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1 Zusammenfassung

Die bloße Anwesenheit von Hunden in Schulklassen verändert bereits das Verhalten der Schüler. Trotz mancher Nachweise dieses sogenannten Biophilieeffektes, ist es bis heute unklar, auf welche Art und Weise sich die Wirkung entfaltet. Ziel dieser Studie ist es daher, den der Biophilie zugrundeliegenden Mechanismen näherzukommen.

Untersuchungsort waren vier Volksschulen und zwei Neue Mittelschulen in Österreich. Sechs Lehrerinnen, welche ihre Schulhunde regelmäßig in ihren Klassen einsetzen, nahmen an der Studie teil und filmten mit einem Camcorder abwechselnd je zwei Stunden mit Hund und zwei Stunden ohne Hund. Von jeder Klasse wurde das Verhalten des Lehrers (n=6), des Hundes (n=6) und von fünf zufällig gewählten Schülern (n=30) beobachtet und kodiert. Der Fokus lag dabei auf der Geräuschkulisse als Indiz für das Klassenklima, der aktiven Mitarbeit der Schüler, der im Gesicht gezeigten Emotionen der Schüler und Lehrer, dem Interaktionsverhalten der Schüler und Lehrer und zusätzlich auf dem Kontakt der Schüler und Lehrer mit dem Hund.

Die statistische Auswertung der von den Videobändern kodierten Daten ergab, dass sich die Schüler in den Stunden mit Hund mehr konzentrierten und weniger interagierten. Insgesamt waren sie bezüglich des Emotionsausdruckes neutraler, und sie fokussierten sich mehr auf ihre eigene Arbeit. Weiters war die aktive Mitarbeit in den Stunden mit Hund geringer, besonders wenn sie ihren Blick länger auf den Hund richteten. Somit war insgesamt durch die reine Anwesenheit des Hundes eine beruhigende Wirkung auf die Schüler messbar. Eine Interaktion, wie Körper- oder Blickkontakt zwischen Schüler und Hund, hätte zu einem erhöhten Oxytocinlevel führen können. Für die Auswirkung bei dieser Studie war keine Interaktion erforderlich. Aus diesem Grund ist das unterschiedliche Verhalten der Schüler auf den Biophilieeffekt rückführbar. Der Hund bewirkte eine erhöhte Konzentrationsfähigkeit der Kinder. Zwischen den Geschlechtern konnten keine Unterschiede festgestellt werden. Auch die Lehrer zeigten keine statistisch relevanten Unterschiede ihres Verhaltens bezogen auf die Anwesenheit eines Hundes in der Klasse.

2 Abstract

Introducing dogs in classrooms can have positive effects on the behaviour of the pupils. The mere presence, based on the biophilia effect, leads to different results. The aim of this study was to test in which way the biophilia effect unfolds.

The study was set in four different elementary schools and two “new secondary schools” in Austria. Six female teachers participated and recorded the class with a camcorder during alternately two lessons with their school dogs and two lessons without their dogs. In each class the teacher (n=6), the dog (n=6) and five randomly chosen children (n=30) were behaviour-coded. Five different parameters were examined. The noise level to evaluate the atmosphere in the class was measured every sixty seconds. Additionally, facial expressions of emotion of pupils and teachers were measured in the same intervals. Frequency of active work of the pupils (e.g. answering a question or raising the hand for this purpose) was noted continuously during all sessions. Duration of interactive behaviour of pupils and teachers and also dog contact of pupils and teachers were examined the whole time of the sessions.

Statistical analysis of the behaviour coded from the video tapes showed a more concentrated, but less interactive learning environment when a dog had been present; pupils were more emotional neutral and interacted less within five or more people. Although overall interactions decreased, individual interactive behaviour rose in most of the classes when a dog was present. They also focused more on their own work than in the no-dog situation. No direct contact to the dog, as stroking or watching, was necessary for the effect. In total, the dog created a more concentrated and calm atmosphere. The biophilia effect unfolded due to the mere presence of the dog. Further, no gender differences were found. The teachers did not show any statistical relevant difference due to of the dogs’ presence or absence.

3 Introduction

3.1 Dogs' Influence on Humans

Initially, positive effects of dogs on humans were described in the area of animal assisted therapy.

The beginning of purposeful animal assisted therapy was in the 1970s. Boris Levinson, a psychoanalytical trained psychologist, left his dog (named Jingles) alone during a therapy session with a traumatized and uncommunicative child. Eventually, the quiet child was talking to the dog (Altschiller, 2011; Levinson, 1965). Moreover, many others experienced similar situations like the psychologist and special pedagogue Henri Julius with his dog "Toto" and a traumatized boy (Julius et al., 2014).

Pets in psychotherapy help to welcome the clients and improve communication and relationships between them and their therapist (Levinson, 1965; Reichert et al, 2016). Children establish trust to animals also when they have difficulties with trusting humans (Kotrschal, 2016). Furthermore, about fifty years ago Levinson (1965) recommended a pet at home. It distracts pressure from the child and offers an opportunity for expressing one's thoughts. Martens (2015) found that dogs can influence the social interplay between children during a dinner at the table; children's behaviour became more cheerfully, they laughed more frequently and showed less aggressive behaviour. Further, signs of nervousness by children decreased and they sat more relaxed. Raising pets can benefit the development of empathy (Poresky and Hendrix, 1989), self-esteem, self-control and autonomy (Levinson, 1978). The positive influence of a dog is more intense on children younger than twelve years compared to older ones; younger children show more cheerful behaviour with a dog being present (Martens, 2015). Levinson (1978) stated that "animal companions have their strongest impact during middle childhood and old age". Growing up close to animals is important for the development of children (Kotrschal, 2014).

There is a multiple impact of different animals on humans. For example, the presence of an aquarium can reduce anxiety of electroconvulsive therapy patients (Barker et al., 2003). Further, pet ownership has positive impacts on human health and the companionship of a pet provides intrinsic satisfaction (McNicholas et al., 2005). The presence of a dog encourages silent children to interact with each other (Martens, 2015). For several reasons dogs are often preferred as therapeutic assistants and for companionship. On the one hand, dogs are one of the oldest known domesticated animals, being companions for about thirty-five-thousand years (Anderson et al., 2009; Thalman et al. 2013; Frantz et al. 2016; Clutton-Brock, 1995, Ulmer, 2010; Kotrschal, 2016). Due to domestication

and selection, they evolved many different body types, colours, sizes and fur qualities which help the species to fit in almost every situation (Hare et al. 2012; Coppinger and Coppinger, 2003). Dogs are the most size-variable species in the world. Therefore they fit many different people with different preferences.

Dogs are very social animals which build strong bonds with their companions. Social animals as dogs frequently show social grooming, close body contact and ritualized muzzle affectionateness (Feddersen-Petersen, 2004). Humans and social canids correlate in different social issues such as social relations, parental investment, hunting together and sharing food, highly evolved communication and evolving alliances (Kotrschal, 2014; Feddersen-Petersen, 2004). In humans and dogs the mechanisms of emotions, thinking and making decisions are similar (Kotrschal, 2016). Furthermore, dogs were selected to communicate well with humans (Teglas et al., 2012) rather than with their conspecifics (Bonnani et al., 2010; Cafazzo et al., 2010). It is more important for a dog to read human cues correctly than conversely (Kotrschal, 2016). Dogs are also able to display human-like cues towards humans which activate human biological responses (Nagasawa et al., 2009; Handlin et al., 2011). This also plays an important role on oxytocin release which will be discussed later. Humans can understand the information transferred by barking of dogs easier than howling of wolves (Pongracz et al., 2011).

