheet was also divided into 6 clusters of 5-minute periods for each of the aforementioned behaviours. Moreover, each 5-minute period was divided into 5 clusters of 1-minute sections to facilitate analysis. In each section the start and end times of each behaviour were recorded and the total duration and frequency of each behaviour exhibited was then extracted. At the end of each 5-minute period the section durations were then added, yielding the period duration. Finally, the period durations were added, giving the total duration of each behaviour exhibited in the 30-minute session. All values were tabulated using Excel, allowing computation of the behaviours' frequency and duration. If a behaviour was expressed, it was marked in the frequency coding sheet at the minute it took place, even if it lasted just a few seconds. Then, in the duration coding sheet, the duration between the onset and the end of the behaviour was assessed. For the total duration, all the durations scored were added.

(b) Parental Questionnaire on the Social Skills, Communication and Behavioural Problems of Children with ASD

Questions from the following tools were used to construct the final form of the *Parental Questionnaire on the Social Skills, Communication and Behavioural Problems of Children with ASD* (see APPENDIX III, Table 4):

(1) *Educational assessment tool for children with ASD in the field of Social Skills* created by Mitropoulou et al. (2012) according to the communication and sociability evaluation of the TEACCH method (Treatment and Education of Autism and related Children Communication Handicapped) (for *proximity* see question 1: "Tolerates human touch during work or rest time", question 3: "Tolerates noises or movements of others while they are playing or working nearby", and question 5: "Maintains appropriate body distance from others in a different place". For *eye contact* see question 1: "Has eye contact", question 2: "Observes others' faces", question 3: "Observes others while they are occupied with an activity" and question 4: "Is visually aware of a familiar person coming or leaving". For *social response* see question 1: "Responds with eye contact or orientation to familiar adults", question 2: "Responds to and follows familiar instructions", question 4: "Responds to and follows new instructions", question 8: "Participates in group activities by imitating others", question 9: "Responds when he/she is asked for help", question 10: "Responds to others' smiling", and question 11: "Shakes hands". For *social initiative* see question 1: "Chooses and participates in group activities", question 2: "Takes the initiative by starting an activity or a game with others spontaneously", and question 3: "Takes the initiative of helping others without asking").

(2) *Educational assessment tool for children with ASD in the field of Communication* also created by Mitropoulou et al. (2012) (for *making a request* see question 1: "Asks for an object/activity", question 2: "Asks for help", question 4: "Asks for repetition of an activity", and question 5: "Asks for a break or asks for an activity to end". For *joint attention* see question 1: "Seeks others' attention, when they are near and he/she wants to communicate", question 2: "Seeks others' attention, when they are far and he/she wants to communicate", and question 4: "Directs others' attention to something". For *rejection-denial* see question 1: "Rejects an object", question 2: "Rejects an activity", and question 3: "Refuses to follow an instruction".

(3) BPI-The Behavior Problem Inventory, Behavioral Problems Scale for people with mental disabilities created by Rojahn et al. (2001), and then translated and adapted to Greek by Aslanoglou & Soulis (2013). It measures the frequency of self-injurious behaviour, aggressive/destructive behaviour and stereotypical behaviour of people with mental disabilities (for *aggressive/destructive behaviour* see question 9: "Hitting", question 10:

"Kicking", question 11: "Pushing", question 12: "Biting", question 13: "Grabbing, pulling", question 14: "Scratching", question 16: "Pinching", and question 17: "Destroys". For *self-injurious behaviours* see question 1: "Self-biting", question 2: "Head hitting", question 3: "Body-hitting", question 4: "Self-scratching", question 5: "Pica", and question 6: "Teeth-grinding". For *stereotypical behaviours* see question 19: "Rocking", question 22: "Sniffing objects", and question 29: "Waving arms".

(c) Research diary

A research diary as a mean of qualitative methodology gives useful information that helps researchers deeply understand central phenomena (Creswell, 2016). In our research this information dealt with the social and communication skills of the students and their behavioural problems and stereotypical behaviours towards the teacher, the dog and the dog attendant. The teachers were encouraged to write down what was happening during each individual session and how they interpreted the events. This practice was employed to orient teachers' observations without any intent to limit them. The advantage of a research diary is that it is written in the writer's own words, usually after reflection, and it is almost ready for analysis, without any further transcription as required for interviews or observations (Creswell, 2016).

Results

In the following sections quantitative and qualitative analyses from the data gathered before, during and after intervention are presented.

Quantitative data

Statistical analysis of the quantitative data gathered in the presence of the dog (intervention phase) was carried out to evaluate the change in each one of the students' behaviours towards the dog, the teacher and the dog attendant (physical proximity, frequency and duration of eye contact, and frequency of self-injurious, aggressive and stereotypical behaviours) in relation to the duration of each session (in total six sessions). In Table 1, descriptive statistics such as means and standard deviations of the time duration scores and the frequency scores are presented. Moreover, we report results for Friedman's Rank test and Kendall's W coefficient for effect size, since the results from the Kolmogorov-Smirnov test suggested that the data were not normally distributed (duration of physical proximity of student with the teacher: $D(3)=.004$, $p<.05$, dog: $D(3)=.008$, $p<.05$ and attendant: $D(3)=.005$, $p<.05$, for the frequency ($D(3)=.006$, $p<.05$) and duration ($D(3)=.004$, $p<.05$) of students' eye contact with the teacher, the dog: frequency-$D(3)=.007$, $p<.05$ and duration-$D(3)=.005$, $p<.05$, and the attendant: frequency-$D(3)=.006$, $p<.05$ and duration- $D(3)=.004$, $p<.05$ and for the students' social responsiveness: $D(3)=.007$, $p<.05$). Analysis suggested that there was a statistically significant change in the duration of physical proximity of the student with the teacher ($\chi_F^2(5)=14.333$, $p<.001$), for the duration of physical proximity of the student with the dog ($\chi_F^2(5)=12.050$, $p<.001$), the duration of physical proximity of the student with the attendant ($\chi_F^2(5)=16.673$, $p<.001$). Additionally, statistically significant results were found for the frequency ($\chi_F^2(5)=17.700$, $p<.001$) and duration of students' eye contact with the teacher ($\chi_F^2(5)=15.429$, $p<.001$), for the frequency ($\chi_F^2(5)=14.038$, $p<.001$) and duration of students' eye contact with the dog ($\chi_F^2(5)=13.952$, $p<.001$), and for the frequency ($\chi_F^2(5)= 17.843$, $p<.001$) and duration of students' eye contact with the attendant ($\chi_F^2(5)=13.723$, $p<.001$). Finally, statistically significant results were found for the students' social responsiveness ($\chi_F^2(5)= 14.712$, $p<.001$). Moreover, in all the above cases Kendall's W coefficient indicated a strong effect size. Scores for the six independent measurements for each student are presented in Figures (1 to 6) for all measures.

Table 1 Means and Standard Deviations of pre/post-training test scores and results for Friedman's Rank test and Kendall's W coefficient for effect size.

Measures	1st-training		6th-training		Non – Parametric Friedman's tests				Training 1st – 6th	
	M	SD	M	SD	χ_r^2	df	p	Kendall's W	Min	Max
Physical Proximity of Student with Teacher	8.33	1.53	9.00	.89	6.07	5	.076	.40	6	18
Physical Proximity of Student with Dog	8.33	2.52	8.00	2.65	7.27	5	.156	.48	6	17
Physical Proximity of Student with Attendant	7.67	2.52	8.33	3.21	6.83	5	.072	.45	5	17
Physical Proximity of Student with Teacher (Duration)	22.52	3.96	26.38	2.51	14.33	5	.000	.88	11.53	29.53
Physical Proximity of Student with Dog (Duration)	22.89	5.41	28.26	1,74	12.05	5	.000	.77	15.16	30.00
Physical Proximity of Student with Attendant (Duration)	20.93	2.03	27.86	2.28	16.67	5	.000	.91	19.50	30.00
Student-Dog Contact	11.33	9.29	9.66	1.15	2.15	5	.270	.14	5	22
Student-Dog Contact (Duration)	.92	.59	1.53	.50	3.95	5	.346	.263	.02	5.15
Student Eye Contact with Teacher	11.00	7.21	20.33	4.72	17.70	5	.000	.924	3	24
Student Eye Contact with Dog	13.67	2.08	21.66	1.52	14.03	5	.000	.869	7	26
Student Eye Contact with Attendant	3.67	.57	9.33	4.04	17.84	5	.000	.923	0	13

