Learning styles and household pets in adolescents attending the 9th grade at Danielsen Ungdomsskole in Bergen

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Abstract

This study investigates the relationship between household pets and different learning styles in adolescents, using Howard Gardner's theory of multiple intelligences as a framework. In describing intelligence as pluralistic, this theory considers that individuals have a profile of intelligences (linguistic, logical-mathematical, musical, bodily-kinesthetic, spatial, interpersonal, intrapersonal, naturalistic and existential), each with varying levels of strength. These intelligences influence how individuals learn and can manifest as preferred learning styles, which shape their approach to acquiring knowledge and skills. Based on previous research indicating health, emotional and well-being benefits for pet owners, including adolescents, my hypothesis is that adolescents having pets at home have stronger interpersonal and intrapersonal learning styles than those without. A self-administered questionnaire assessing the nine learning styles was distributed to all 9th grade students at Danielsen Ungdomsskole in Bergen, yielding 80 responses out of 90 participants (88.89% response rate). The study population reflected the national trends in gender balance, sibling status, and pet in the household status, with 57.5% of participants reporting pet(s) in their household, mostly cats (30%) and dogs (26.3%). Data analysis revealed that adolescents with pet(s) in their households scored significantly higher in the naturalistic learning style compared to those without, while other learning styles, including interpersonal and intrapersonal, showed no notable differences. These findings disprove my hypothesis and challenge previous findings about the broader cognitive and emotional benefits of having pet(s) in the household. However, they indicate that pets(s) in the household may potentially enhance the naturalistic learning strength of adolescents and foster greater engagement with nature. Further research could help us understand if having pet(s) at home might make adolescents more aware of nature and the environment, and if it might help to enhance adolescents' environmental awareness, responsibility, and sustainable practices.

Introduction

Personal perspective

I have a dog named Sparky, a cat named Kygo, and 4 fish named Ole, Toole, Foole, and The Lonely One. Every time I return home, my dog Sparky greets me with boundless excitement with his tail wagging enthusiastically. Kygo is more reserved, so he doesn't jump on me like Sparky does, but he comes gently after a while and likes to sit on my lap. They both seem to sense how I am feeling, in their different ways, but react in somehow similar way. On stressful days, they quietly stay by my side, offering comfort in a way that feels instinctive. When I am excited and full of energy, they also seem wired to my mood. Young people at my age have mood swings while having homework, school activities, *etc.* and this might be difficult to handle. This got me thinking: could having a pet like Kygo or Sparky, or even one of my fish influence a person's emotional intelligence, motivation, and self-awareness? Could pets have a positive influence on us, the adolescents, and help us go through this challenging period? Is it possible to find out if this is true? With all the activities and tasks going on in my life at this time, I was wondering if pets can also help in learning and coping with all the endeavors a teenager like me has in this demanding period of life. Can one measure that?

Scientific background

Adolescence is a period of rapid emotional and cognitive development, growth and change, where relationships, both human and non-human, can play a crucial role (1). Pets may offer companionship and emotional support, potentially shaping how people develop skills like empathy, emotional regulation, social interaction, and even a deeper connection to others. Previous studies have found that household pets have a positive impact on emotional well-being, including children and adolescents (2). A systematic review went through many studies and found evidence of associations between pets and educational benefits; as well as between pets and emotional health benefits particularly for self-esteem and loneliness (3). However, defining and measuring emotional intelligence or emotional well-being is challenging because it encompasses complex, interconnected abilities such as self-awareness, empathy, emotional regulation, and social skills. Unlike cognitive intelligence, which can be assessed with standardized tests, emotional intelligence is harder to quantify due to its subjective nature and context-specific manifestations (4). Current measurement tools, such as self-reporting questionnaires, are often criticized for relying on personal perception rather than objective evaluation, making it difficult to obtain reliable and valid results (5).

Traditionally, intelligence has been viewed as a single, measurable entity, referred to as the *g-factor*, a theory developed by Charles Spearman. This model suggests that general intelligence underlies all cognitive tasks, a concept that still forms the foundation for many standardized IQ tests (6). However, alternative theories have challenged this narrow view, highlighting that intelligence is more diverse and context dependent. For example, the *Cattel-Horn-Carrol (CHC) Theory* distinguishes between fluid intelligence (problem-solving in unfamiliar situations) and crystallized intelligence (knowledge acquired through experience) (7). Similarly, *Sternberg's Triarchic Theory* breaks intelligence into analytical, creative, and practical components, reflecting the varied ways individuals adapt and succeed in different environments (8). These models suggest that intelligence is multifaceted, but they still rely heavily on academic and problem-solving skills. Building on these ideas, Howard Gardner developed the *Theory of Multiple Intelligences,* proposing that intelligence is not a single entity but a collection of distinct abilities, each valuable in its own way, particularly for the learning process (9, 10). Gardner argues that intelligence should not be measured solely by IQ tests, as each type of intelligence plays a unique role in learning and problem-solving (11). His most famous quote is '*It's not how smart you are that matters, what really counts is how you are smart'.* Gardner initially identified seven types of intelligences or *learning styles/strengths*; later he added the naturalistic and the existential intelligences/learning styles (**Figure 1**). They are defined as follows:

