

Attitudes towards the use of Animals of Students enrolled in Animal Welfare and Laboratory Science courses in The Netherlands

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ABSTRACT

For the last decades a change in our moral attitude towards animals can be seen. Animal welfare is getting an important role in the Dutch society, but in general people are getting more concerned about how animals are treated. In this study, students from three different master courses about animal welfare, animal ethics and the use of laboratory animals at Utrecht University completed a questionnaire on attitudes towards different categories of animals before and after attending a course. Higher attitude scores suggest that students are more concerned about how an animal is being treated. Statistics were done with significance set at $p < 0.05$. Attitudes towards Pets (85.5%) were significant higher than those towards Pest, Profit and Laboratory animals (73.7% vs. 60.9% and 59.2%, respectively) and almost comparable attitude scores on the Profit and Laboratory animal subscales were found. Gender difference in attitudes existed in one course with veterinary students only, in which females scored higher. Students that were vegetarian scored significantly higher on the Profit, Pest and Laboratory subscale. Owning a pet or prior pet ownership as a child did not affect the attitudes score in comparison to students that never owned a pet. Dutch students compared to other European students scored significant lower on the Pets subscale and no difference was found in attitude scores between students that were brought up in a city or a village. Finally, the used method in this study did not measure any difference post-course. The attitude scores did not demonstrate a significant increase or decrease after attending any of the three courses.

Key words: attitude towards animals, animal welfare, pest pet profit-scale, education

I. INTRODUCTION

Nowadays, people are getting more concerned about the welfare of animals and the way animals are being treated by humans.¹ The general public is in this case not only concerned about the welfare of laboratory animals or animals used for commercial purposes, but also about the welfare of companion animals.¹ Our moral attitude towards animals changed over the last century, but interestingly, this change can be recognized in opposite directions. On the one hand, animals become more and more instrumental. They often function as mere instruments in industrialized processes. On the other hand, animals get a stronger position in society than ever before, e.g., The Netherlands has a political party that stands up for the rights of animals (Partij voor de Dieren), we now speak about animal rights, laws speak about intrinsic value of animals and more therapeutic approaches are getting accepted in society for our pets, for example the availability of physiotherapy for dogs. Either way, both developments can explain the increased attention for animal welfare.

Professionals working with animals, for example veterinarians, veterinary assistants, animal scientists and biologists must be well aware of these changes in societal views, given the specific involvement of animals in their daily jobs. This is mainly because changes in the current view may have important impact on what treatments are viewed as acceptable or unacceptable. It is therefore getting more important in the present day that these professionals with a degree in 'animal work' have the competence to exhibit a professional attitude towards animals, which is for example essential to address the societal discussion in their work, but

also essential for the welfare of the animals in society. Veterinarians are often seen as ambassadors of animals and society and clients expect them to have a basic knowledge about factors influencing animal welfare.² In the old curricula for professions working with animals, less attention was given to animal welfare and ethics and to attitude formation.¹ Enlarging the scientific knowledge of the students was the main purpose.^{1, 3} Veterinary Medicine Faculties are beginning to acknowledge this shortcoming of education in their curricula now and provide prohibited courses which focus mainly on animal ethics and animal welfare and the view of society on the needs of animals.^{2, 4-6} To make sure students are up to date about the changing attitudes towards animals.

The Department Animals in Science & Society (AISS) of the Faculty of Veterinary Medicine at Utrecht University aims to optimize animal welfare through research, education, and communication. Like the shift which is mentioned above, the education provided by the department changed also. Besides the transfer of scientific knowledge the department is dedicated to build the attitudes of the future veterinarian or researcher towards the (emotional) demands of animals, and also towards the current demands of the society. This way AISS aims to contribute to animal welfare by offering knowledge of the demands of all animals in our society to the students. In order to have the proper attitude towards these kind of issues.

The study of social psychology studies the phenomenon of 'attitudes' from the beginning of its research field. Despite the decades of attitude research the question of how attitudes are formed, shaped and maintained and how they influence our individual behaviour is still one of the main subjects of social psychology research.⁷ This is why we first clarify the term 'attitude', before proceeding to the description of the aim of our present study.

'Attitude' is a term used by psychologists to describe the different preferences of an individual for specific objects, ideas, behaviours and even preferences for other people.⁸ Two conceptions exist of attitudes, the relative stable attitude and the more flexible one.