Student Eye Contact with Teacher (Duration)	.43	.03	1.06	.48	15.42	5	.000	.895	.03	2.16
Student Eye Contact with Dog (Duration)	.43	.03	1.36	.92	13.95	5	.000	.843	.12	2.54
Student Eye Contact with Attendant (Duration)	.06	.01	.19	.09	13.72	5	.000	.835	.02	.37
Student's Social Responsiveness	13.33	7.37	22.33	5.68	14.71	5	.000	.814	5	27
Student's Social Initiative	.67	1.15	1.00	1.00	3.27	5	.161	.278	0	5
Declaration of Student's Request	6.33	7.09	7.33	2.88	2.50	5	.318	.167	0	17
Self-Injurious Behaviour	2.00	3.46	1.00	1.7	4.34	5	.12	.29	0	6
Stereotypical Behaviour	2.33	2.08	.00	.00	8.58	5	.09	.57	0	0
Stereotypical Behaviour (Duration)	.06	.8.58	.00	.00	8.58	5	.09	.57	0	6

Afterwards, we estimated the RCI for each student and measure. According to Guhn et al. (2014), the Reliable Change Index (RCI) is a concept in measurement and assessment. An RCI is a psychometric criterion used to evaluate whether a change over time of an individual score (i.e., the difference in score between two measurements in time) is considered statistically significant. Computationally, RCIs represent a ratio in which the numerator represents an actual observed difference in the score between two measurements, and the denominator is some form of standard error of measurement of the difference. An RCI indicates whether an individual change in score (e.g., between a patient's pre-intervention and post-intervention assessment) is statistically significantly greater than a difference that could have occurred due to random measurement error alone.

Furthermore, the Reliable Change Index (RCI) for each child individually was calculated to specify whether gains within each child were clinically significant and not subject to measurement error. Score variations that exceed these estimated base-rates of change are presumed to reflect clinically meaningful improvement. RCI was calculated by utilizing the standard error of prediction (SE_{pred}), which evaluates differences between predicted and actual scores during the retest interval. The SE_{pred} is used to compute a confidence interval (CI). If the difference between the obtained and the predicted retest scores exceeds this confidence interval, clinically meaningful change is inferred to have occurred. RCI was calculated based on the formula:

$$RCI = \frac{T2 - T2}{SEpred}$$

where T2−T1 is the difference between post-test and baseline scores. SE_{pred} was calculated based on the formula:

where SDt2 is the standard deviation of scores at T2 and rtt is the correlation between tests. The 90% CI was computed by multiplying the SE_{pred} by +/- 1.96. Further estimated true scores were computed as follows:

$$Score_{true} = M + r * (Score_{Actual} - M)$$

where M is the sample mean of the test and r is the reliability coefficient. The RCI is to be interpreted as a z-score. A cut-off score for RCI, which is formed at ±*1.96* can be considered as clinically significant (Duff, 2012). In terms of the duration of physical proximity of students with the dog and the attendant, all students had a significant reliable change. Significant reliable change was also found for the duration of a student's eye contact with the teacher, the dog and the attendant. Finally, statistical analysis suggested significant/reliable change for students' social responsiveness (Table 2).

Table 2 Reliable Change Index per student per measure

Measures	***Students***		
	1	***2***	***3***
Physical Proximity of Student with Teacher	2.47	1.24	-1.24
Physical Proximity of Student with Dog	.00	.00	.75
Physical Proximity of Student with Attendant	1.45	.72	-.72
Physical Proximity of Student with Teacher (Duration)	1.30	.18	4.54
Physical Proximity of Student with Dog (Duration)	2.64	.35	3.57
Physical Proximity of Student with Attendant (Duration)	2.40	2.99	3.83
Student-Dog Contact	4.10	1.26	1.26
Student-Dog Contact (Duration)	.92	.95	5.78
Student Eye Contact with Teacher	1.76	2.78	3.03
Student Eye Contact with Dog	4.04	1.65	4.04
Student Eye Contact with Attendant	2.81	4.21	1.66
Student Eye Contact with Teacher (Duration)	1.72	2.66	4.98
Student Eye Contact with Dog (Duration)	1.65	2.04	4.60
Student Eye Contact with Attendant (Duration)	2.19	4.38	1.39
Student's Social Responsiveness	1.97	.00	4.68
Student's Social Initiative	.00	1.92	.00
Declaration of Student's Request	-1.94	1.55	1.55
Self-Injurious Behaviour	-2.26	.00	.00
Stereotypical Behaviour	4.12	.00	3.19
Stereotypical Behaviour (Duration)	4.66	.00	1.67

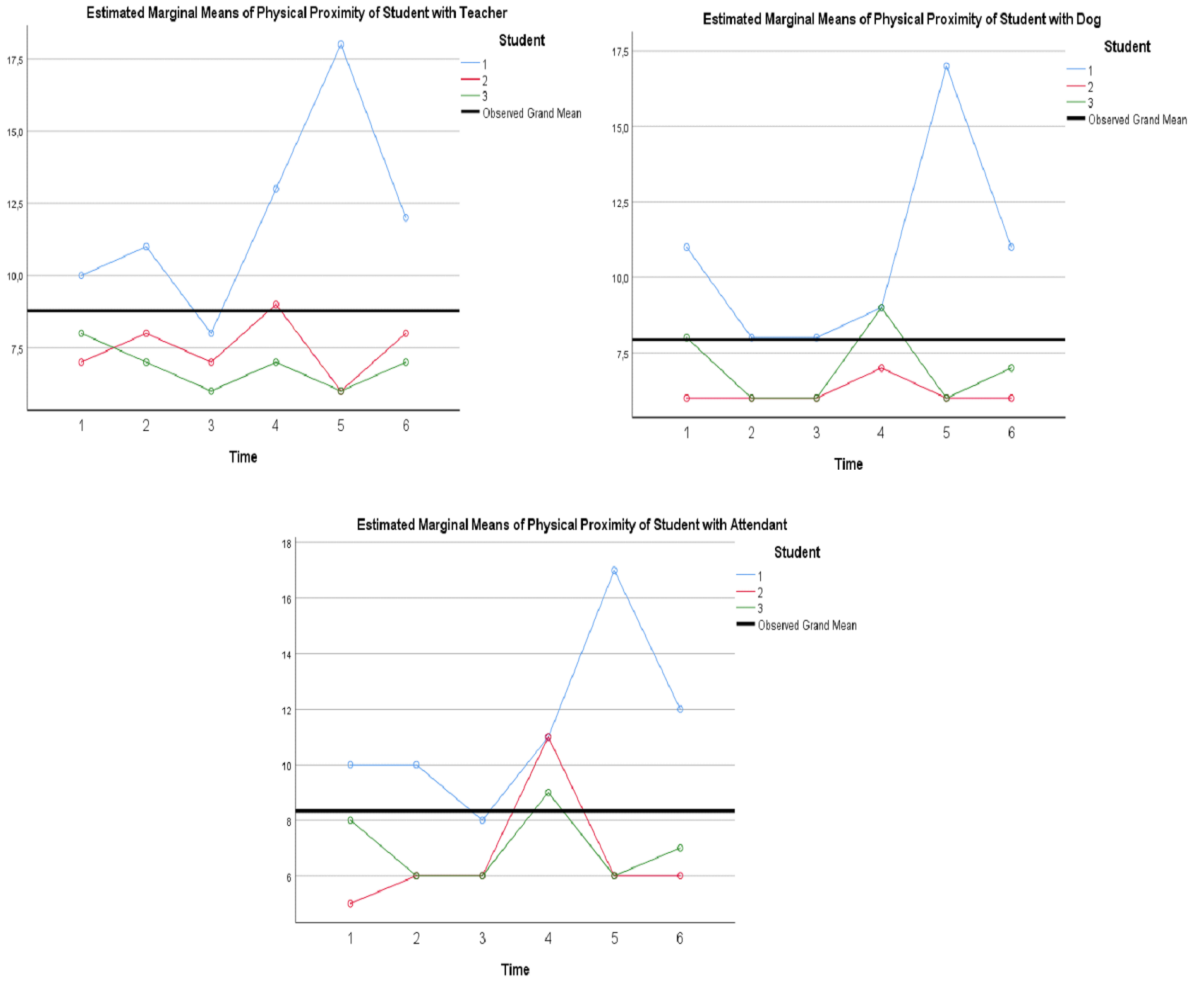

Figure 1 Scores for the six measurements for physical proximity of each student that participated in the study with his/her teacher, dog and attendant (frequencies).