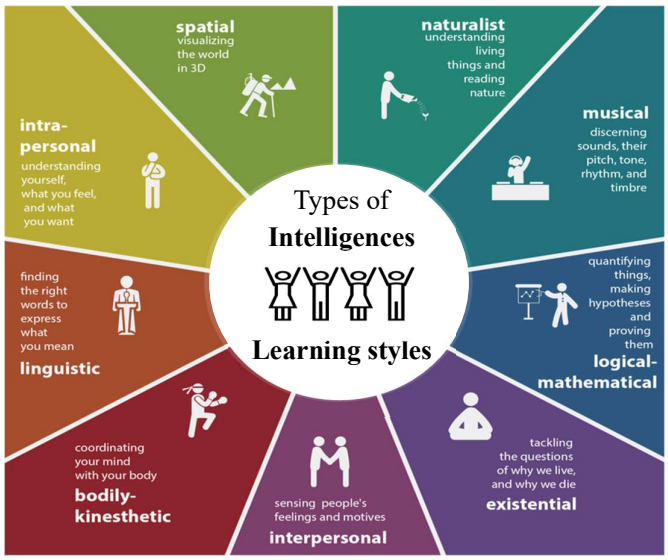

Figure 1. *The 9 types of intelligences/learning styles based on The Theory of Multiple Intelligences of Gardner (9,10) (figure adapted from https://rsd2-alert-durden-connections.weebly.com/multiple-intelligences--howard-gardner.html).*

1. Linguistic – sensitivity to language and the ability to use words effectively.
2. Logical-Mathematical – strong analytical and reasoning skills, often associated with math and science.
3. Musical – a talent for music, rhythm, and sound.
4. Bodily-Kinesthetic – the ability to control body movements and handle objects skillfully.
5. Spatial – the capacity to visualize and manipulate spatial concepts.
6. Interpersonal – the ability to understand and interact effectively with others.
7. Intrapersonal – deep self-awareness and understanding of one's own emotions and motivations.
8. Naturalistic – the ability to recognize and classify patterns in nature.
9. Existential – the ability to reflect on life's big questions, like meaning and purpose.

His research revolutionized how we understand intelligence, leading to more personalized teaching methods (10, 11), and challenging the idea that standardized IQ tests fully measure a person's intelligence and learning potential. His model incorporates learning styles related to emotional intelligence, particularly interpersonal and intrapersonal intelligences. Interpersonal intelligence involves the ability to understand and interact effectively with others, while intrapersonal intelligence pertains to self-awareness and emotional regulation. Some studies suggest that pets can positively affect emotional development by fostering empathy, communication skills, and responsibility (12). Regular interaction with pets often requires interpreting non-verbal cues such as body language, vocalizations, and behavior, which can enhance interpersonal intelligence. For example, dog owners may enhance interpersonal intelligence by learning to read and respond to their pet's emotional cues, such as body language, movement, and vocalizations (13). Additionally, pets provide companionship and emotional support, creating opportunities for self-reflection and emotional growth. Studies have shown that these interactions can promote emotional regulation and improve social skills, contributing to overall well-being (1,3). Caring for pets may thus help individuals develop a greater understanding of their own emotional responses and enhance their capacity for empathy and introspection, possibly strengthening the intrapersonal intelligence.

Research question, aim, and hypothesis of the study

With this background in mind, *the research question* for this study is:

- *Does having pets in the household associate with certain learning styles/intelligences of adolescents?*

The aim of this study is to investigate if having pets in the household correlates to specific learning styles/intelligence types in 9th grade students at Danielsen Ungdomsskole in Bergen.

Based on the above-mentioned research literature that suggests that pets have a beneficial influence on human emotions, development, social skills and mental health, my *hypothesis* is that:

- Adolescents with pets in their household have stronger interpersonal and intrapersonal styles/intelligences compared to those without.

Methods

Choice of the measurement tool

Gardner's theory has been widely applied in educational settings, with several test instruments (questionnaires) designed to assess different intelligence types or learning styles in children and adolescents (14, 15). Although there is criticism towards using such tools for research (4), these questionnaires offer a structured and previously tested approach for measuring emotional and cognitive development in adolescents (10). The questionnaire I chose to use in this study (https://www.lovetoknow.com/parenting/kids/multiple-intelligence-test-children) was selected due to its practicality and suitability for the school setting. It was user-friendly, quick to complete (taking approximately 20 minutes), and easy for students to understand what was demanded of them without requiring extensive supervision. These factors were important to ensure a high response rate and minimize survey fatigue, which could have led to incomplete responses or low participation.

Study population and distribution of the questionnaire

The group I was specifically targeting was my peers' group, the 9th grade at Danielsen Ungdomsskole in Bergen, where there are three classes with 90 students enrolled. I have sent a request to Research Data Authority in Norway (Norsk Senter for Forskningsdata), and after completing some questions on their webpage, I got an automatic answer that I did not need to apply for an ethical approval or to report to them for conducting my study. I translated the questionnaire from English to Norwegian and tested on myself and 2 other friends that know both English and Norwegian. The questionnaire did not contain any sensitive questions, and my colleagues were told to complete the questionnaires anonymously. To be able to distribute the questionnaire, I took contact with the Teaching Leader (trinnleder) of the 9th grade and my biology teacher, Kristoffer Karlsen, and asked him for permission to present my research project to my colleagues. I received half an hour in each class to present my study. I distributed the questionnaires among the students, I waited for them to finish, and finally I collected the completed questionnaires. At the end, after I had been through the three classes, I had in total collected 80 different questionnaires, all with different learning strength scores. The questionnaire is added at the end of this report. In addition to the structured questionnaire on 9 sections each addressing a different learning style/intelligence type, I included introductory questions which were meant to record factors that might also influence the scores, such as gender, siblings and existence of pets in the household. I only received two cases where somebody refused to answer one of the questions, and the other answered: '*Don't*

want to say' on the question referring to gender. Further down the questionnaire, there were nine different categories representing the nine intelligences: verbal, musical, logical…and so forth. Each category included six statements that respondents could answer by letting it blank (empty), or giving it a score of 1, 2, or 3. Blank indicated that the statement did not relate to them at all, 1 meant the statement somewhat applied but very little, 2 meant that the statement described them fairly well, and 3 meant that it was a strong and clear match with their self-perception. These were the only options presented to the students on the questionnaire.