3.2 Present Dogs in Schools

A few studies focus the effects on children at school. Especially in German-speaking Europe dogs at schools are on the rise (Beetz, 2013). Dogs can operate as a social stimulus, be a fellow, a protector or convey success (Wohlfarth & Mutschler, 2016). With animals being present, relationships among pupils as well as between pupils and teacher become more cooperative and friendly. Moreover, there may be a positive effect on learning (Gee et al., 2010). Beetz et al. (2012a) mentioned that it is easier for children to establish positive body contact with a dog instead of a friendly human, which is most effective in stress regulation; a school dog can generate better social interactions with peers and teachers and therefore, may improve the social atmosphere in a classroom. Hutter (2015) found that children living in a residential youth welfare service program were laughing and smiling longer in a dyadic interaction with pedagogues when a dog is present. In addition, aggressive behaviour decreased (Olbrich, 2003) and “a higher inner state of calmness and a more intensive interaction style manifested in a dog’s presence” (Hutter, 2015). Moreover, physical contact and working with dogs increases self-confidence (Beck & Katcher, 1983) and the level of oxytocin (Handlin et al., 2011) and decreases blood pressure, heart rate (Handlin et al., 2011;

Friedmann et al., 1983) and the level of the stress hormone cortisol of humans (Beetz et al., 2011; Friedmann et al., 2011). Furthermore, children in classes with dogs improve their positive attitude toward school and their emotions related to learning (Beetz, 2013). A study on elderly persons found a positive effect of attachment to a pet on depression (Garrity et al., 1989).

With a dog or another animal is present in a classroom, it is important to establish respect for the animal's needs and boundaries. Thus, it can be helpful to generate a list of "do's and don'ts"; this list can be developed from a discussion with the pupils led by the teacher or the dog owner who explains what the dog likes (Anderson & Olson, 2006; Beetz, 2013). Lehner (2016) examined people's knowledge on dogs' body language and showed that individuals having an own dog or at least dogs in their circle of friends and acquaintances are better in correct interpreting optical cues of dogs than people who do not have an own dog. Further, older people with regularly dog contact improved their knowledge on dogs' body language compared to others; this supports the importance of early and regularly interactions of children with dogs. Thus, they can react to the animals' feelings in a better way and learn to respect them by regular contact. In addition, communicating with a non-verbal being, such as a dog requires empathy (Levinson, 1978). And the more empathetic humans are with animals, the more they are with other humans (Paul, 2000).

Ainsworth and Bowlby (1991) defined three different types of attachment in children (secure, insecure-avoidant, insecure-anxious/ambivalent); Main and Solomon (1986) added a fourth category (insecure-disorganized/disoriented). In babies the presence of an attachment figure leaves them open to stimulation that may activate exploration. Further, securely attached one-year-olds are less aggressive and avoidant towards their mother and other adults and emerge as more sympathetic in interaction with peers when they grow older (Ainsworth, 1979). In adults, secure attached people find it easier to establish closer relationships with others and are more comfortable depending on them. They hardly worry about being abandoned. In contrast, avoidant adults find it more difficult to trust others entirely and are more nervous when anyone gets too close. Anxious attached adults worry that their partner does not really love them or want to stay with them. They want to merge completely with another person (Hazan and Shaver, 1987). This reinforces the importance of secure attachment bonding in children for their later life. In addition, the secure base effect can occur in connection with different people for example parents or older siblings (Ainsworth, 1989). Other studies introduce the possibility that dogs can also provide as secure base for children, for example when pupils rather like school when they have a dog in the class (Beetz, 2013; Anderson & Olson, 2006). Good relations to animals can help to evolve a secondary secure attachment towards humans (Kotrschal, 2014). The positive impact dogs have on children with medical conditions diseases was

explored (e.g. on children with severe emotional disorders; Anderson & Olson, 2006). The animal's presence led to emotional stability and facilitated student's learning responsibility, respect and empathy; further, each child in the study formed a bond with the dog (Anderson & Olson, 2006). The better the relation to an animal, the better is the positive effect of it (Kotrschal, 2014). Additionally, after a stressor the cortisol levels of children with insecure or disorganized attachment dropped more quickly and to lower levels when supported by a real dog compared with support by a toy dog or a friendly person. During the social stressful situation the support condition did not affect peak salivary cortisol levels (Beetz et al., 2012a).

In regular schools also, probably each child could profit from interacting with a dog and from social support by a dog during stressful tasks (Beetz et al., 2012a). Especially children with suboptimal attachment benefit from a dog (Kotrschal, 2014).

3.2.1 The Role of Oxytocin

Oxytocin plays an important role in the positive effects dogs and other animals having on humans. This neurohormone, synthesized by the hypothalamus, is a peptide of nine amino acids and is released by women during birth; further, it stimulates the milk production during lactation by somatic impressions of the senses like seeing the own baby or hearing a baby crying. This hormone seems to be necessary for development of attachments and leads to caring behaviour (Bear et al., 2009). Oxytocin keeps humans and other animals together (Julius et al., 2014). Moreover, its effects largely correspond with the effects of human-animal interactions and it is possible, the oxytocin system is explaining the majority of its effects (Beetz et al., 2012b).

On the one hand, the intranasal administration of oxytocin increases eye contact during interactions of humans; not only the number of fixation, but also the total time is on the rise (Auyeung et al., 2015; Guastella et al., 2008). In human couple interactions, this hormone boosted the duration of affirmative behaviour in relation to adverse behaviour during a conflict discussion; besides, after this dispute it reduced salivary cortisol levels (Ditzen et al., 2009). Also the quality of relationships is important for the oxytocin levels. Human telling grander support from their partners presented more plasma oxytocin before and after a period of close physical contact with their mates (Grewen et al., 2005).

On the other hand, dogs with intranasal administered oxytocin, showed higher social orientation and affiliation toward their owners; however, the exchange of social-positive behaviours triggers the release of oxytocin which supports the idea of a positive feedback loop in dog's social bonding (Romero et al., 2014).

Combining the effects of Oxytocin in humans and dogs, Nagasawa et al. (2009) demonstrated a correlation between a dog's gaze and its owner's urinary oxytocin level. The dog's gaze has a strong effect on the neuroendocrine system of the human.

3.3 Biophilia

Wilson (1984) described the "innate tendency to focus on life and lifelike processes" or expressed in another way the extreme interest of humans in nature and animals as biophilia. People react differently to organisms than to machines (Kellert & Wilson, 1993). Other animals do not show this kind of instinctive interest in nature; the complex of mental, emotional and social skills and traits is species-specific for humans. The ability to reflect on the world, nature and the own human being is necessary for biophilia (Kotrschal, 2014). Biophilia evolved during human evolution as hunter-gatherers and could be a base for the positive effect of animals on humans (Kellert & Wilson, 1993). Humans always had to interact with, and react to, animals; further, Barrett (2005) describes different roles animals had played in human's lives. Some animals prey on humans or defend themselves when threatened; others serve as food or competitors for food. Moreover, wild animals were kept as pets or food and could also have had a predictive function for humans. It is probable, that these factors are important for human interest in animals.

Therapeutic interventions involving animals are based on the assumption that humans are attracted and motivated by animals (Melson & Fine, 2006). The relationship between children and both, animals and nature is an important component for developing a happy and balanced life (Kellert & Wilson, 1993; Kotrschal, 2014; Urquiza-Haas & Kotrschal, 2015). Moreover, interactions with animals improve mental, emotional, social and locomotory development, coordination skills, social skills, concentration and self-confidence of children (Kotrschal, 2014, 2016).