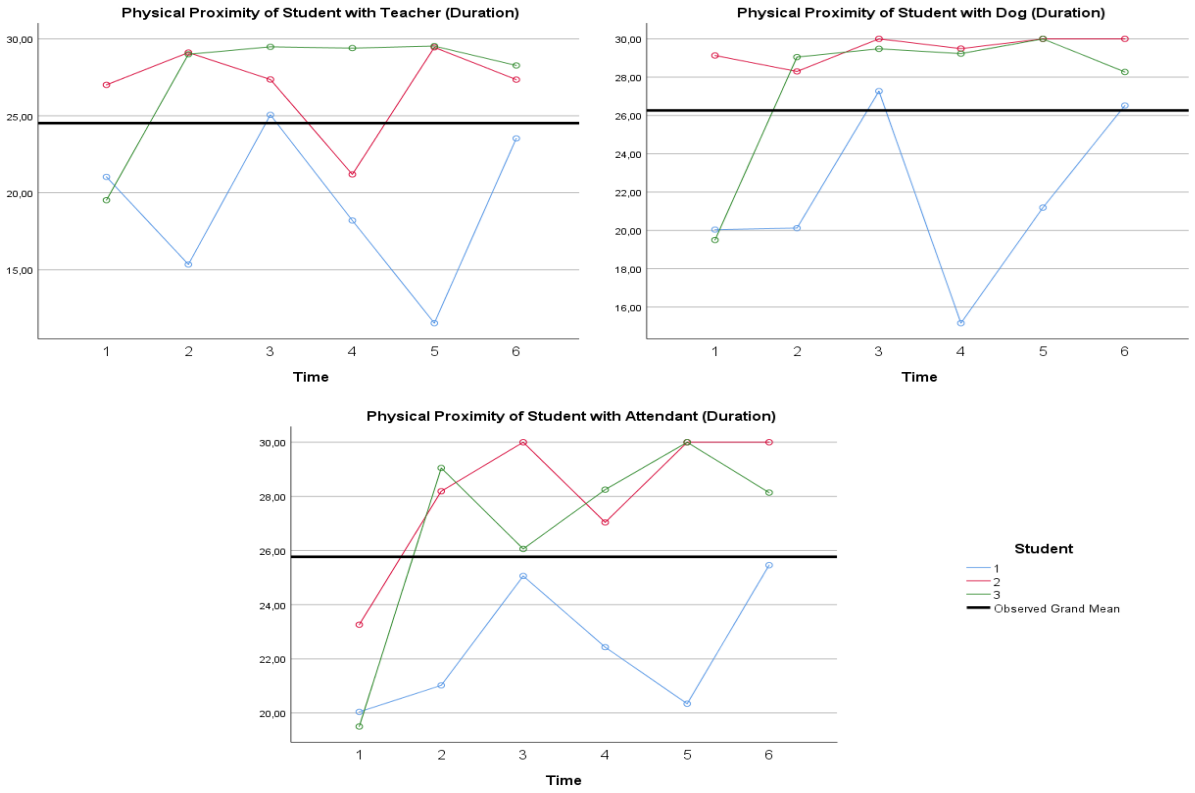

Figure 2 Scores for the six measurements for the duration of physical proximity of student with teacher, dog and attendant.

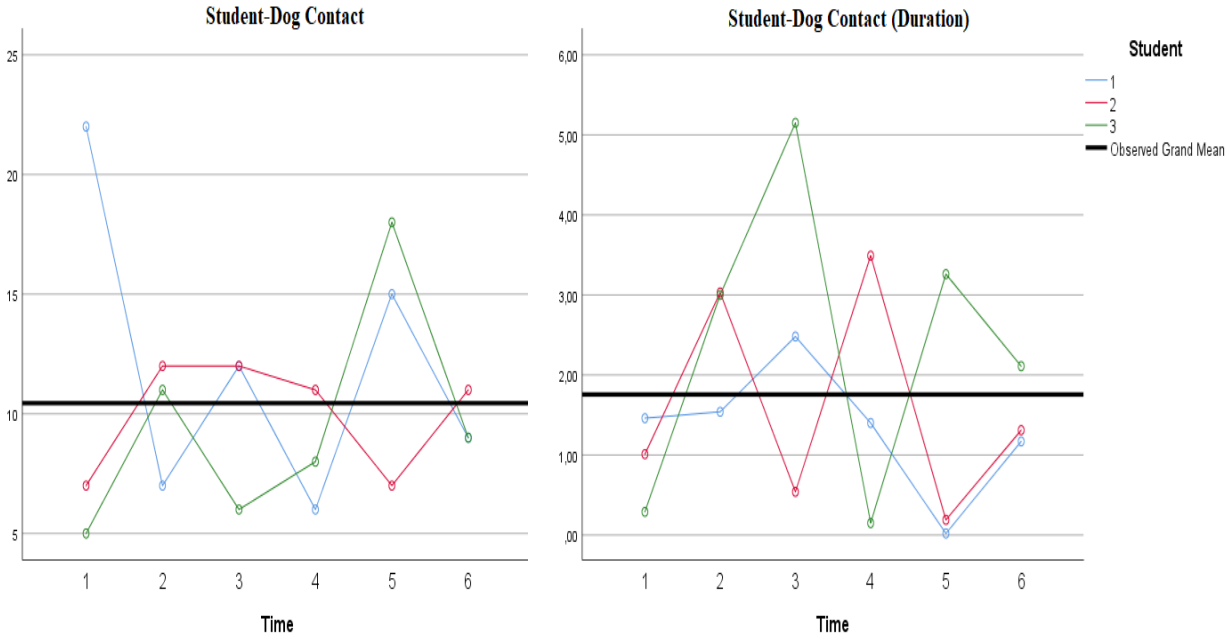

Figure 3 Scores for the six measurements for the frequency and duration of student-dog contact (frequencies).