Data digitalization and curation

To analyze the data, I had to give an ID number to each questionnaire, I added the sum of the different categories and placed the numbers for each intelligence type/learning style in a sorted excel-file. The maximum score for each individual learning style was 18. I would take paper after paper and write the sum on the side of each category. Afterwards, I created an excel-file where I took all the information and transferred it there (digitalized it) for further analysis. The first column contained the ID's. The second to fourth column had the answers to the introductory questions: '*Do you have a pet?*', '*If so, which pet(s) do you have?*'…and so forth. The rest of the columns contained the scores of each type of learning style/intelligence. For example, the numbers could be 15, 8, 18, 3, 5… Later, as I was reviewing the results, I found two mistakes. In one of the columns for questionnaire with ID 59, I had accidentally placed the number 9 instead of 1 at musical, which was the original and correct number, and for questionnaire with ID 43, I didn't place anything in the verbal category where it was a score of 9. I added an additional variable with the sum of all scores, and I called that variable 'total score'. On top of that, I coded the variables of gender, sibling status, and pet in the household status, meaning I put '1' instead of 'girl', '2' instead of 'boy', '3' instead of 'do not want to mention', and '0' instead of 'no', '1' instead of 'yes' at the other questions. This reduced the time spent on entering the information from each questionnaire and allowed later statistical analysis.

Data analysis

To investigate whether household pets, gender, or sibling status correlated to any type of the learning styles/intelligence, I had to perform data analysis. I calculated myself using excel the frequencies of the variables gender, sibling status and pets in household status, as well as mean, standard deviation, median, and mode. With the assistance of researcher Tarig Al-Hadi Osman, I learned how to upload my dataset to SPSS. Here, we first used descriptives to look

at how data was distributed for each learning style (outliers and normal distribution for the scores recorded each learning style). Then we applied the t-test to compare the means of the scores for each type of learning style for each of the two groups of the variables gender, sibling status, and pet in the household status. We chose a significance level of 0.05. For the variable pet(s) status, we also combined multiple categories together, to evaluate if this would also have a major impact. We would merge the categories 'dog' and 'cat' into one variable and compare them to other pet categories or all of them. I used Excel to produce the graphs.

Results

Description of the study population

From all 90 students enrolled in 9th grade at Danielsen Ungdomsskole in Bergen (age 14-15), I have gathered 80 self-answering questionnaires. This means that the response rate of my study was 88.89%. The distribution of gender was 44.8% girls, 55.0% boys, and 1.3% did not want to mention, indicating a slightly higher proportion of boys compared to girls in the study population, though the difference was not substantial. Most of the participants (91.3%) had siblings (from one to 4 siblings). Out of 80 participants, 57.5% had one or more pets in their households, while 42.5% did not have pets at home (**Figure 2**). Cats were reported as the most frequent pet to be in the households of students (by 30% respondents), while dogs were the second most frequent ones (26.3%). Only 6 respondents had both dogs and cats (7.5%), and also only 6 respondents (7.5%) had reported to have more than 2 pets, which were either rabbits, chicken, fish, turtle, or birds in addition to cats and dogs at home.

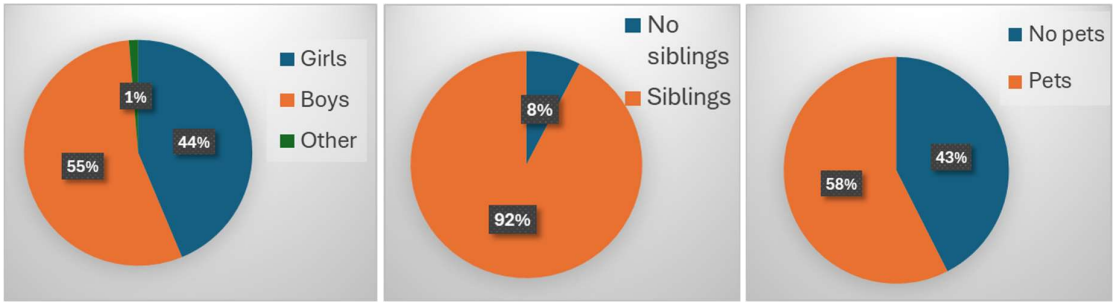

Figure 2. *Distribution of students according to gender, sibling status and presence of pet(s) in their*

Profile of learning styles among 9th graders at Danielsen Ungdomsskole Bergen

The total score for all learning styles had a wide range from 30 to 138 points, out of maximum of 162, with the mean of 83.61 (standard deviation of 22.71). The median of 82.00 was closely aligned with the mean, indicating that the distribution of the total score followed a normal distribution as further illustrated by the histogram in **Figure 3**. The mode of the total score was 100, indicating that most participants possess learning strength levels above the

midpoint of the scale (50%) and suggesting a generally higher-than-average learning ability withing the group investigated. When looking at the scores of the learning styles, all of them had a normal distribution, as illustrated in the histograms on **Figure 3**.