The stable attitude does not alter easily across time and context, unless or until the person encounters a successful persuasion attempt which changes (often outside of awareness) the first attitude into a new one.⁹ Because of this stable property, an attitude is able to function as a 'global evaluation guide' in our behaviour. It summarizes different (social) contexts and can be used by an individual to react across different situations.⁹ Due to this, the stable attitude tends to reflect a person's core principles, core values, long-term goals, normative social standards and central and enduring features of the attitude object.⁹

We also have the concept of an attitude to be more adaptable, as evaluations of an individual which can shift quite flexibly in response to the immediate social environment.⁹ This part of attitudes functions more as a 'local evaluation guide', a flexible guide which guides someone's behaviour or reaction in a specific situation by taking specific details of that single moment and context into account.⁹

In this paper we are mainly interested in evaluating the attitudes toward animals. Many authors have sought to represent people's basic attitudes to animals as reviewed in Serpell (2004).¹⁰ In this review article the different attitudes of humans towards animals are characterized. The 'global' attitudes towards an animal can be considered in two ways; first, affection for animals (or empathy/identification) and secondly, an economic and pragmatic view (or instrumental/utilitarian). Someone's attitude towards an animal leans more or less towards one of these considerations.^{10, 11} Serpell (2004)¹⁰ also describes the influence of broad factors that influence the creation, change or stability of a person's particular attitude towards an animal. These so-called 'attitude modifiers' can also be divided into three main categories of; animal attributes (judging of, and discrimination between animal species due to specific traits like cuteness, vulnerability, fragility or rarity), individual human attributes (for example; gender, age, educational background, urban or rural environment and childhood exposure to animals) and cultural factors (history, cultural and religious beliefs/values), which can alter someone's attitude toward an animal in more empathy for an animal or a more instrumental or utilitarian view.¹⁰ To evaluate the attitude towards the use of animals in research, which is also a goal of the present paper, people's perceptions of harm and risk and the ethical concerns raised by these factors should be taken into account.¹⁰

Background Information - Attitude measuring in general

Attitudes in general can be evaluated in two ways: Through observing subjects and by asking subjects questions about what they believe¹² With either method, there are some difficulties in interpreting the final measured result. When choosing for an observational method, the researcher assumes that behaviour is linked to the attitude of the subject. Major problems related to this method are misinterpreting of the behaviour by the researcher and/or the lack of recognition of some sets of behaviour that are linked to the attitude towards the concept which is being measured.¹² The other method, usually called the 'self-report method', in which participants have to answer a couple of questions or propositions about an attitudinal issue, also deals with some difficulties. Subjects may provide misinformation and unreliability's arise when participants respond in a way they think is socially acceptable, instead of giving the answer of what they actually believe. It is even possible that a participant agrees with a proposition in case of uncertainty or doubt about their own point of view.^{12, 13} As cited in Dwyer (1993)¹², Thurstone & Chave¹⁴ already noticed these shortcomings early in the research field and thought of a way to deal with these problems, see the box below:

"All that we can do with an attitude scale is to measure the attitude expressed with the full realization that the subject may be consciously hiding his true attitude or that the social pressure of the situation made him really believe what he expresses... All we can do is minimize as far as possible the conditions that prevent our subjects from telling the truth, or else to adjust our interpretation accordingly."

Thurstone & Chave, 1929¹⁴

The scientific study of attitudes became possible by the development of scales to assess them, introduced by L.L. Thurstone¹⁵ and R. Likert.¹⁶ In general, scaling is used for measuring personal, subjective responses such as feelings or preferences. Attitudes are often measured using the self-report method as described above. Many scales are developed to rank attitudes, like the well-known Likert scale, the Thurstone Scale, Guttman Scale, Stapel's scale, Semantic Differential Scale, Multidimensional scaling and the Q-sort technique.^{17,12} It depends upon the specific attitude to be measured which one is the most appropriate. Most commonly used in 'attitude towards animals and research' studies are versions of discrete scales or continuous scales.^{5, 18-22}

The Likert-scale is a discrete scale to measure attitudes.¹⁶ This type of scale is more often used in studies involved in attitudes toward animals or research.^{5, 19-21} A person translates his or her opinion to an issue into a categorical option, most commonly the numbers 1 to 5, in which typically 1=Strongly Disagree, 2=Disagree, 3=Neutral/Undecided, 4=Agree, 5=Strongly Agree. Sometimes even a 7 or 9-point Likert-scale is used.^{6, 20} When a scale counts more options it makes the Likert-scale more discriminating and reliable, because of the larger number of possible responses a participant can give.¹⁷ At the end, not only the subjects to which a participant agreed but also the subjects to which he or she disagreed are weighed and taken into account. The Likert-scale is considered easy to interpret and is widely used.²³

Aim of the study

In the introduction section we already focussed on the emerging acknowledgment of universities and the need of attention for animal welfare in present curricula of studies related with careers working with animals. Concerning the focus of AISS to guide the perception of students with respect to animals, the questionnaire used in the present study aims to give insight in the effect of our educational programmes which emphasizes on animal welfare and ethics and the use of animals by humans.