Compared with the impact of oxytocin the "biophilia effect" does not need direct physical contact or eye contact of dogs and humans to unfold.

3.4 Aim of this Study

Although it was already shown that humans are affected by a dog's presence, the mechanisms of this influence remain unclear. The aim of this study is to find out in which way the biophilia effect unfolds. Are communication and interactions indeed more relaxed when a dog is present? And if – why? Are the communication and the interactions of the teachers different, when a dog is being

present in a room as compared with no dog present? Or makes the dog present the pupils being more relaxed and facilitates their concentration? Does the effect unfold differently when a student is often interacting with the dog or looking at it instead of ignoring it? Finally, the dog present may similarly affect both sides (the teachers and the pupils). Hence, I will examine interactive behaviour and emotional expression of teachers and pupils, active work of the pupils and the class social atmosphere. Thereby I aim to understand how the presence of a dog influences the communication of four different types of relationships: between the teacher and the children, between the teacher and the dog, between the children and the dog and among the children themselves.

4 Material & Methods

The study was conducted in four different elementary schools and two “new secondary schools” in the Austrian provinces Burgenland, Lower Austria and Styria. Six different teachers and their pupils (“classes”) participated in the study. They themselves, their dogs and their classes were video-taped. In each class five pupils, who were present in all lessons, were chosen randomly for behavioural coding. A fix amount of pupils per class was important due to different sizes of the classes and because not all pupils were present in each lesson. In addition a proper sample size was necessary for statistical analyses. In total thirty children were observed, fourteen female and sixteen male. Prior to the study the children have been introduced to the dog and were habituated to the situations with the dog being present. So this situation was common for the pupils. Some were observed in an open-learning-situation while they could move independently. The different situations in the lessons resulted from different teaching methods of the teachers who were instructed to behave as usual. Due to such differences in teaching styles, it was important to compare each class with itself in conditions with and without a dog. Half of the record sessions were with a dog present and the other half without.

4.1 Procedure

The teachers participating in this study were informed about the procedure, their tasks and the general aim of the study research. Informed consent was asked from the parents of the children, the teachers and the headmasters. They were informed about the procedure of the research in advance. To keep them free from bias, they were told the research focused on the interaction and the communication behaviour of the humans and the dogs in class, but no details of the video analyses were given.

Video-recordings were made by the teachers themselves after a detailed introduction to minimize disturbance which could occur when a foreign person would be present. The video cameras were placed on a tripod or on a bracket in a corner in the front of the classrooms in a way that each human and, in the lessons with the dog, also the dog was clearly observable on the screen as well as possible. Preferably, the faces of the children, the place of the dog and the teacher were recorded.

Recording started at the beginning of the break before the lesson and stopped during the break after the lesson. During the lesson the dog had the possibility to move around as desired.

4.2 Video Recording

Videos were recorded in winter 2016. The groups started with a dog present. Two recording sessions with a dog present and two without a dog were set at each class (Tab.1).

Tab.1: Chronology of situations for video recording in each class.

Lessons recorded	Week 1	Week 2	Week 3	Week 4
Lessons chronology	Dog present	No dog present	Dog present	No dog present

4.3 Video Analysis

Videos were behaviour-coded by Sarah Lehner and Franz Unterberger (for the ethogram see Tab.2). The focus of the observation was on the interactions between teacher – pupils, teacher – dog, pupils – dog and pupils – pupils.

Three different acoustic noise levels were coded to indicate the social atmosphere in class. Noise level one indicated a very calm situation with no one or just one person talking; while level two characterised normal talking and working volume of several persons. Noise level three was the uneasiest situation when many people talked at the same time or sang together; it was rather noisy.

Tab.2: Ethogram for behaviour encoding.

Individuals		
Interaction (continuous recording, duration): interaction is defined by verbal and nonverbal communication or tactile interplay		
1	Visible interactions two persons	two persons (two children or children and teacher or two teachers) interact with each other this behaviour is also coded when two children talk with each other during a huge group interaction (e.g. while the teacher is explaining something)
2	Interaction small group	up to four individuals interact
3	Interaction huge group	five or more individuals interact, the whole class interacts also teacher talks to the whole class, singing or dancing in the group, doing a listening comprehension, contributions of single children in front of the class, teacher asks a child something in front of the others
4	No interaction	pupil/teacher is alone and does not interact with anybody
Position (continuous recording, duration): body position, walking or sitting behaviour		
1	Sitting in an unsettled manner (chair)	restless leg, moving the body back and forth, moving the chair while sitting on it, often change in position, scratching really badly

2	Sitting in a relaxed manner (chair)	normal movement during the lesson, including writing or taking material out of the schoolbag
3	Sitting calmly (chair)	nearly no movement, eyes "stare", apparent "daydreaming", has to be obvious and to occur for several seconds
4	Sitting in an unsettled manner (floor)	restless leg, moving the body back and forth, often change in position (e.g. change between sitting and lying on the floor several times), scratching really badly
5	Sitting in a relaxed manner (floor)	normal movement during the lesson
6	Sitting calmly (floor)	nearly no movement, eyes "stare," apparent "daydreaming," has to be obvious and to occur for several seconds
7	Standing	when children are standing at a place, dancing or singing at a place
8	Walking	child goes or runs around in the classroom

Noticeable behaviour (continuous recording, frequency)

1	Conspicuous behaviour	Every time when any specific behaviour occurs it will be coded. If the same sign happens two times in a row and seems to have a special trigger it will only be coded once (e.g. itchy spot on the skin). If it is interrupted by any other nervous indication, three signs will be counted. Conspicuous behaviour includes: scratching legs, arms, face or head, putting finger into mouth (without food), touching face or neck, rubbing hands/fingers, putting hands together, shaking head vigorously or as in a movement to get hair out of the face, blinking an eye very often in a short time (more than usual), adjusting glasses, pressing lips together, playing with objects, moving objects back and forth, playing with hair, shaking the leg perpetually
2	Active work	cooperation in the lesson; to put one's hand up, say something in front of the group
3	Special behaviour	the child is raging, riots, becomes aggressive, etc.

Emotional expression (scan sampling, 60sec)

1	Neutral	the emotional expression of the face seems to be neutral, no special muscles are tensed, the child or teacher is busy with his/her own work or just looks at the table
2	Positive emotion	e.g. smiling, laughing, kissing, dancing independently from the group
3	Negative emotion	e.g. being sad or angry, weeping, crying, shouting not: seem to be bored → neutral

The whole class

Noise level (scan sampling, 60sec)

1	1	The noise level is very low or it is completely quiet in the classroom. The pupils are working quietly and concentrated or the teacher is talking in front of the class while the pupils listen to him.
2	2	There is a normal volume (e.g. some people are talking). Nobody has to raise its voice for others to be able to understand them.