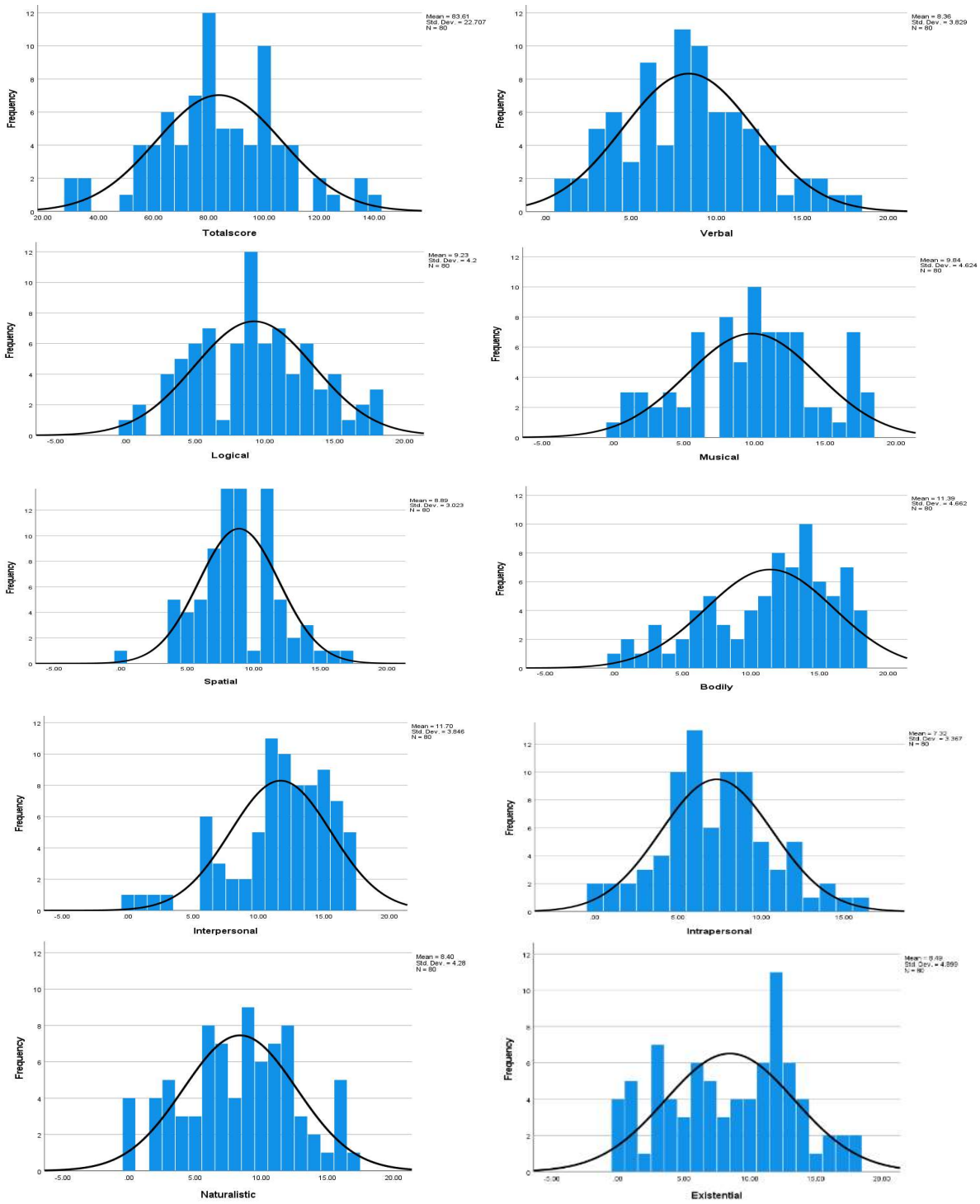

Figure 3. *Histograms showing the distribution of the self-reported scores of learning styles.*

The highest mean among the 9th graders at Danielsen Ungdomsskole in Bergen was for the bodily, and interpersonal learning styles while the lowest score was for the intrapersonal learning style (**Figure 4**), although it was not a significant difference between the means of the scores for all learning strengths (for descriptive values of all intelligence/learning styles see **Table 1**).

Learning style	*Verbal*	*Logical*	*Musical*	*Spatial*	*Bodily*	*Interpersonal*	*Intrapersonal*	*Naturalistic*	*Existential*	*Total score*
N	80	80	80	80	80	80	80	80	80	80
Mean	**8.363**	**9.225**	**9.838**	**8.888**	**11.388**	**11.700**	**7.325**	**8.400**	**8.488**	**83.613**
Std. Error of Mean	0.428	0.479	0.517	0.338	0.521	0.430	0.376	0.479	0.548	2.530
Median	8.000	9.000	10.000	9.000	12.000	12.000	7.000	9.000	9.000	82.000
Mode	8.000	9.000	10.000	8.000	14.000	11.000	6.000	9.000	12.000	100.000
Std. Deviation	**3.829**	**4.281**	**4.624**	**3.023**	**4.662**	**3.846**	**3.367**	**4.280**	**4.899**	**22.707**
Variance	14.664	18.328	21.378	9.139	21.734	14.795	11.336	18.319	24.000	515.607
Range	17.000	18.000	18.000	17.000	18.000	17.000	16.000	17.000	18.000	108.000
Minimum	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	30.000
Maximum	18.000	18.000	18.000	17.000	18.000	17.000	16.000	17.000	18.000	138.000