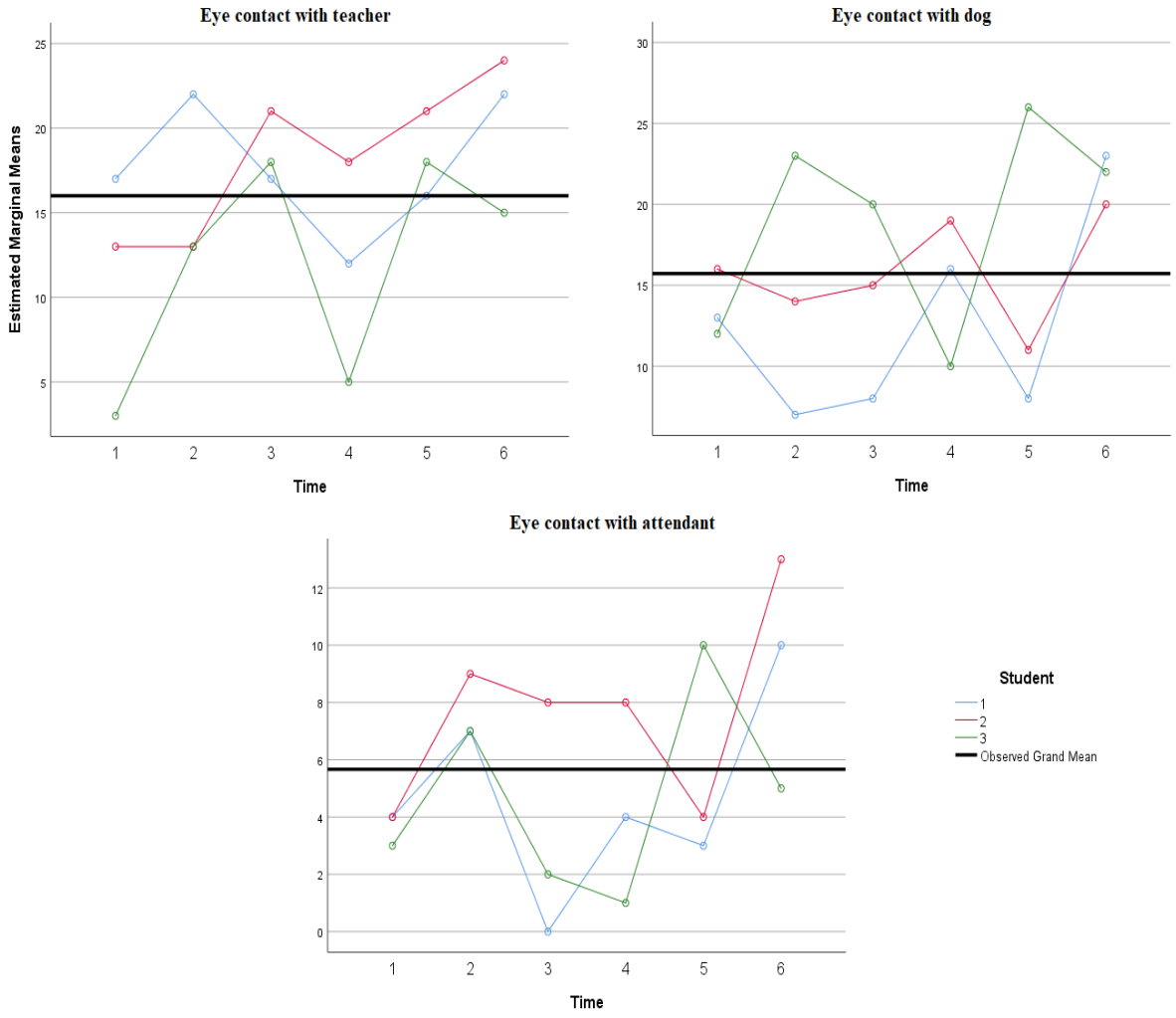

Figure 4 Scores for the six measurements for the student eye contact with teacher, dog and attendant (frequencies).

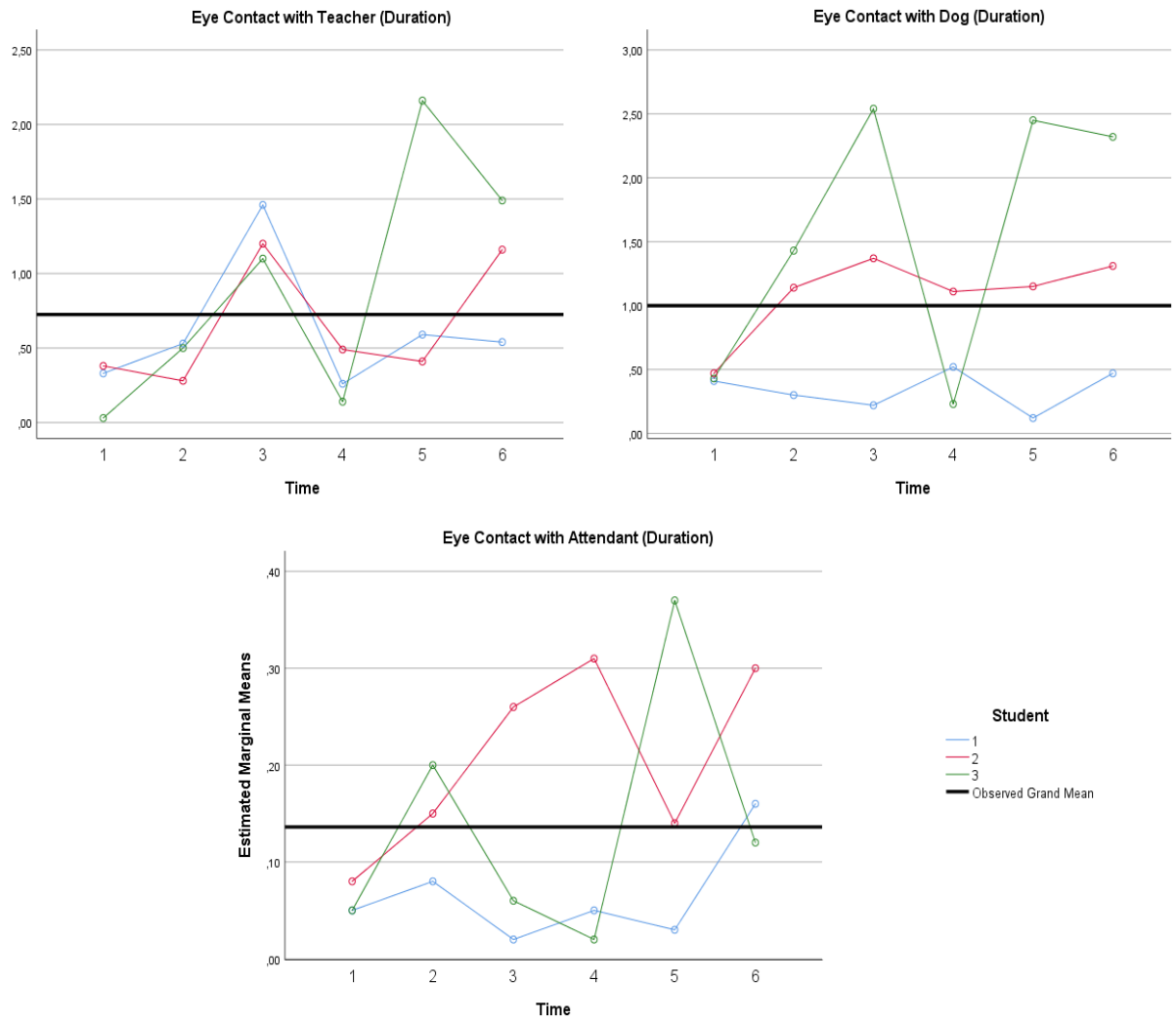

Figure 5 Scores for the six measurements for the duration of student eye contact with teacher, dog and attendant.