Some research has already been done about the effects of animal welfare courses in the curricula^{4,5} It appears that participating in such a course has positive effects on the level of knowledge and the level of comfort of students associated to animal use and to research and analysis of animal welfare issues.⁴ This change in level of comfort reported by Lord et al. (2010)⁴ may indicate a change in the attitude towards animals due to education. Not much research has been done to support the hypothesis that students adjust their attitudes after attending an animal welfare course. This is why the present study investigates if students enrolled in the courses of AISS change their attitude towards animals.

By distributing a survey before and after participation to a course, it could be determined if there is a significant difference between the attitudes of students pre- and post-course. We hypothesize that the attitude score of students of all participating courses will generally increase after attending the course, equating to a more pro-animal treatment attitude (more concerned). Based on a former study of Hazel et al. (2011)⁵, we expect that students will have measurably different attitude scores toward animals depending on the animal (e.g. pet, pest or profit) and that specifically our supplementary items on laboratory animals will be affected after attending the Laboratory Animal Science course (course content see "*Methodology*"), because of the focus on animal experimentation.

Many studies describe attitude towards animal differences based on demographic factors (or as previously described cultural factors/human attributes), like age, gender, career, upbringing, currently owning a pet, being vegetarian etc.^{5, 6, 19, 21, 24, 25} We would like to check whether the attitude towards animals is dependent on any of these demographic factors and if we can find similar results as these previously performed studies report.^{5, 6, 19, 21, 24, 25} The studies performed questioned similar students with a future career with animals in comparable educational programs. One of the findings we are interested in is the gender difference. Some studies describe that females are more sensitive to animal welfare and are more concerned with animal welfare issues than males. Females score higher on empathy or attitude scores and find the use of animals often less acceptable.^{6, 18, 21, 22, 24} Some articles even remark that females are more desired vets because they are more sensitive to the emotional nature of the pet-owner-relationship than males.⁴ Therefore, we hypothesize that females score higher on the pro-animal attitude measures in the present study. Vegetarians may score higher on the Profit subscale because of their life style of not eating meat, and the current or prior pet ownership could provide for a higher attitude score towards Pets because of a strong bond that exists people have/used to have had with their pet.¹⁸ It could also be that results of foreign participants show attitude differences, as described before in Izmirli et al. (2012)²¹, between Australian and Turkish veterinary medicine students. This is why we also compare the attitude scores of students from different nationalities and expect some differences in animal attitudes due to different cultures and traditions.

Study procedure

General attitudes toward the treatment of animals have been measured before using a single scoring system, such as the Animal Attitude Scale (AAS)²⁶ developed by Harold Herzog. The original AAS scale consisted of 29 questions regarding the use of animals and has high levels of statistical reliability with former empathy towards animal scales.^{18, 27} Items are scored and summed up so, that a high score indicates pro-animal welfare attitudes using the 5-point likert scale

As we just found out and described above using Serpell et al 2004¹⁰, different contexts in which we see animals do matter in the formation an attitude. The AAS measures attitudes towards animals in general and does not discriminate between the differences in attitudes towards different categories of animals, such as pets, pests and commercially valued species. It may be that those who received a high AAS score only do so, due to their attitude towards a single category of animals visualized when filling in the form, rather than evaluating the general attitude towards animals.¹⁸ A newly developed and validated Pet (companion animals), Pest and Profit (utility animals) or PPP-scale by Taylor & Signal. (2009)¹⁸ does differentiate attitudes toward animals by the named categories and shows different scores per subscale. This is the main reason for using this scale in the current research. The PPP scale is related to the AAS and proved to have strong internal reliability.¹⁸ Thirty propositions of our questionnaire are also based on this PPP-scale. In our opinion, the PPP-scale lacks a discriminating fourth category of laboratory animals. In our study, this fourth category with a total of nine propositions is supplementary. In order to use the new items concerning laboratory animals, a non-published pilot validation study with students at Utrecht University was distributed before use (Verhave, unpublished data) (see Table 1).

II. METHODOLOGY

Study Design, Study Participants and Course Descriptions

To evaluate the attitude towards animals a questionnaire will be used. The questionnaire will be distributed to participants of three different courses given at Utrecht University, the Netherlands. The three courses have a common overarching goal, which is providing the student knowledge about both animal welfare and animal ethics.^{28, 29} All the students are taught about the sentience of animals and the development of attention to animal welfare and each of the students is taught about the 'five freedoms'; Replacement, Reduction, Refinement and Responsibility and Utrecht's veterinary position on welfare and animal ethics, but each of the courses have a different focus area.