Table 1. *Descriptive values of scores for all learning styles.*

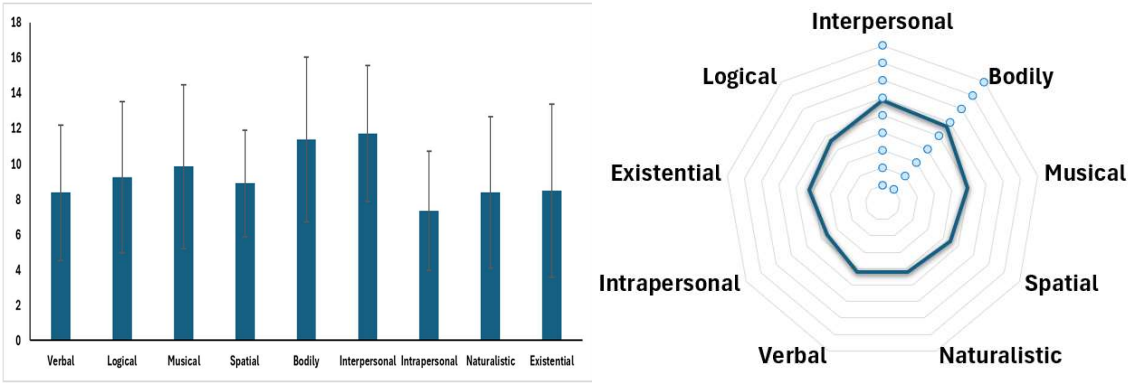

Figure 4. *Bar chart graph to the left showing means and standard deviation of the scores of different learning styles. Radar chart to the right visualizing the means of the different learning styles. The strongest are further from the center and closer to the margins of the chart (interpersonal and bodily).*

Associations of different factors with different learning styles

When looking at the differences between girls and boys, there was no significant difference between the scores self-reported by the two genders for all the different learning styles, as well as for the total score. However, girls had slightly higher scores for the verbal, musical, naturalistic, and existential, while boys had a slightly higher score for the bodily type (**Figure 5**). Since most of the participants had siblings, a comparison between the scores of adolescents with and without siblings was not performed because comparisons between groups require reasonably balanced sample sizes.

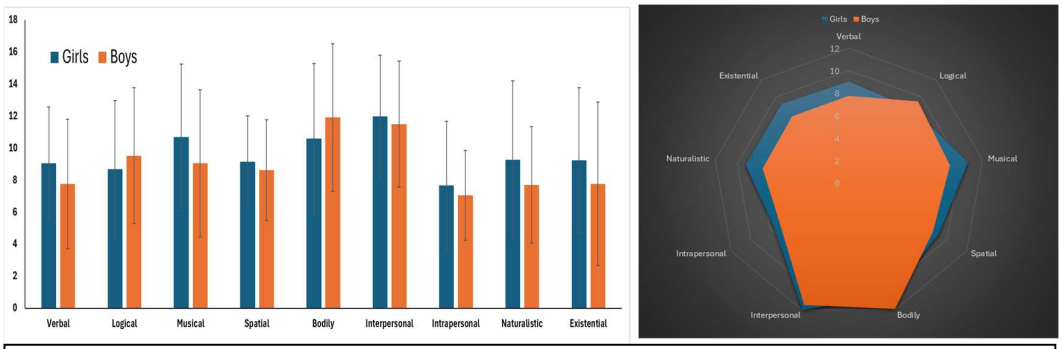

Figure 5. *Bar graph showing distribution of the learning style scores between boys and girls to the left. To the right is a radar plot showing almost completely overlapping areas delineated by the different scores for girls and boys, indicating no significant differences between genders.*

The number of adolescents with pets/no pets in the household were relatively equal, so we went further to comparing the results amongst these groups. For the total score and for most of the learning styles the means of the scores were very similar (**Table 2**), with the exception of naturalistic learning style. The naturalistic strength among adolescents who have pets in the household was significantly greater (P<0.001) compared to those who did not have pet(s) in their household (**Table 2** and **Figure 6**).

Learning style score		N	Mean	Std. Deviation	Std. Error Mean	P-value
Verbal	No pet(s)	34	8.000	4.119	0.706	0.235
	With pet(s)	46	8.630	3.623	0.534	
Logical	No pet(s)	34	9.206	3.930	0.674	0.486
	With pet(s)	46	9.239	4.566	0.673	
Musical	No pet(s)	34	9.441	4.405	0.755	0.257
	With pet(s)	46	10.130	4.806	0.709	
Spatial	No pet(s)	34	8.471	3.296	0.565	0.146
	With pet(s)	46	9.196	2.802	0.413	
Bodily	No pet(s)	34	11.765	4.645	0.797	0.269
	With pet(s)	46	11.109	4.706	0.694	
Interpersonal	No pet(s)	34	11.971	4.145	0.711	0.296
	With pet(s)	46	11.500	3.644	0.537	
Intrapersonal	No pet(s)	34	7.412	3.636	0.624	0.422
	With pet(s)	46	7.261	3.193	0.471	
Naturalistic	No pet(s)	**34**	**6.706**	**4.380**	**0.751**	**<0.001**
	With pet(s)	**46**	**9.652**	**3.784**	**0.558**	
Existential	No pet(s)	34	8.088	5.236	0.898	0.267
	With pet(s)	46	8.783	4.671	0.689	
Total	No pet(s)	34	81.059	24.380	4.180	0.195
	With pet(s)	46	85.500	21.450	3.160	

Table 2. *Descriptive values of scores for all learning styles grouped by having or not pet(s) in the household.*

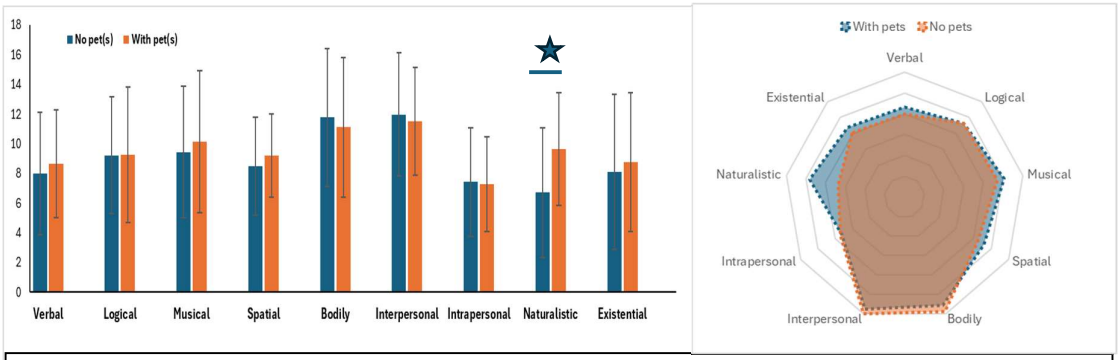

Figure 6. *To the left bar chart showing the distribution of the self-reported scores of learning styles in the two groups of students (without and with pets in the household). Data shows mean and standard deviation. *P<0.01. To the right radar plot showing a larger area for those with petsin their household.*