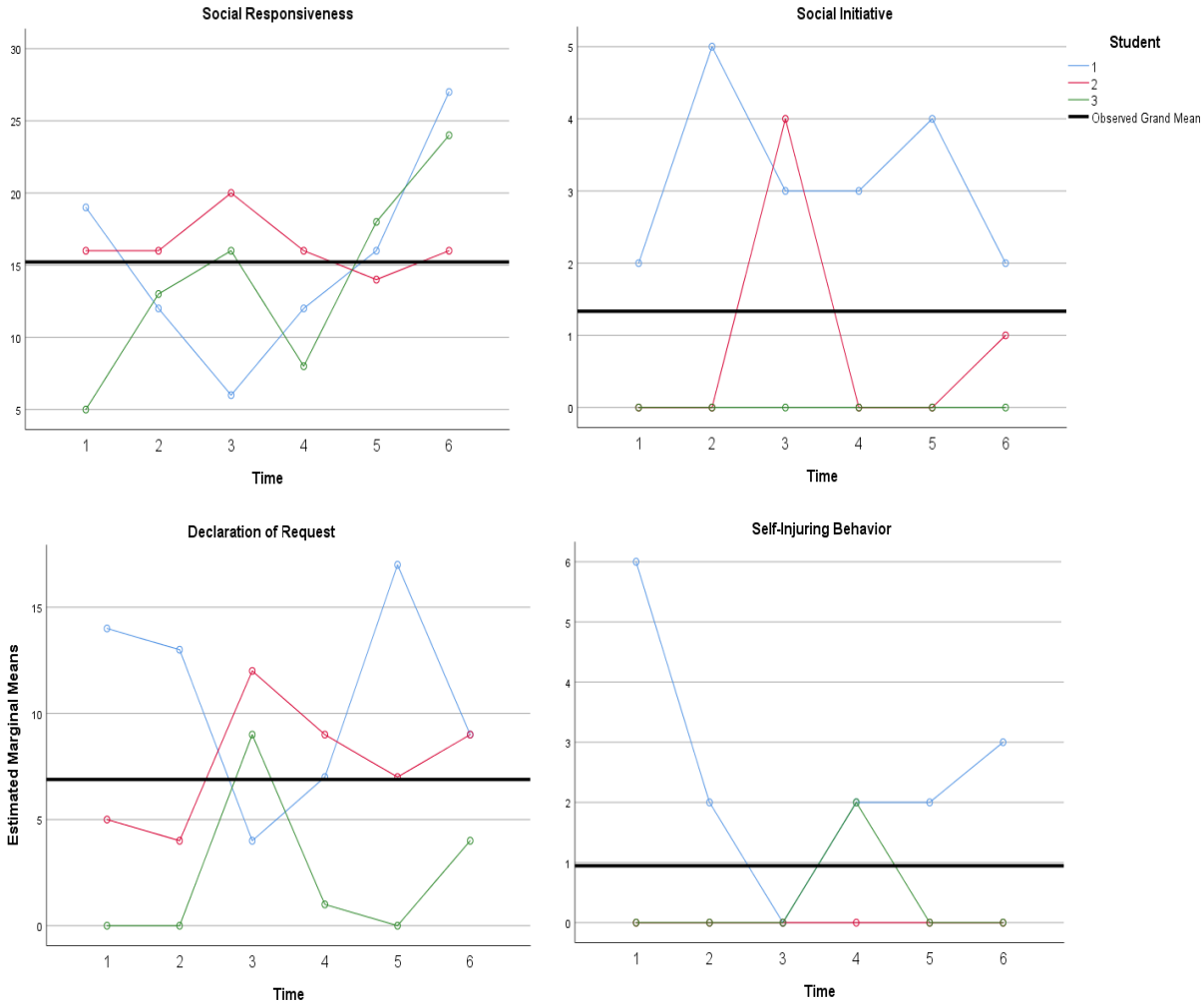

Figure 6 Scores for the six measurements for student social responsiveness, initiative, declaration of request and self-injurious behaviour (frequencies).

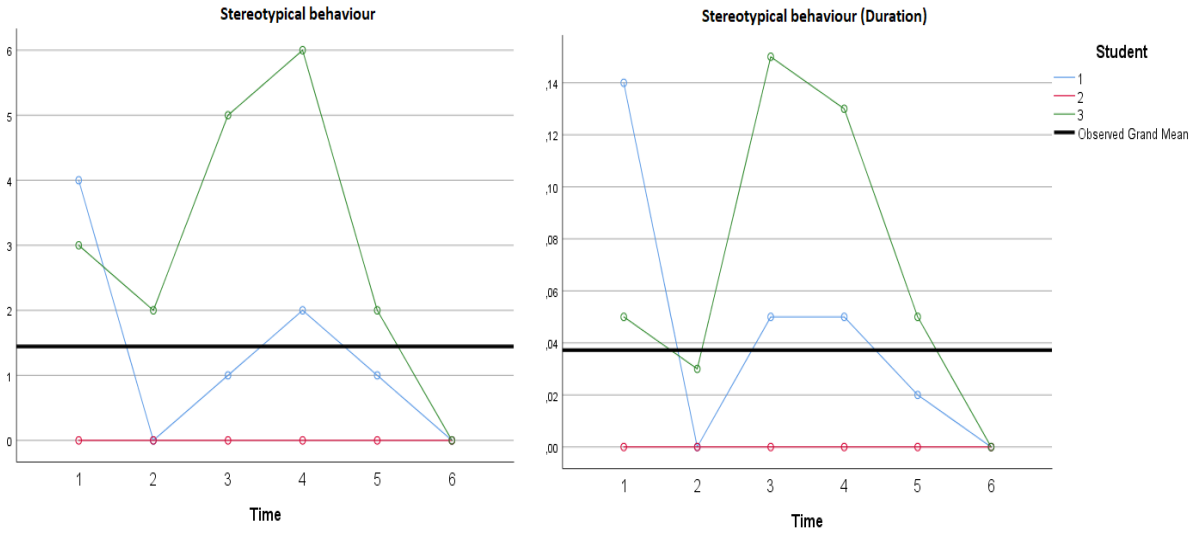

Figure 7 Scores for the six measurements for the frequency and duration of student's stereotypical behaviours.

Qualitative data gathered during the pre- and post-intervention phase

Data derived from the Parental Questionnaire on the Social Skills, Communication and Behavioural Problems of Children with ASD were organized into three main categories: (1) social skills, (2) communication skills, and (3) behavioural problems and stereotypical behaviours. In the following subunits data analysis for each student with ASD in all the above categories is presented.

(1) Social skills

Both the parents and the teachers noticed some improvements in the students' social skills from the beginning to the end of the sessions. More specifically, they both reported that at the end of the sessions S1 and S2 looked more carefully at others faces or around them while they were doing something. They also participated more often in group activities, imitated others, shook hands, took initiatives to start an activity or a game with someone spontaneously and several times helped someone without being asked. The teacher also stated that at the end of the sessions S1 and S3 could tolerate physical contact and the noise or the movements of other people working or playing next to them more easily. S1 and S2 had more frequent and longer lasting eye contact in response to familiar adults, and they could also follow familiar and new instructions more readily. No changes were mentioned from the first to the last session in the frequency S2 exhibited in tolerating noises and others' movements, looking at others' faces, responding when someone needed help, shaking hands, taking initiatives and responding to help without being asked. Moreover, the teacher and the parent did not mention any changes in student S3's response with eye contact when familiar persons were talking to her or in taking initiative in helping others without being asked.

(2) Communication skills

The communication skills of the students with ASD were reported both by the teacher and the parent as increasingly improved from the first to the sixth session. S1 began to ask for what he wanted verbally and calmly. The three students started finding ways to attract their partners' attention or showing in an appropriate way what they wanted the others to look at. For S2 the parent noticed that when he wanted to interact with people at a distance from him, he looked for ways to attract their attention. S1 and S3

also began to ask the teacher more often for help, for an object or for an activity. However, no changes were observed either at school or at home in S1's and S2's refusal to use objects or participate in an activity when asked to do so. As for S3, no changes were mentioned in acts like asking for help or a break, and in refusing to follow an instruction.

(3) Behavioural problems and stereotypical behaviour
For S1 and S2 both the parents and the teachers noticed some changes at home and in school from the beginning to the end of the sessions wherein the students bit themselves less often, hit their head far less frequently with their hand or other parts of the body and they hit or bit other people or destroyed objects less frequently. Moreover, S1 significantly reduced the number of times he fluttered or shook his hands, and also the times when he looked carefully at objects (e.g., turning them all around, twirling them). However, with respect to the above behaviours, the parent of S2 did not confirm any improvement from the beginning to the end of the sessions at home. Finally, the teacher and the parent of S3 mentioned that she did not show any behavioural problems or stereotypical behaviours either before or after the intervention phase. However, during the intervention phase, the teacher reported that the student greatly reduced the number of times she swallowed inedible objects (pica) or rocked at school. Also, the parent mentioned that the student pushed other people less frequently.

Qualitative data gathered during the intervention phase

Diary

To analyse the diaries, instructions were given so that the teachers could include the state the children were in before coming to the session, their relationship with the dog, their behaviour and feelings towards the dog, the teacher and the dog attendant, and also the activities that took place in each session and all the social, communicative and behavioural problems that teachers believed should be reported. Teachers were encouraged to complete the diaries immediately after the end of each session. From the analysis of the data that captured the experience of the teacher in the presence of a therapy dog in sessions with students with ASD, 3 categories and 21 sub categories were identified as shown in Table 3 (APPENDIX III).

Sociability

Dog approach

Prior to the first session, the students were informed about the dog's visit to the school and the image of the dog was added to their individual visual schedule. They all followed the teacher to the hall where the dog was. Even when a student was in a bad mood, the dog appeared to be good at making him/her feel better.

Dog petting

Student 1 seemed to be more familiar with dogs than the other two students with ASD and he used more expressive ways to show his liking, such as hugging it. In case of S3, the teacher used a stuffed dog to entice her and lead her to the hall where the dog was. That worked successfully but she preferred to talk to the dog rather than pet it. Student 2, had little experience with dogs and was a bit hesitant to be in close proximity with him.

Dog hugging

Students 2 and 3 enjoyed the presence of the dog and they both wanted to touch him. However, they did not hug Pluto, no matter how close they were to him. On the contrary, S1 seemed to get satisfaction by hugging the dog.