3	3	It is rather noisy in the room and therefore hard to understand what people say. Many different people are talking at the same time, for example during group works. The children are singing together loudly.
Cooperation (continuous recording, duration)		
1	Passive cooperation	the child/teacher works because of a group instruction, sitting attentive in a circle on the floor/chair or at the table
2	Single person working	the child/teacher works on its own, independently of the rest of the group, there is no generally instruction given
3	Break	the child/teacher is not working, it does something else (e.g. playing with a soft toy, chatting with the person next to it)
Dog contact (continuous recording, duration)		
1	Approach	the child/teacher talks to the dog or tries to attract him, verbal or nonverbal
2	Body contact	there is body contact between the person and the dog (e.g. stroking the dog, the dog touches the person with its nose)
3	Observing	the child/teacher is observing the dog
4	No contact	there is no contact or interaction with the dog
Dog contact (continuous recording, frequency)		
1	Person initiates contact	the child/teacher initiates the contact with the dog (e.g. after attracting the dog, going to the dog's place)
2	Dog initiates contact	the dog goes to the person on its own and decides to get in contact
3	Indistinguishable	it is not sure whether the person or the dog started the interaction

Dog's behaviour		
Arousal (continuous recording, duration)		
1	Place	the dog is at its place, the position is not relevant, it can be resting, standing, sitting, sleeping
2	Classroom	the dog is not at its place, it moves around the classroom independently
3	In contact pupil	the dog is standing/sitting/laying next to a pupil while being in physical contact (e.g. contact laying, being stroked)
4	In contact educator	the dog is standing/sitting/laying next to the educator while being in physical contact (e.g. contact laying, being stroked) also coded when there is contact to a pupil at the same time
Stress (continuous recording, frequency)		
5	Stress	The dog is showing possible signs of nervousness like scratching, yawning, licking intention, shaking, panting or blinking very often. It is also coded when it is in a social interaction with a person and maybe has a calming purpose.

4.4 Statistical Analysis

Data were analyzed with SPSS (version 24.0.0.0) and figures were created with SPSS and Microsoft Excel. Behavioural data was checked for normal distribution by using the Kolmogorov-Smirnov-Test. The possibility of pooling data from pupils of different classes was tested by pairwise testing of the medians with independent samples from the categories. In the case of non-normally distributed data, the adequate non parametric Wilcoxon-test was applied for dependent data and Mann-Whitney-U-Test for independent data like difference of sexes. Finally, correlations between categories were analyzed with the Pearson-Test. The different measured behaviours were compared between the two conditions (dog present and dog absent).

5 Results

The lessons of the different schools and periods were conducted by the teachers involved in different ways; open learning situations and regular teaching alternated. Pooling the data of pupils from different classes therefore was not reasonable because of such heterogenous teaching styles. Pairwise testing the medians of the parameters indeed, resulted in significant differences of the six groups; hence, the data from different groups were analyzed independently. In contrast, the teachers were pooled because of the small sample size of six teachers to allow at least some statistical analysis.

The Kolmorov-Smirnov-Test for data distribution revealed a non Gaussian distribution of the data in all categories (p-value between $1,3^{-17}$ and 0.043; exceptions: interactions without dog $p=0.06$, no communication with dog $p=0.102$, emotion neutral with dog $p=0.2$); as a consequence non parametric tests were used.

We found no significant gender difference between the pupils in any of the behavioural categories. Therefore, sexes (female $n=14$, male $n=16$) were not distinguished in further tests.

The reliability test between the two encoders Sarah Lehner and Franz Unterberger resulted in 98.7% correlation of the decoded behaviour of the teachers, pupils and dogs.

5.1 Expressions of Emotions

5.1.1 Teachers

The Wilcoxon-Test revealed no significant differences between the six teachers' emotions "neutral" (Wilcoxon: $Z=-0.734$, $p=0.463$), "positive" (Wilcoxon: $Z=-0.730$, $p=0.465$) and "negative" (Wilcoxon: $Z=-1.342$, $p=0.18$) in the two conditions (dog present and dog absent).

5.1.2 Pupils

In classroom groups four, five and six the children showed significantly more neutral expressions when a dog was present as compared with the sessions when no dog was in the classroom (Tab.3). Nevertheless, in the other half of the classes no significant difference could be noticed in any of the three emotional expressions (Fig.1).

Tab.3: Wilcoxon Z and p-values of the emotion categories neutral, positive and negative in the two dog conditions per class. For better understanding the result of emotion “neutral”, situations with higher mean values are declared additionally.

	class 1	class 2	class 3	class 4	class 5	class 6
neutral p	0.225	0.345	0.08	0.043*	0.043*	0.043*
neutral Z	-1.214	-0.944	-1.753	-2.023	-2.023	-2.023
higher when dog	absent	present	absent	present	present	present
positive p	0.345	0.500	0.465	0.109	0.684	0.109
positive Z	-0.944	-0.674	-0.730	-1.604	-0.406	-1.604
negative p	1	0.109	0.461	1	1	1
negative Z	0	-1.604	-0.736	0	0	0

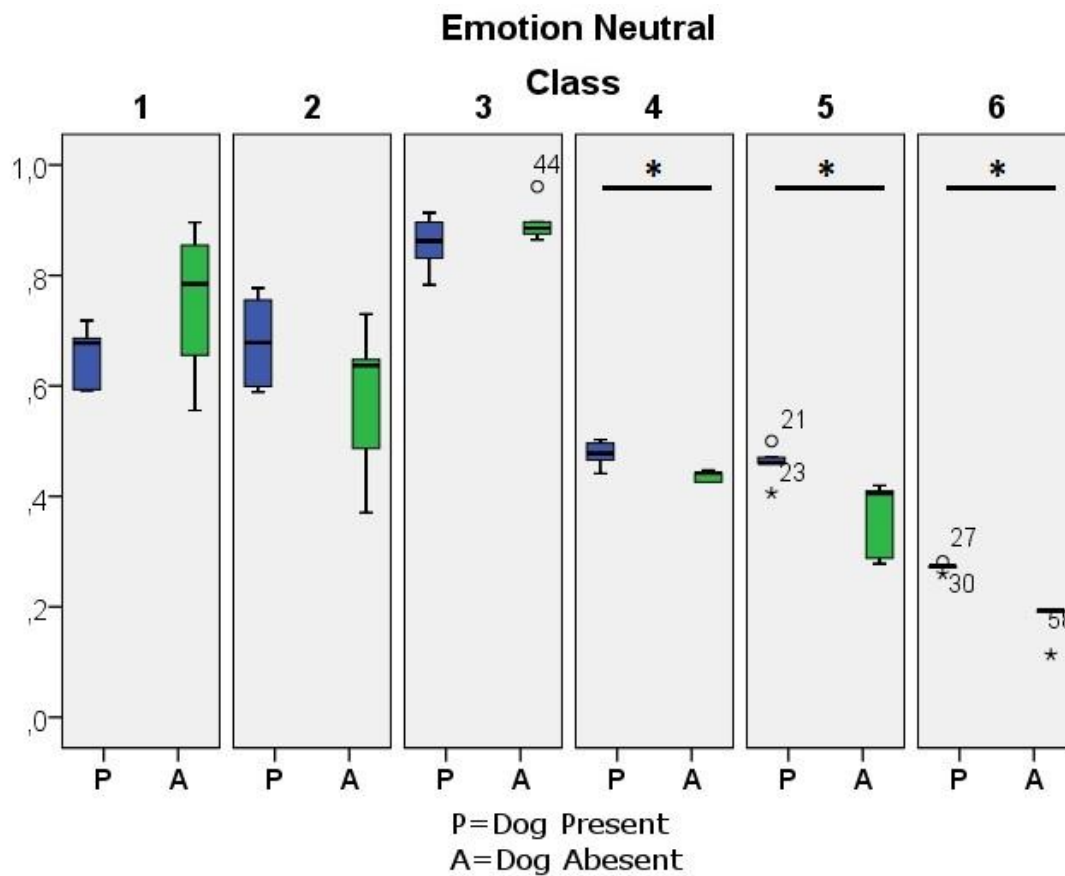


Fig.1: Boxplot of the emotion neutral with and without a dog for each class (1-6). Class 4: Wilcoxon: $Z=-2.023$, $p=0.043^*$; class 5: Wilcoxon: $Z=-2.023$, $p=0.043^*$; class 6: Wilcoxon: $Z=-2.023$, $p=0.043^*$. Significant p-values ($<0,05$) are marked with an asterisk.