When we compared the means of scores for all learning styles between those with cats or dogs only in the household compared to those without cats or dogs, we found that the naturalistic intelligence held a significant difference for both those having only cats or only dogs. However, the naturalistic score was the highest for those with dogs only in the household (10.28 ± 3.88 compared to 9.5 ± 3.2 for those with cats only in the household (**Figure 7** and **Tables 3** and **4**). Those having cats in their households had also higher scores for the bodily intelligence/learning style, although the P-value did not reach the significance level of 0.05.

Figure 7. *To the left radar plot showing the distribution of the self-reported scores of learning styles of adolescence with cats only in their household compared to the rest. To the right radar plot showing the distribution of the self-reported scores of learning styles of adolescence with dogs only in their household compared to the rest.*

Learning styles score		N	Mean	Std. Deviation	Std. Error Mean	P-value
Verbal	No cat	56	8.089	3.863	0.516	0.165
	With cat	24	9.000	3.753	0.766	
Logical	No cat	56	8.911	4.131	0.552	0.159
	With cat	24	9.958	4.620	0.943	
Musical	No cat	56	9.464	4.112	0.549	0.168
	With cat	24	10.708	5.645	1.152	
Spatial	No cat	56	8.768	3.156	0.422	0.296
	With cat	24	9.167	2.729	0.557	
Bodily	No cat	***56***	***10.857***	***4.765***	***0.637***	***0.060***
	With cat	***24***	***12.625***	***4.251***	***0.868***	
Interpersonal	No cat	56	11.554	4.221	0.564	0.303
	With cat	24	12.042	2.836	0.579	
Intrapersonal	No cat	56	7.304	3.572	0.477	0.466
	With cat	24	7.375	2.901	0.592	
Naturalistic	No cat	**56**	**7.929**	**4.600**	**0.615**	**0.044**
	With cat	**24**	**9.500**	**3.244**	**0.662**	
Existential	No cat	56	8.143	4.971	0.664	0.170
	With cat	24	9.292	4.732	0.966	
Total	No cat	56	81.010	23.600	3.150	0.600
	With cat	24	89.660	19.600	4.000	

Table 3. *Descriptive values of scores for learning styles grouped by having or not cat(s) in the household.*

Learning styles score		N	Mean	Std. Deviation	Std. Error Mean	P-value
Verbal	No dog	59	8.441	3.953	0.515	0.381
	With dog	21	8.143	3.540	0.772	
Logical	No dog	59	9.492	4.376	0.570	0.177
	With dog	21	8.476	4.008	0.875	
Musical	No dog	59	9.610	4.864	0.633	0.232
	With dog	21	10.476	3.907	0.853	
Spatial	No dog	59	8.898	3.128	0.407	0.478
	With dog	21	8.857	2.780	0.607	
Bodily	No dog	59	11.576	4.739	0.617	0.274
	With dog	21	10.857	4.509	0.984	
Interpersonal	No dog	59	11.949	3.693	0.481	0.167
	With dog	21	11.000	4.266	0.931	
Intrapersonal	No dog	59	7.288	3.434	0.447	0.435
	With dog	21	7.429	3.249	0.709	
Naturalistic	No dog	**59**	**7.729**	**4.242**	**0.552**	**0.004**
	With dog	**21**	**10.286**	**3.888**	**0.848**	
Existential	No dog	59	8.305	4.984	0.649	0.290
	With dog	21	9.000	4.733	1.033	
Total	No dog	56	83.288	22.850	2.970	0.416
	With dog	24	84.520	22.820	4.980	

Table 4. *Descriptive values of scores for learning styles grouped by having or not dog(s) in the household.*

Discussion

The key finding of my study is that adolescents with pets in their household had significantly higher scores for the naturalistic learning style/intelligence type than those without pets in their household. The surprising part of the results is that my hypothesis, although based on previous studies showing increased well-being of adults and children/adolescents with pets in the household (3), was not supported by my study. The field of human-animal interactions is a very complex one and relatively under-researched. The research literature in this field shows varying findings. While some studies are indicating benefits of having pets for human health and well-being (3), others remain inconclusive or even suggest detrimental effects (16). For example, a study from UK on companion animals and child development has reported negative correlations with pets for several emotional and cognitive factors (17). This variability is also reflected in my study results, where pet(s) in the household was found to be associated with stronger naturalistic learning style, but showed no clear associations with other learning styles.