Imitating the dog

Imitation was used in the intervention process as a way for the students to be engaged in the activities with the dog attendant. The latter was often the model for S1 to pet and stroke the dog. She was also imitated by S3, the most anxious and aggressive student among the three, while demonstrating ways to keep the dog calm and have him follow the rules. Student 2 imitated the dog quite often. His speech was more mature in contrast to the others and imitation mostly took place while the dog attendant read him fairy tales and during card games showing animals.

Playing with the dog

Playful interactions with the dog were demonstrated during most of the sessions with all three students, regardless of how familiar they were with animals and their mood at the onset of the session.

Relaxing with the dog

One of the most common shared activities between each student and the dog was relaxation. Whether they were in a bad mood at the onset of a session or whether they started the session with caution or joy, all students seemed to enjoy relaxing with the dog.

Going for a walk with the dog

A walk with the dog seemed to be one of the most popular activities for the three students, especially for S2 who used to take him for a walk and then stroke him or play piano for him. These activities may have soothed him a lot and he thought they would soothe the dog.

Willingness to engage physically and stroke

The presence of the dog in the daily routine of the students seemed to be a pleasant experience as they all tried to have physical contact with him with one way or another (e.g., touch or hug) and share calming activities such as stroking him. The end of every session included time for relaxation. The students seemed to be familiar with this and they sought relaxation for themselves and for the dog.

Communication

Eye contact with the dog

S1 was easily engaged in playful activities with the dog and each time he entered the hall and saw him, he sought eye contact to get close to him. Moreover, S2 sought to have eye contact with dog as a way to attract his attention during storytelling. S3 was very well coordinated with all participants during the sessions and the teacher confirmed her good eye contact with her, the dog attendant and the dog.

Talking to the dog

Despite their language difficulties, all three students tried to talk during the sessions but not all of them talked to the dog. S1 used several ways to accomplish this, such as saying good morning to him on a microphone or talking to him about his toys and kindly asking the dog to do things with him or keep a distance from him. S2, despite his more advanced speech development and the fact that he talked a lot to the teacher and the dog attendant about the dog and about the activities he wanted to share with him, did not talk directly to the dog. Also, S3 did not talk directly to the dog although she gestured him with signs to sit next to her or to share things with him.

Storytelling to the dog

Storytelling was an activity with agreater degree of difficulty for students with ASD because of their language problems. However, S1 and S2 told stories either to the dog or to all the participants in the session in order to keep the contact with the dog. Even when language development made it difficult for the child, such as S3's difficulty in telling a story using words, she used signs and cards to facilitate contact.

Describing toys to the dog

The description of an object presupposes language development and it was an activity that rarely was demonstrated in the sessions with the three students of our study. From the beginning of the sessions S1 seemed to be happy with the idea that he would meet the dog and he entered the hall eager to meet him. The description of his toys to Pluto might have been his own way of showing him how excited he was by his presence. Although S2 spoke better than S1 and S3, he limited his activities to storytelling and did not include descriptions. S3, as the most immature student among the three in terms of language development, was mostly limited to motor activities and showed the dog affection without using words (e.g., petting, walking with him, relaxing and stroking).

Naming animals

During the sessions the students had the chance to play with animal cards or other games with or without animals. They were free to choose what to play and they determined the flow of the sessions according their interests in each activity. S2 named animals in the fifth session, according to the teacher's diary, during a playful interaction where he picked up plastic animals one by one naming them and giving them to the dog. He seemed to enjoy the session. Moreover, oral activities proved to be easier for S2 than for S1 and S3 who preferred to go for a walk with the dog, or lay down and relax after several motor activities.

Requesting joint activities with the dog

The presence of the dog was a motive for the students to share joint activities with him. More specifically, according to the teacher's diary, S1 quite often asked the dog to play together even from the first session when they did not know each other. He asked to play a game with the dog or take him for a walk and most of the times the first thing he did before asking him to play together was to run to the dog and hug him or ask for him as soon as he got in the hall. S2 typically asked the dog if he could stroke him and/or relax with him. S3 asked the teacher through pictures to sit behind her so that she could take some toys to the dog, or to lay down with her and the dog in order to relax.

Reading to/for the dog

Reading to/for a dog is an activity of greater difficulty. That is why it was mostly demonstrated by the student with the highest language abilities, S2. In his fourth session, S2 chose to read a story about a bear with the teacher and he repeated many words. The teacher suggested that he looked very happy at that time. Moreover, although S2 was upset when he came in the hall for his fifth session, he was happy to read sentences with Pluto as the subject.

Writing about the dog

In addition to reading to/for the dog, S1 wrote sentences in which the dog was the subject. As for S2, the teacher commented that the dog helped him during learning the process as S2 wrote down words and sentences for Pluto and then he used to read them out loud.

Responding to instructions

At the beginning of the intervention phase, the students with ASD had difficulty responding to instructions. Especially S1 refused to sit down on the carpet for the activities and participate in any activity in general. However, that changed through the session as all children became more open to any adaptation of adults' instructions.

Utterance of spontaneous speech

Although speaking was not an easy process for the students of the present study, S1 and S2 whose language ability was at a higher level than S3, uttered spontaneous speech from the second session on when they had met Pluto once and were somewhat familiar with him. S1 talked to Pluto during most of the sessions, trying to tell him a story, asking him to sit next to him, asking the teacher to play with him and to stroke him without any prompt or intervention from the teacher or the dog attendant. S2, who was a bit hesitant with Pluto during the first two sessions, uttered spontaneous speech for the first time in

the third session (naming animals). From that session on he used to repeat words he had previously heard without any further prompt.

Behavioural problems and stereotypical behaviour

Crying

Although the students with ASD did not cry during the sessions, sometimes before the onset of the session they cried or were upset in their classroom.

Hand fluttering

The students fluttered their hands when they were nervous or excited.

Stereotypical movements

According to the teacher's diary, S1 used to bite his hands in every session. However, in the sixth session he bit them fewer times and he was quieter than in the other sessions. He showed stereotypical movements only in the third session. As for S2, the teacher did not mention any behavioural problem or stereotypical behaviour, while for S3 she mentioned several times that she showed stereotypical movements but she had no other specific comments about what kind of stereotypical movements they were. In her first session she was very upset and irritated. In the second session she showed stereotypical behaviour only once and by the fourth session only some incidents of irritation and emotional distress were mentioned. S3 exhibited self-injurious behaviour quite often in her normal class but never during the sessions.

Discussion

The literature review has shown that the presence of a dog in a clinical or a school setting is a means of psychological healing for children, typical or non-typical, with immediate benefits for their social and communication skills (Fine, 2010; Fine & Eisen, 2016; Mallon, 1994; Ross, 1981, 1984, 1989). In the present study we further investigated the role of the dog in an intervention programme which was implemented in six 30minute-sessions on three students with ASD. More specifically, we examined the students' social and communication skills and their behavioural problems before the intervention. Research diaries assisted qualitative analysis as they provided data on what happened during the sessions, and on events that had already happened before the sessions at home or school which might affect the course of the sessions. Also, we investigated students' physical and eye contact, and behavioural problems during the intervention. Finally, in the post-intervention phase possible changes in the examined variables were investigated.

Our first hypothesis was that there would be differences in the pre- and post-intervention phase in the students' social and communication skills, and also in their behavioural problems and stereotypical behaviour. The parents and the teachers of S1, S2 and S3 all noticed changes in the above parameters. Regarding their social behaviour, the teachers mentioned that their students with ASD were more tolerant to sensory stimuli, physical contact and people moving or playing around them. They also kept an appropriate distance from other people, to give them the chance to communicate. Students with ASD also imitated social skills more often and they followed a sequence of new instructions or engaged in group activities imitating others more easily. Moreover, from the first to the sixth session, they responded with a smile more often, responded when asked for help or when a person they loved was coming or leaving. Teachers and parents also confirmed that after the sessions, students had more frequent and longer eye contact and they responded much more frequently with mutual gaze to familiar persons at home and school. Additionally, according to teachers and parents, when the intervention finished the students asked more frequently and in a more

appropriate manner (e.g., without screaming, by using words) for what they wanted. They also started to attract others' attention or direct others' attention where they liked. Our results confirmed our hypothesis and also previous research which found that the dog's presence promotes students' participation in social activities, their language and their general attitude towards school (Berry et al., 2013). They are also in line with studies which showed that the dog's presence during therapy sessions can be the starter for a friendly conversation which accelerates and increases the development of communication and collaboration (Kruger & Serpell, 2010) between the therapist and the child, without the latter feeling anxiety. Moreover, an interesting finding is the decrease of the self-injurious, aggressive and stereotypical behaviours as mentioned by parents and teachers in the post-intervention phase which is of special significance for students with ASD and their quality-of-life experiences in their daily routine.