Correlations of the behaviour and dog contact were tested in classes one to five ($N=25$). In class six the pupils had no direct dog contact at all. None of the pupils looked at the dog, talked to it or had body contact; hence, class six was not rated. Furthermore, there was a significant correlation between neutral emotion and no contact with the dog (Pearson 0.849, $p=8,1^{-8}$). Positive expressions correlated significantly with no dog contact (Pearson 0.478; $p=0.016$) and attracting the dog (Pearson

0.510; $p=0.009$). Negative emotions correlated significantly with no dog contact (Pearson 0.488; $p=0.013$), dog attracting (Pearson 0.564; $p=0.003$) and body contact (Pearson 0.438; $p=0.029$).

5.2 Interactions

The following interactions were recorded: no interaction, interaction between two people, interaction between up to four persons and interaction within five or more persons. The latter three were summed up as “interaction”.

5.2.1 Teachers

No significant difference could be found between the two conditions, with or without dogs, regarding the duration of teachers’ interactive behaviours (Wilcoxon: $Z=-1.363$; $p=0.173$) and the duration of non-interactive time (Wilcoxon: $Z=-1.782$; $p=0.075$). The means showed more time of interactive behaviour than non-interactive behaviour in all sessions.

5.2.2 Pupils

In groups one, four and five the pupils showed significantly more interactive behaviour of the pupils when the dog was absent (Fig.2); respectively in the same classes and additionally in class six the overall time of no interactions was significant longer when a dog was present (Tab.4, Fig.3). Only in group two more interactions were found when a dog was present and the time spent non-interactive was longer in the absence of the dog.

Tab.4: Wilcoxon Z and p-value of the interactive behaviour of the pupils sorted per class. The situations with higher mean values are declared below the Z.

	class 1	class 2	class 3	class 4	class 5	class 6
interaction p	0.043*	0.043*	0.080	0.043*	0.043*	0.893
interaction Z	-2.023	-2.023	-1.753	-2.023	-2.023	-0.135
higher when dog	absent	present	present	absent	absent	Absent
no interaction p	0.043*	0.043*	0.138	0.043*	0.043*	0.043*
no interaction Z	-2.023	-2.023	-1.483	-2.023	-2.023	-2.023
higher when dog	present	absent	absent	present	present	Present

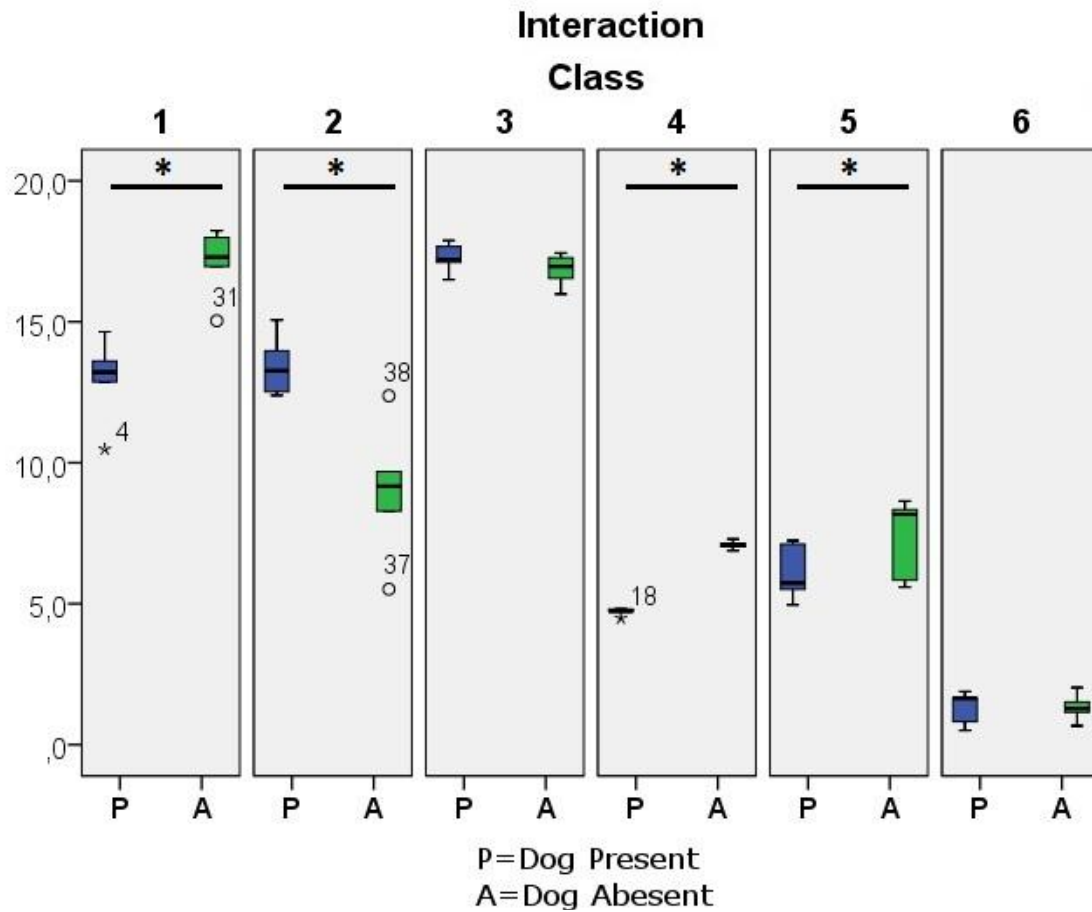


Fig.2: Boxplot of the interactions with and without a dog for each class (1-6). Class 2: Wilcoxon: $Z=-2.023$, $p=0.043^*$; class 4: Wilcoxon: $Z=-2.023$, $p=0.043^*$; class 5: Wilcoxon: $Z=-2.023$, $p=0.043^*$. Significant p-values ($<0,05$) are marked with an asterisk.