Naturalistic intelligence/learning style refers to the capacity to identify, categorize, and interact effectively with elements of the natural world (9). Individuals with strong naturalistic style are highly attuned to patterns in nature, including plants, animals, weather, and environmental phenomena (10). This intelligence involves a deep sensitivity to the natural environment, often reflected in the ability to notice subtle changes, classify organisms, and understand ecological relationships. People with high naturalistic intelligence may excel in activities such as gardening, wildlife observation, conservation work, or environmental science. They are often curious about the living world and may have a strong appreciation for sustainability and environmental protection. This type of intelligence is frequently seen in naturalists, botanists, biologists, farmers. My results might corroborate with other studies that show that pet ownership, particularly dog ownership, is related with increased physical activity (18, 19). Of note, when we analyzed separately the data for adolescents having cats or dogs only in their home, the naturalistic score was the highest for those with dogs only (10.28 ± 3.88) compared to those with cats only (9.5 ± 3.2). Cats are more independent than dogs and do not usually require supervision when going on outings. Therefore, it seems reasonable to infer that the adolescents living with dogs in their household are more likely to take more trips than those with cats. This might have contributed to the higher learning style scores in the naturalistic intelligence category observed for those with dogs in their household. However, my study did not address factors such as if the adolescents went trips with their pet(s), the

intensity of the interaction with the pet(s), the lengths of interaction with the pet(s), or the individual personalities of both the teenager and the pet(s) that might have influenced the outcomes. The questionnaire I chose did not include questions addressing these factors since I wanted to keep it simple so not to have drop-offs (my colleagues getting bored and not filling in the questionnaire). While the fact that I did not prove my hypothesis had surprised me, it did also motivate me to think of a follow up study in which I would like to devise a more elaborate questionnaire and maybe conduct some in depth interviews to investigate more the complex interaction between adolescents and pets.

The other interesting finding of my study is that the highest means of the scores were for bodily and interpersonal intelligences types/learning styles among the 9th graders at Danielsen Ungdomsskole in Bergen. A previous study showed the 4-to-6-year-old preschool children had the visual-spatial intelligence as their strongest learning style (20). My study included older participants, namely adolescents of 14-15 years, and although it is difficult to corroborate these two studies which have been performed in different cultural settings, they might suggest a switch in the learning styles with age/development. This is also supported by another study performed in Mexico in elementary schools (3 to 6 grade, approximately 8 to 11 years old children), which showed the highest scores for interpersonal, bodily and linguistic learning styles (15), similar to my study. This could indicate that the switch might occur at school entry, as children adapt to new educational demands and social structures. This shift may reflect changes in learning environments and priorities. In early childhood education, play is a central tool for learning, which often emphasizes hands-on activities and imaginative tasks, thereby enhancing visual-spatial intelligence. As children transition into formal schooling, social interactions and structured group activities become more important. Most likely, this change stimulates interpersonal intelligence, while the increased focus on physical engagement in sports, games, and practical tasks may strengthen bodily-kinesthetic intelligence (10, 11).

Although it was performed on only one school, the strength of my study is its relatively high response rate (88.89%) and in the fact that the demographic composition of my study group, including gender, sibling status, and presence of pet(s) in the household, closely aligns with the national statistics, making the findings more representative of the general adolescent population in Norway. According to the Central Statistics Bureau of Norway (SSB), the gender distribution among adolescents aged 15 to 19 is approximately 51% boys and 49%

girls (https://www.ssb.no/en/befolkning/folketall/statistikk/befolkning). In my study population, the distribution is 55% boys and 44% girls, indicating a slightly higher, but relatively similar proportion of boys compared to the national average for this age group. Data from the Central Statistics Bureau of Norway (SSB) show that the majority of children in Norway grow up with at least one sibling, while single-child households are less common. As per September 2024, only approximately 19.6% children lived without siblings at home, while about 80.4% lived with at least one sibling (https://www.ssb.no/en/befolkning/barn-familier-og-husholdninger/statistikk/familier-og-husholdninger). This is also reflected in my study in which the vast majority of participants (91.3%) reported having siblings. The statistics on pet ownership in Norway from STATISTA.COM shows as of 2023, that approximately 33% of Norwegian households owns at least one cat, while around 17% has at least one dog (https://www.statista.com/statistics/517029/households-owning-cats-dogs-europe-norway/). This indicates that about half of Norwegian households have a cat or a dog. However, it is important to note that some households may own both, so the total percentage of households with pets could be slightly lower. My results show approximately the same figures: 57.5% of the respondents had pets at home, with cats being the most frequently reported pet (30%), followed by dogs (26.3%). A smaller proportion (7.5%) had both dogs and cats, and another 7.5% reported owning other pets such as rabbits, fish, turtles, and birds. I would like to mention that in Norwegian statistics, pets are typically categorized as 'companion animals' and primarily includes dogs, cats, fish and birds, and I used this definition for my study.

There are some previous studies which suggested that girls scored better in school subjects than boys, with higher grades in language and science (21). This is not supported by my study, which showed no significant differences in the means of the scores of intelligences types/learning styles, including the total score of intelligences. This is in line with the previous study performed on Mexican children in primary schools which also did not find any differences between boys and girls when it comes to the average scores for multiple intelligences (15). However, in my study the girls scored slightly higher in linguistic, musical, naturalistic, and existential learning styles, whereas boys scored higher in the bodily learning style. This might indicate that there might be subtle differences in the preferred learning style between girls and boys that can be further investigated to explore whether these variations in learning styles influence for example career preferences over time.

The main weakness of my study is that I used a simplified self-reported questionnaire to address a very complex topic. This might have had several consequences. First, even though I have explained the concept of multiple intelligences, and clarified that the questionnaire was not a test, some of my colleagues might have still interpreted it as a test and therefore given higher than accurate (real) scores. Second, the simplicity of the questionnaire may not have captured all aspects of the multiple intelligences, or of the interaction with the pets. In addition, there are limitations common to all tools used for assessing emotional intelligence and learning. No widely accepted test exists to objectively measure each of Gardner's intelligences (22). The test I have used was developed and recommended to be used by teachers for educational purposes. Finally, my study is based on the theory of Gardner, which is not widely accepted and has received criticism that it lacks empirical evidence (23). However, this remains a topic of ongoing debate.