Our second hypothesis was that from the first to the sixth session of the intervention phase there would be an increase in the duration of students' social behaviour, communication, physical proximity, physical (touch) and eye contact with the dog, the teacher and the dog attendant. This hypothesis was also confirmed as during all sessions all the students exhibited long-term physical intimacy with the dog, their teacher and the dog attendant. Also, the duration of the physical proximity between the student and the special educator was found to be statistically significant in all sessions which is in line with similar research findings (Fung & Leung, 2014; O'Haire et al., 2014; Silva et al., 2011). Regarding eye contact, statistical analysis showed that the frequency of students' eye contact with their special educator and the dog, and the duration of students' eye contact with their special educator and the dog attendant increased from the first to the sixth session. The students had more frequent and longer eye contact with the dog, then with the special educator, and finally with the dog attendant, a finding that is also confirmed by qualitative data, as mentioned in the special educators' diaries. All students with ASD showed almost two times more social responsiveness from the beginning to the end of the sessions. Moreover, according to the quantitative analysis, the special educators mentioned that the students sought physical contact first with the dog and then with them and the dog attendant. Their explanation was that students kept in physical contact with them because of the dog's presence. It seems that the dog facilitated physical contact and its presence increased the time students remained involved in an activity or had physical contact with their teachers and the dog attendant, as also reported in several studies (Elmaci & Cevizci, 2015; Grandin et al., 2015). Also, in teachers' diaries it was mentioned that all students maintained good eye contact with the dog during sessions. Literature review on studies focused on the child-dog mutual gaze confirm that children produced mutual gazes more frequently and the duration increased in the dog's presence (Grandgeorge et al., 2020; Jalongo, 2018). This finding is also in line with studies where it has been shown that dogs are sensitive to human cues for communication, they attend human visual cues, they have the ability to read human intentions (Bradshaw & Nott, 1995) and they do it selectively, when they really want to (Brucks et al., 2017; Szetei et al., 2003). Child-dog eye contact may indicate not only the innate ability of the human and dog species to communicate, but also the need children with ASD have for bonding in some way with the dog and to share common activities with him which is found to be rare or difficult for children with ASD (Warreyn et al., 2014). The above findings are consistent with the literature where the dog is mentioned as the facilitator of physical proximity and its presence increases the time spent in an activity and physical contact with teachers and other therapists (Grandin et al., 2010; Silva et al., 2011). Dogs are also found to act on children with ASD as a speech elicitor and help them with language imitation, language response, spontaneous speech, eye contact, following instructions, being patient and physical contact (Fung & Leung, 2014). In the diaries the special educators reported that the students followed instructions successfully, especially when they had to do with the dog, and that they responded socially

to the dog. We see that the animal's mere presence, its spontaneous behaviour and its willingness to interact provide opportunities and benefits that would be impossible, or much more difficult, to obtain if the animal was absent, as in Kruger and Serpell's study (2010). Studies have shown that in therapeutic contexts where dogs are present, children increase their period of attention and alertness, while at the same time they become more social (Prothmann et al., 2006). Children are not afraid to be judged by the dog which leads to a unique interaction, emotionally and socially supportive for the children (Friesen, 2010). The diaries also stated in some way children expressed (verbally or non-verbally) their willingness to do things and especially share joint activities with the dogs. Reading to a pet has been found to make the reading procedure a more relaxing, interesting, attentive and even fun and full of meaning activity for children with special educational needs and/or disabilities (Fung, 2019). Moreover, the dog's participation in children's activities may increase their ability to read, write and generally participate in group activities (Esteves & Stokes 2008). The sense of relaxation, even when students had had a difficult day, was observed by the special educators, as was the students' joy at the onset of the sessions. These behavioural modifications can be expected to facilitate the student's daily life, as also noted by Kruger and Serpell (2010). More specifically, it is worth mentioning that S1 and S2 in the 6th session wrote about Pluto. Being with him seems to have been a developmental process that culminated in the production of written speech, while progress was also made in oral speech with the utterance of words for and to the dog, but also at a more advanced level, with the reading of stories for and to the dog. S1 and S2 not only took initiatives to speak to the dog, but they made their own choice of a fairy tale to engage him.

According to our third hypothesis regarding the behavioural problems and stereotypical behaviour of the students with ASD in the study, the findings are of great interest. Regarding self-injurious and stereotypical behaviour, the statistical analysis did not show any statistically significant decrease. However, it was found that during the last two sessions the students showed a significant reduction in their self-injurious behaviour. Also, during the last three sessions the stereotypical behaviour of the students decreased and in the last session they did not show any stereotypical behaviour at all. The most interesting finding was that the students did not show any aggressive behaviour during the intervention phase. This is in line with the findings of similar studies which have shown that the frequency and duration of aggressive behaviours towards inanimate objects and verbal aggression towards the therapist were significantly rarer in sessions where the therapy dog also participated (Silva et al., 2011). More specifically children with ASD in these contexts show positive behaviours more frequently and for longer periods and fewer negative behaviours (Silva et al., 2011). Also, the parents and the teachers observed the decrease or the lack of self-injurious behaviour, behavioural problems and stereotypical behaviours before and after the intervention, while the special educators suggested that the dog seems to have acted as a regulator for the students, offering a feeling of relaxation and calm even on some difficult days for the children. This was evident for all the students in every session according to adult participants.

As demonstrated, animal assisted interventions in a school setting facilitate the social responsiveness of children with ASD, their ways of communicating with others and decrease negative behaviours shown when children feel stressed or are challenged in any way. They are beneficial to the extent that they prevent and address the difficulties of children with disabilities (Elmaci & Cevizci, 2015) and improve their cognitive and socio-emotional learning, especially in populations with special educational needs such as children with ASD (Beetz, 2017) which was the main purpose of the present study. Although our study sample was homogeneous, the participants were few, so our results are not representative of the larger population of children with ASD. Also, our data did not allow more appropriate

statistical tests and for this reason we used the quantitative statistical analyses to support our qualitative data, as the quantitative data by themselves were insufficient.

The present study highlights the importance of incorporating animals, especially dogs, in the educational process, which is rare or non-existent in Greek schools. More systematic interventions are needed in the daily routine of children with ASD so that the calm and sense of relaxation derived from a dog's presence in therapeutic sessions can be extended to their daily life. The beneficial impact of a dog on a child's physiological and mental health may lead to harmony in their social life and wellness for life in all aspects.

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APPENDIX I

Coding Sheet

Video analysis of each Session (total duration 30-min. divided in 6 x 5-min. intervals)

Student	_____
Date	_____
Session Number	_____

Frequency

Behaviors		Student's Scores						Student's Scores						Student's Scores						Student's Scores						Student's Scores						Student's Scores					
		0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
Physical Proximity with the Teacher (<1m.)	1st 5min.																																				
Physical Proximity with the Dog (<1m.)																																					
Physical Proximity with the Attendant (<1m.)																																					
Child-Dog Contact																																					
Eye contact with the Teacher																																					
Eye contact with the Dog																																					
Eye contact with the Attendant																																					
Child's Social Responsiveness																																					
Child's Social Initiative																																					
Making a Request																																					
Self-Injuring Behavior																																					
Aggressive/Destructive Behavior																																					
Stereotypical Behavior																																					

2nd 5min. 3rd 5min. 4th 5min 5th 5min. 6th 5min.