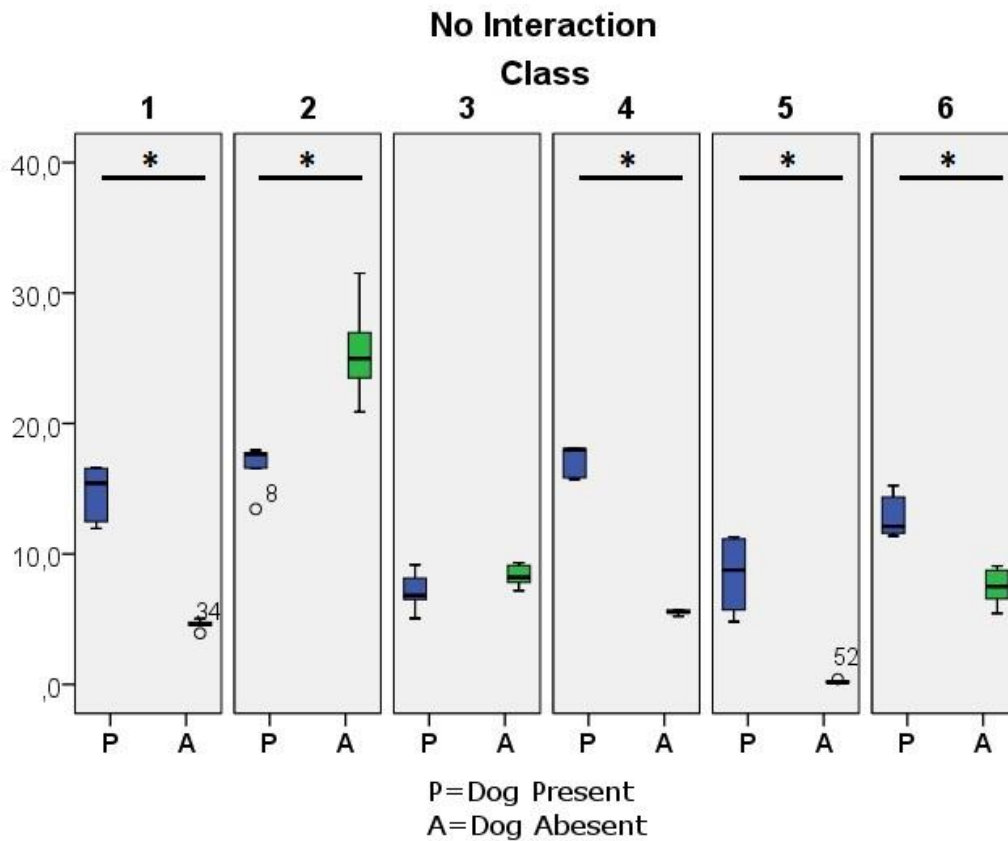


Fig.3: Boxplot of the non interactive time with and without a dog for each class (1-6). Class 1: Wilcoxon: $Z=-2.023$, $p=0.043^*$; class 2: Wilcoxon: $Z=-2.023$, $p=0.043^*$; class 4: Wilcoxon: $Z=-2.023$, $p=0.043^*$; class 5: Wilcoxon: $Z=-2.023$, $p=0.043^*$; class 6: Wilcoxon: $Z=-2.023$, $p=0.043^*$. Significant p-values (<0.05) are marked with an asterisk.

In the two conditions interactions within two persons and within a small group were tested (Tab.5). The interactions between two persons were significantly different between the two conditions only in two classes. In one class (class two) the pupils interacted more when the dog was absent; in the other class (class five) it was the other way round. The result was similar regarding small group interactions. In class three and five they had more interactions with a dog present, in class six the behaviour was reverse.

Tab.5: Wilcoxon Z and p-value of the interactive behaviour within two persons and small groups of the pupils sorted per class. The situations with higher mean values are declared below the Z.

	class 1	class 2	class 3	class 4	class 5	class 6
two persons p	0.225	0.043*	0.686	0.498	0.043*	0.893
two persons Z	-1.214	-2.023	-0.405	-0.677	-2.023	-0.135
higher when dog	present	absent	absent	present	present	absent
small group p	0.686	0.08	0.043*	1.000	0.043*	0.043*
small group Z	-0.405	-1.753	-2.023	0.000	-2.023	-2.023
higher when dog	absent	present	present	present	present	absent

Negative correlations of interactive behaviour and dog contact were found for “no interactive behaviour” and “observing the dog” (Pearson -0.540; $p=0.005$) and “general dog contact” (Pearson -0.467; $p=0.019$); hence, more non-interactive behaviour correlated with less observing the dog and vice versa. Moreover, interactions correlated with no dog contact (Pearson 0,877, $p=8,5^{-9}$).

5.3 Active Work

Active work of the pupils included hand signal to catch the teacher’s attention and requests to speak or answering a teacher’s question. Significant differences for the two conditions were only found in class two and four; in class four active work was more frequent in the sessions without a dog, while the result was oppositional in class two (Tab.6, Fig.4).

Tab.6: Wilcoxon Z, p-value, mean score and standard deviation (sd) of the pupils active work (frequency per minute) in the conditions with a dog being present in the classroom and without a dog per class.

	class 1	class 2	class 3	class 4	class 5	class 6
p-value	0.345	0.043*	0.345	0.043*	0.893	0.180
Z	-0.944	-2.023	-0.944	-2.023	-0.135	-1.342
dog present (mean ± sd)	0.154±0.07	0.206±0.062	0.25±0.146	0.055±0.028	0.012±0.008	0.003±0.496
dog absent (mean ± sd)	0.212±0.061	0.025±0.01	0.197±0.091	0.154±0.093	0.015±0.011	0.001±0.002

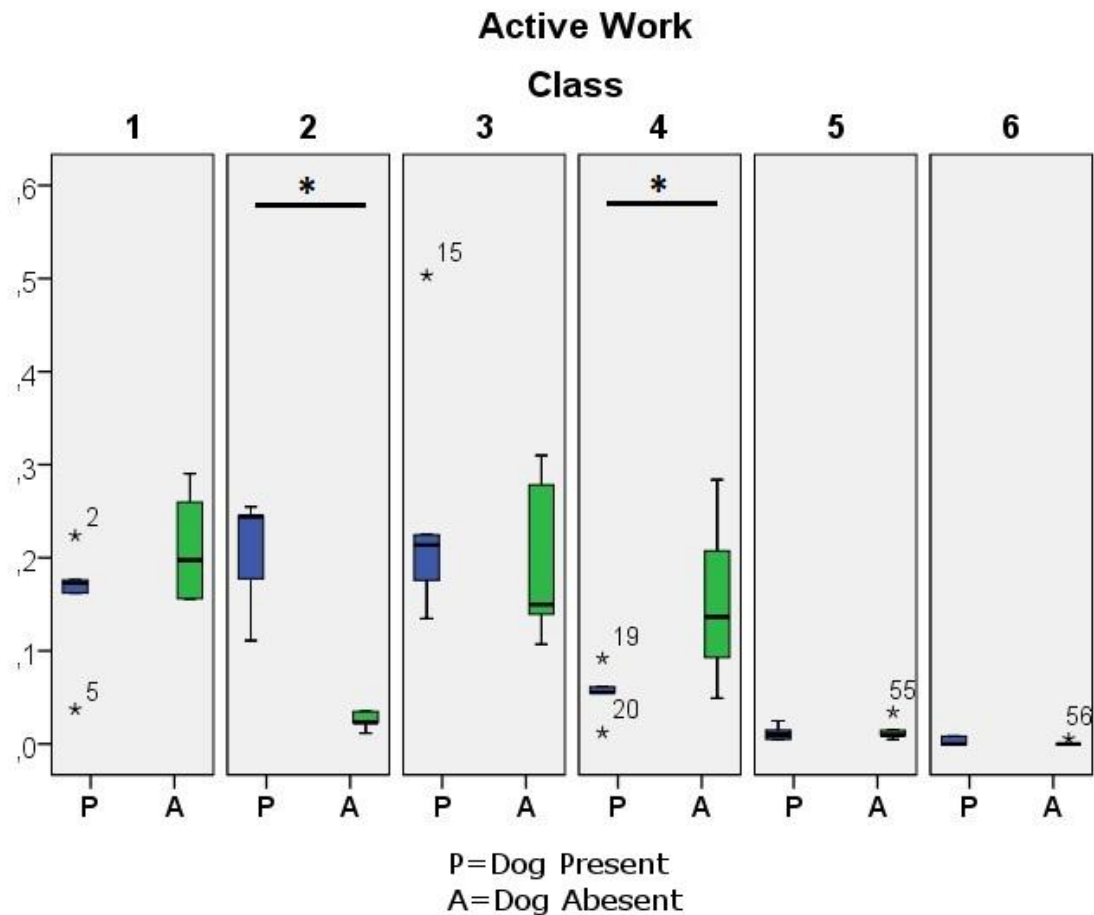


Fig.4: Boxplot of active work with and without a dog for each class (1-6). Class 2: Wilcoxon: $Z=-2.023$; $p=0.043^*$; class 4: Wilcoxon: $Z=-2.023$; $p=0.043^*$. Significant p-values ($<0,05$) are marked with an asterisk.