Significance of the study

Although performed on a small study population limited to 9th graders at Danielsen Ungdomsskole in Bergen, this study highlights that household pets might play a role in enhancing adolescents' naturalistic learning style, which reflects a stronger connection to nature and the environment. By fostering empathy, responsibility, and an awareness of living beings, pets may encourage adolescents to develop a deeper appreciation for the natural world. This connection is increasingly important in today's context of environmental challenges and climate change. Encouraging pet ownership, particularly in ways that promote responsible care and outdoor experiences, may contribute to shaping a generation that is more attuned to environmental protection and sustainability. Taking this into a broader aspect, being near pets and caring for them might lead adolescents to closer connection to nature and increased care for nature and planet, too. Adolescents who grow up with pets may be more inclined to protect nature and advocate for ecological preservation, ultimately contributing to efforts to combat climate change and create a more compassionate and environmentally aware society.

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Annex – Questionnaire in Norwegian

Hvis du ønsker å delta i mitt forskerskoleprosjekt om effekten av kjæledyr på ulike typer intelligenser hos tenåringer, vennligst fyll ut dette skjemaet.

Har du kjæledyr? *(sett sirkel rundt ditt svar)*

Ja Nei

Hvis ja, hvilket type kjæledyr (hund, katt, skilpadde, kylling, kanin, hamster, osv……)?

……

Hvilket kjønn identifiserer du deg med? *(sett sirkel rundt ditt svar)*

Jente Gutt Annet

Har du søsken? *(sett sirkel rundt ditt svar)*

Ja Nei

Fullfør hver seksjon nedenfor ved å plassere et tall (1, 2 eller 3) ved siden av hver påstand som du mener passer for deg:

- Hvis du mener at påstanden **beskriver deg svært godt**, gi den **3 poeng**.
- Hvis du mener at påstanden **for det meste beskriver deg**, gi den **2 poeng**.
- Hvis du mener at påstanden **beskriver deg noe**, gi den **1 poeng**.
- Hvis du mener at påstanden **ikke beskriver deg**, la feltet stå **tomt**.

Seksjon 1	
	Jeg tror jeg kjenner mange ord og/eller liker å lære nye ord.
	Jeg husker ting når jeg leser eller tar notater.
	Å fortelle / skrive en historie / poesi er en glede for meg.
	Jeg liker å lære fremmedspråk.
	Jeg opplever at jeg leser for fornøyelsens skyld de fleste dager.
	Jeg er flink til ordspill som kryssord og anagrammer.
Seksjon 2	
	Et av mine favorittfag på skoler er/var matte.
	Jeg kan lett regne ut summer i hodet.
	Logiske puslespill er morsomme og en av mine styrker.
	Jeg liker å løse problemer på en logisk og trinnvis måte.
	Jeg liker å spille strategispill som sjakk.
	Jeg liker å organisere tingene mine i logiske kategorier.
Seksjon 3	
	Jeg liker å synge eller spille et musikkinstrument.
	Jeg kan ikke forestille meg en dag uten å høre på musikk.
	Jeg plukker opp rytmer veldig lett.
	Jeg kjenner når en person eller instrument er ustemt.
	Jeg husker melodier og sangtekster lett.
	Jeg foretrekker å se en musikal istedenfor et skuespill.

Seksjon 4	
	Kunst er et av mine favorittfag.
	Jeg har in god stedstands og liker å lese kart.
	Å løse puslespill eller leke med konstruksjonsleker er en av mine hobbyer.
	Mote er noe jeg legger merke til og bryr meg om.
	Jeg liker å spille videospill.
	Jeg husker bilder og ansikter lett.
Seksjon 5	
	Trening er in viktig del av livet mitt.
	Jeg elsker å spille fysiske spill.
	Jeg synes jeg har god balanse og koordinasjon.
	Kunst, håndverk og praktiske aktiviteter tiltaler meg.
	Jeg liker å se på sportsarrangementer eller danseforestillinger.
	Jeg vil heller spille en sport enn å lese eller studere.
Seksjon 6	
	Jeg har en stor vennekrets og tror at jeg er godt likt.
	Vennene mine kommer til meg hvis de er opprørt.
	Jeg vil heller være sammen med venner enn å være alene.
	Jeg jobber best i en gruppe eller i et team.
	Jeg bryr meg om hva som skjer i verden.
	Jeg synes det er gøy å møte nye mennesker.
Seksjon 7	
	Jeg vil heller jobbe alene enn som en del av en gruppe.
	Jeg er god til å formulere og analyzere mine egne teorier.
	Jeg liker å skrive tankene mine i en dagbok.
	Jeg synes det er gøy å bruke mye tid på å spille data- eller videospill alene.
	Jeg har dype personlige og moralske overbevisninger.
	Jeg er trygg på mine egne evner og jobber godt uten veiledning.
Seksjon 8	
	Jeg elsker å leke med kjæledyrene mine eller skulle ønske jeg hadde kjæledyr å leke med.
	Jeg elsker å tilbringe mye tid ute og nyte naturen.
	Når jeg blir voksen, tror jeg at jeg vil jobbe med noe som har med natur eller dyr å gjøre.
	Å beskytte miljøet ved å resirkulere, spare vann eller utforske alternative energikilder er noe jeg tror på.
	Jeg liker hagearbeid og har eller ønsker meg blomster eller grønnsaker å stelle.
	Jeg liker å besøke dyrehager, akvarier og dyreparker når jeg har tid.
Seksjon 9	
	Jeg tenker ofte over meningen med livet.
	Jeg liker å diskutere filosofiske og spirituelle spørsmål.
	Jeg undrer meg over hva som skjer etter døden.
	Jeg liker å lese om religion, filosofi og eksistensielle temaer.
	Jeg reflekterer over min plass i universet.
	Jeg funderer ofte på om alt i livet har en større hensikt.