APPENDIX II

Duration of the behaviors and social responsiveness exhibited by each child with ASD during a session

Behaviors	1st 5min.	2nd 5min.	3rd 5min.	4th 5min.	5th 5min.	6th 5min.
Physical Proximity with the Teacher (‹1m.)	1min: hour/min-hour/min	1min	1min	1min	1min	1min
	2min	2min	2min	2min	2min	2min
	3min	3min	3min	3min	3min	3min
	4 min	4 min	4 min	4 min	4 min	4 min
	5 min	5 min	5 min	5 min	5 min	5 min
Physical Proximity with the Dog (‹1m.)	1min	1min	1min	1min	1min	1min
	2min	2min	2min	2min	2min	2min
	3min	3min	3min	3min	3min	3min
	4 min	4 min	4 min	4 min	4 min	4 min
	5 min	5 min	5 min	5 min	5 min	5 min
Physical Proximity with the Attendant (‹1m.)	1min	1min	1min	1min	1min	1min
	2min	2min	2min	2min	2min	2min
	3min	3min	3min	3min	3min	3min
	4 min	4 min	4 min	4 min	4 min	4 min
	5 min	5 min	5 min	5 min	5 min	5 min
Child-Dog Contact	1min	1min	1min	1min	1min	1min
	2min	2min	2min	2min	2min	2min
	3min	3min	3min	3min	3min	3min
	4 min	4 min	4 min	4 min	4 min	4 min
	5 min	5 min	5 min	5 min	5 min	5 min
Eye contact with the Teacher	1min	1min	1min	1min	1min	1min
	2min	2min	2min	2min	2min	2min
	3min	3min	3min	3min	3min	3min
	4 min	4 min	4 min	4 min	4 min	4 min
	5 min	5 min	5 min	5 min	5 min	5 min
Eye contact with the Dog	1min	1min	1min	1min	1min	1min
	2min	2min	2min	2min	2min	2min
	3min	3min	3min	3min	3min	3min
	4 min	4 min	4 min	4 min	4 min	4 min
	5 min	5 min	5 min	5 min	5 min	5 min

Appendix III

Table 3 The presence of a therapy dog in sessions with students with ASD as perceived by teachers

Categories	Theme Clusters	Example quotes from teachers' diaries
Sociability	Dog approach	"A. [the student] had very nice contact with Pluto from the beginning. He immediately sat next to him, talking to him and trying to tell him a story" (S1, 1st session)
	Dog petting	"He listened to his heart and Pluto's heart with the stethoscope and he liked to caress him" (S2, 1st session).
	Dog hugging	"As soon as A. entered the room, he immediately approached Pluto on his own and hugged him" (S1, 5th session).
	Imitating the dog	"We [the student and the teacher] played games with animals and he was very good; he tried to repeat what I [the teacher] was saying and made very good eye contact with me" (S2, 6th session).
	Playing with the dog	"She [the student] was happier than ever. She invented an activity that she found hilarious: climb the stairs on to my [teacher's] back and take the toys to Pluto. She made very good eye contact with me and Pluto" (S3, 3rd session).
	Relaxing with the dog	In the end he lay down spontaneously and relaxed next to Pluto. He was very receptive to contact, although he didn't want Pluto to go close to his face, […], this contact calmed him down a lot" (S1, 3rd session).
	Going for a walk with the dog	"He [the student] asked me [the teacher] to take the dog for a walk and then played the piano for him" (S2, 2nd session).
	Willing to engage physically and stroke	"She [the student] wanted physical contact, stroking and back pressure and relaxed very quickly from the beginning of the session. She had very nice eye contact with Pluto and she was smiling at him. She was touching him all the time" (S3, 5th session).
Communication	Eye contact with the dog	"He [the student] read sentences under pictures to Pluto and he [the student] liked it very much, […], he had very good

		eye contact with all three of us [the dog, the teacher and the dog attendant]" (S2, 5th session).
	Talking to the dog	"He [the student] didn't like Pluto to approach him near his face and very nicely said to him 'I do not want that'" (S1, 1st session).
	Storytelling to the dog	"Today he chose to read to us [the dog, the teacher and the dog attendant] a tale with animals and what they do" (S2, 5th session).
	Describing toys to the dog	"He asked to play with the figures of Karagiozis, he wanted to show them to Pluto and described them to him" (S1, 1st session).
	Naming animals	"We wrote down sentences and their subject was Pluto. He [the student] liked it a lot. Then he was happy to read them for him" (S1, 6th session).
	Requesting common activities with the dog	"She [S3] asked me [the teacher] through pictures to sit on her back and transfer some toys to the dog or lay down with her and the dog in order to relax" (S3, 4th session).
	Reading to/for the dog	"Although he was upset when he came in the hall, he was happy to read sentences with Pluto as the subject" (S2, 5th session).
	Writing about the dog	"[…] we wrote some sentences where Pluto was the subject and he liked it a lot" (S1, 6th session)
	Responding to commands	"She took her transition object and went alone to the hall! She was responding to all instructions very nicely, e.g., sit down, take, give, here ….. She took Pluto for a walk and had a very good response to our instructions" (S3, 6th session).
	Utterance of spontaneous speech	"He was a bit hesitant with Pluto during the first two sessions. However, in the third session he uttered spontaneous speech for the first time (naming animals)" (S2, 3rd session).
Behavioral problems	Crying	"She came very upset. She was crying a lot the whole morning in the class. She managed to relax completely by the end of the session" (S3, 4th session).
	Hand flattering	"Today he didn't bite his hand at all. He did some stereotypical movements

		like hand fluttering but it was mainly from enthusiasm" (S1, 3rd session).
	Stereotypical movements	"He showed stereotypical behaviour with his hands only once. He was very happy during the whole session" (S2, 2nd session).

Table 4 Target behaviour, Sectors and Questions on Parental Questionnaire

Target-Behaviour	**Sectors**	**Questions in the Questionnaire**
Social Skills	Proximity	1. Tolerates human touch during work or rest time.
	Proximity	2. Tolerates noises or movements of others while they are playing or working nearby.
	Proximity	3. He/She maintains appropriate body distance from others (not too far not too close).
	Eye Contact	4. Has eye contact.
	Eye Contact	5. Observes others' faces.
	Eye Contact	6. Observes others while they are occupied with an activity.
	Eye Contact	7. He/She is visually aware of a familiar person coming or leaving.
	Social Response	8. Responds with eye contact or orientation to familiar adults.
	Social Response	9. Responds to and follows familiar instructions.
	Social Response	10. Responds to and follows new instructions.
	Social Response	11. Participates in group activities by imitating others.
	Social Response	12. Responds when he/she is asked for help.
	Social Response	13. Responds to others' smiling.
	Social Response	14. Makes hand gestures.
	Social Initiative	15. Chooses and participates in group activities.
	Social Initiative	16. Takes the initiative by starting an activity or a game with others spontaneously.
	Social Initiative	17. Takes the initiative of helping others without asking.
Communication	Making a Request	18. Asks for an object.
	Making a Request	19. Asks for an activity.
	Making a Request	20. Asks for help.
	Making a Request	21. Asks for repetition of an activity.
	Making a Request	22. Asks for a break or asks for an activity to end.
	Joint Attention	23. Seeks others' attention, when they are near, when he/she wants to communicate.
	Joint Attention	24. Seeks others' attention, when they are far, when he/she wants to communicate.

	Joint Attention	25. Directs others' attention to something.
	Rejection-Denial	26. Rejects an object.
	Rejection-Denial	27. Rejects an activity.
	Rejection-Denial	28. Refuses to follow an instruction.
Behavioural Problems	Self-injurious behaviour	29. Self-biting.
	Self-injurious behaviour	30. Hitting head.
	Self-injurious behaviour	31. Hitting body (except head) with own hand or with other body part.
	Self-injurious behaviour	32. Self-scratching.
	Self-injurious behaviour	33. Teeth grinding.
	Self-injurious behaviour	34. Pica: Mouthing or swallowing of non-food items.
	Aggressive/destructive behaviour	35. Hitting others
	Aggressive/destructive behaviour	36. Kicking others.
	Aggressive/destructive behaviour	37. Pushing others.
	Aggressive/destructive behaviour	38. Biting others
	Aggressive/destructive behaviour	39. Grabbing and pulling others.
	Aggressive/destructive behaviour	40. Scratching others.
	Aggressive/destructive behaviour	41. Pinching others
	Aggressive/destructive behaviour	42. Destroy things (e.g., rips clothes, throw chairs).
	Stereotypical behaviour	43. Rocking back and forth.
	Stereotypical behaviour	44. Waving or shaking hands.
	Stereotypical behaviour	45. Manipulating objects repeatedly.