The correlations of active work and the three forms of dog contact showed different results. A significant negative correlation of observing the dog and active work was indicated (Pearson -0.491 ; $p=0.013$). Attracting the dog (e.g. talking to the dog; Pearson 0.086 ; $p=0.682$) and body contact (e.g. stroking the dog; Pearson 0.289 ; $p=0.161$) had no impact on active work behaviour. Moreover, a highly significant correlation between active work and no contact with the dog was shown (Pearson 0.757 ; $p=0.000012$).

5.4 Noise Levels in Class

In none of the three different levels a significant difference concerning a dog's presence was recognised (Fig.5). Singing together was most common in class one which led to most of the noise level three (Fig.6).

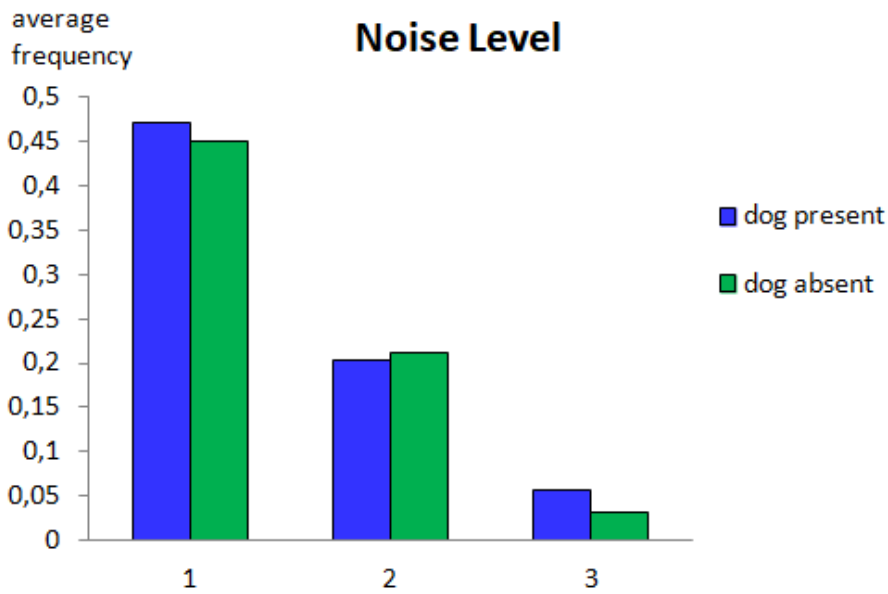


Fig.5: Mean scores of all noise levels in the situations with and without a dog.

Testing the noise levels per class also resulted in no significant difference between the two conditions (Fig.6).

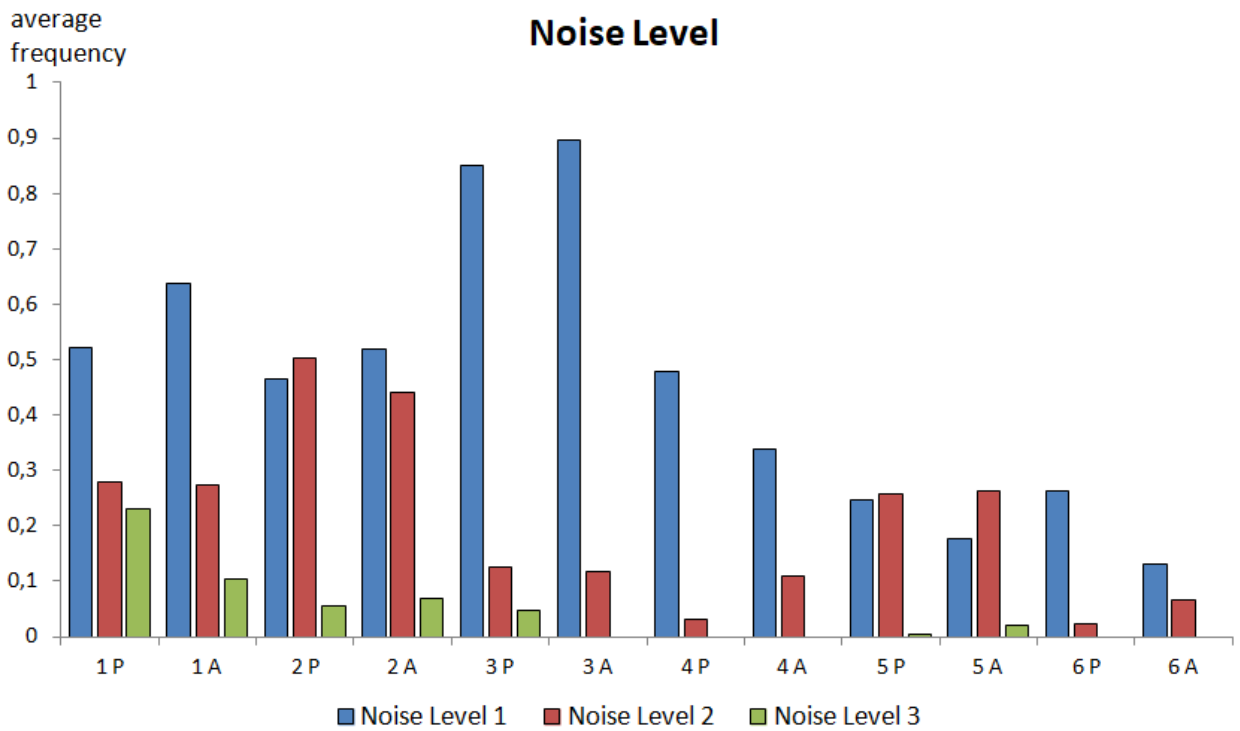


Fig.6: Average frequency of noise levels of each class (1-6) with and without a dog. P = dog present, A = dog absent.

6 Discussion

The mere presence of a dog in the classroom led to less emotional expressions of the present pupils; not only negative but also positive emotions decreased. Explanation of this result might be that the pupils were more concentrated in the lessons with a dog which led to a neutral and concentrated facial expression. Also, these were classes with children showing “normal” (non-challenged) social behaviour. Hence we expected that changes in behaviour due to the presence of the dogs, if any, would be subtle. This was indeed the case.

Nevertheless, positive emotions correlated with attracting or speaking to the dog while negative emotions correlated not only with attracting the dog but also with body contact with the dog. This may seem contradictory at the first glance; however, there is a difference between the mere presence of a dog and interacting with a dog. Most of the time, the dogs were just present and no interactions between dogs and pupils occurred; the biophilia effect can unfold. Kotrschal (2014) also describes a calming effect of a calm dog’s presence which is compatible with the findings of the present study. While the dog’s presence was found to lead to an emotional calming, direct interactions with the dog were found to lead to emotional behaviour independently whether the emotions were positive or negative. Perhaps concentrated work of some pupils was interrupted by dog contact. These results also only seemingly contradict Hutter (2015) who came to the result that insecurely attached children were laughing or smiling longer in a dog’s presence without direct contact with the dog. But Hutter monitored were socially and behaviourally challenged children in a therapy setting. Anderson and Olson (2006) described an overall increased emotional stability of children with emotional disorders with a dog. This is in accordance with the present results.

The overall interaction time was longer when the dog was not present in the classrooms; in contrast, in the lessons with a dog being present the time of non-interactive behaviour rose. Nonetheless, in one class (class two) the result was conversely which will be discussed later. Further, spending more time observing the dog led to less non-interaction time at all. As described above, working concentrated resulted in more frequent neutral facial expressions and in less interactive and communicative behaviour. Nevertheless, contrasting results were found in the effect on interactions within two persons or small groups of up to four persons. In some classes the pupils were more activated to interactions when the dog was present, in others they chatted more often when the dog was absent. Again, class two showed opposite significant results than the others. This outcome leads to the assumption of different kinds of activations caused by the dog’s presence, which was also found by Kotrschal & Ortbauer 2003). Each pupil and each teacher differs from each other, which suggests that in some classes individual activity for social behaviour with the classmates rose with the presence of the dog which is in accordance with the research results of Martens (2015).

The hand signal to catch the teacher's attention and requests to speak or answering a teacher's question (summed up as "active work") was more frequent when the dog was absent in one class, in class two the result was contrarily again. These results were strengthened by a negative correlation between observing the dog and active work. Children who observed the dog longer tend to show less active work. The pupils showed a higher level of active work in the absence of a dog while observing the dog calmed them down. Nonetheless, observing the dog activated the pupils to social behaviour (e.g. interacting with each other). This might be a factor why the pupils were distracted from active work when a dog was present in the classroom.

Regarding the apparently frequent converse results of class two, this is examined more closely. In several situations with the dog being present a strange behaviour of the children was noticeable. Some seemed to do not dare to stroke the dog and pulled back their hand in the middle of the movement to the dog. One situation occurred when the dog went with a soft toy in its mouth to a child who was sitting on the floor. The child seemed to feel comfortable with the situation and laughed but the teacher told it to stand up and not to play with the dog. The dog often seemed to be overlooked or even ignored by the teacher and the pupils. Nonetheless, the dog was found to show very social behaviour by moving freely around in the class, stopping next to the pupils. Also most of the children made the impression to like the dog by caring about it. They placed willingly the dog's blanket on the floor and liked to bring it in the class at the beginning of the lesson and restore after the class. However, the relationships of the humans with the dog seemed to be very different compared to the other observed classes. Probably the perceived strict behaviour of the teacher influenced the behaviour of the pupils which resulted in the observed outcomes of this study. This is an example which clearly indicates the complexity of the teacher-dog-pupil triangle. Summarized, the pupils of class two seemed to interact generally more frequently when the dog was present, while individual interactions between two individuals were higher in absence of the dog. Moreover, the pupils of this class were found to show more often active work with a dog in the classroom.

Kotrschal and Ortbauer (2003) observed fourteen boys and ten girls at an elementary school in Vienna. In contrast to their results, where boys showed more clearly behavioural changes in the presence of a dog than girls, no difference between the sexes of the sixteen boys and fourteen girls could be found in respect to the behaviour in the present study. The generally greater effects in this case than in the present study may be explained by the fact that the children in that study were first graders and hence, considerably younger than the children involved in our present study.,

The teachers seemed to show no difference in emotional expressions concerning dog's presence; furthermore, the interactive behaviour did not differ in the two conditions (with and without a dog), too. The interpretation should be done carefully because in general, the constructions of the different lessons distinguished severely from each other. Moreover, the teachers were not visible all the time during the examination of the videos since the cameras were positioned in a way the pupils were visible best; hence, the cameras were in the front of the classes and depending on the lesson design often just the back and the back of the teachers' head were recorded. To evaluate the teachers' behaviour in a better way a second camera should have been positioned in each class. Moreover, the different results of the pupils of class two could also correlate with a different behaviour of their teacher compared with that of the teachers of the other classes.

Furthermore, in some of the classes the dog was on its place during the entire lesson. These were not visible on the tape in most of the classes. Therefore, it was not possible to evaluate the behaviour of each dog properly and sometimes also the interactions with the pupils and the teachers were not entirely recorded because of the camcorder's limited perspective. Considering the result of Martens (2015) body contact with a dog is important for reducing physiological stress parameters.

In total, no significant difference concerning the class atmosphere could be found. All lessons were dominated from an appropriate noise level. Most of noise level three (the loudest one) was in class one when all pupils sang a song together which were loud but relaxed situations for the children. The class atmosphere was in all sessions dominated by silence or one person talking. In contrast to studies concerning children with insecure attachment (Beetz et al., 2012), emotional disorders (Martens, 2015; Hutter, 2015, Anderson & Olson, 2006) or pupils in open learning situations (Kotrschal & Ortbauer, 2003) the expected influence of a dog in a classroom with average pupils in regular learning situations with a teacher giving instructions was not as dominant. The social atmosphere in a classroom can be influenced and lasting positive (Kotrschal, 2014). Generally, probably the biophilia-effect (Wilson, 1984) unfolds stronger in people who are found to be less emotional balanced than in the pupils of the present sample.

With regard to the results, as mentioned in Beetz (2013), it is important to keep in mind that these parameters could have been affected by several other factors besides the presence of a dog. These are difficult to determine and control and include for example the individual personality of the people being observed and the interaction style of the teachers and the dogs. As six different dogs and six different teachers were observed in the present study they may have different effects; hence, regarding pairwise testing the medians of the parameters the classes were evaluated separately.

7 Appendix

7.1 Declaration of Consent

Before the study started the teachers got declarations of consent to deliver them the parents of the pupils.

Liebe Eltern!

An der Schule wird derzeit eine Studie in Zusammenarbeit mit der Universität Wien durchgeführt. Dabei soll herausgefunden werden, welche Auswirkungen die Anwesenheit eines Hundes auf das Verhalten und die Kommunikation der Kinder und Lehrpersonen im Klassenzimmer hat. Es ist bekannt, dass Hunde freundliches Verhalten fördern, Ängste mindern, beruhigend wirken und die Konzentration unterstützen. Damit sind auch wichtige Voraussetzungen für effektives Lernen gegeben.



Zum Ablauf:

Die Datennahme erfolgt anhand von Videoaufzeichnungen von Stunden in der Klasse, mit und ohne Hund.

Die Lehrperson wird die Kamera am Beginn der Stunde (ev. bereits in der Pause davor) einschalten und danach wieder abschalten. Die Versuchsleiter der Universität Wien (Sarah Lehner und Franz Unterberger) werden das gesammelte Videomaterial auswerten.

Die in der Studie gewonnenen Daten werden anonymisiert, nicht an Dritte (auch nicht an die Lehrer) weitergegeben und beeinflussen auch nicht die Note. Der Hund ist kindersicher und speziell für den Einsatz in der Klasse ausgebildet.

Ich (Name) stimme zu, dass mein Kind (Name)
..... geboren am (Datum) an der Studie zu
den Auswirkungen eines Hundes im Klassenzimmer teilnimmt. Ich bin einverstanden,
dass mein Kind im Laufe der Studie in Unterrichtsstunden mit und ohne Hund gefilmt
wird.

Unterschrift: Ort, Datum.....

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