The Master course *Ethology and Welfare (EW)* is part of the master track Behavioural Neurology, within the prestige master program Neuroscience and Cognition of Utrecht University. The course aims at behavioural neurobiology students. Students from this track are required to have followed the general Neuroscience and Cognition introduction (4.4 ECTS), but the course is also an elective course open for other students with BSc-level knowledge of neuroscience and behavioural biology. The course is open to students from this track, on condition that they have completed the general Fundamentals Course. It is also open for other students, especially those from the specialization programme 'Behavioural Ecology' within the 'Environmental Biology' Master program of the Utrecht University. EW is given once a year (in November) and is a 4-week fulltime course (6 ECTS). Data was collected from the EW course starting on the 19th of November 2012. After attending the course AISS expects that students should have a profound understanding of: animal welfare as a science concept, (neuro)ethological concepts that are important for the investigation and evaluation of animal welfare, factors that may contribute to the development of behavioural problems of animals kept under human supervision and the limits of behavioural and physiological adaptation and its underlying neurophysiological and ethological mechanisms. The students learn how the fundamental knowledge can be applied in order to firstly, evaluate animal welfare, secondly, design appropriate housing environments and management procedures for animals kept under human supervision and thirdly, diagnose behavioural and animal welfare problems of animals kept under human supervision. The students learn of factors that are relevant for the design of experiments and procedures used to investigate animal welfare or relevant mechanisms underlying welfare related questions.³⁰ At the end of the course, it is expected from the student that he or she is able to use and apply the learnt concepts and make ethograms in order to develop and design research on animal welfare related topics. Students must be able to contribute to the public debate in the field of animal welfare by using sound scientific arguments and to evaluate animal welfare of animals kept under human supervision, understand and possibly diagnose behavioural problems of these animals and translate public questions in the field of animal welfare in terms of sound scientific research questions.³⁰

Laboratory Animal Science (LAS) Course;

This course has a national and international version. The international course is open for international students with a particular background. The students' entrance requirements are a PhD- or MSc- level in (Medical) Biology, Medicine or Veterinary Medicine, but the course is also part of several specific studies e.g. Technical Medicine. These students can participate in the course on condition that they have knowledge of the basic biological subjects at level of at least 18.75 ECTS (500 SBUs). Of these, the subject of anatomy/zoology and animal physiology must count each for at least 7.5 ECTS (200 SBUs). Data was collected from four, two-week fulltime courses of this kind starting on the 3rd (international course) and 24th (national course) of September, 5th (international course) of November and 10th (national course) of December 2012, respectively.

The LAS course teaches students about animal welfare but it emphasizes on laboratory animals and their use in animal experiments. The goal is to present basic facts and principles that are essential for the human use and care of laboratory animals and for the quality of research.³¹ The content of this course is nationally determined as Utrecht University is not the only Dutch university providing LAS courses. It is a by Dutch law required course to perform animal experiments and at the end students have to pass an exam which allows them to be legally authorized to perform animal experiments in their future research career. (ex art. 9 Wet op

de dierproeven/ex art. 9 the Dutch Experiments on Animals act) The students learn about general gnotobiology, the design and statistical analysis of animal experiments alternatives for animal use in research and learn how to write a research proposal underlining the description of use of animals in experiments. The students learn to make a proper calculation of the estimated discomfort in animals caused by experiments and the way of judgement of research proposals by the Dutch Animal Experiment Commission or DEC. The students learn to recognize good animal welfare and animal laws and are offered three afternoons or mornings of general animal handling and learn about the basic principles of laboratory skills, for example how to properly inject a mouse. The students also get a tour in the GDL (Gemeenschappelijk Diergeneeskundig Laboratorium) or Central Laboratory Animal Research Facility at Utrecht University.

Responsible Use of Experimental Animals Course ('Verantwoord Proefdiergebruik, VP);

VP is part of an obligatory Master course of the Faculty of Veterinary Medicine of Utrecht University. The entrance requirements consist of a BSc-level of Veterinary Medicine. The lectures are taught together with another course called Management and Social Responsibility. Data will be collected from one course of this kind and is taught from January the 7th till the 31st of 2013. The subject of the VP lectures are comparable to the LAS course, but the VP course counts less lectures and the education is a shorter period (only one week in credits) The course is geared towards training students to conduct laboratory animal tests responsibly and to plan and supervise tests using laboratory animals. The insights and skills gained from the Master course serves as the foundation for the responsible use of animals for educational purposes during the clinical sections of the Master programme of Veterinary Medicine.²⁸ The students are also able to do an exam in order to get a license for animal experimentation ('ex art. 9 of the Dutch Animal Experiments Law') like the students of the LAS course. After attending the course, the veterinary student must be able to meet several final terms of the veterinary medicine study²⁹ First, the student must be able to have a critical, analytical attitude with respect to the use of experimental animals for the purpose of scientific research and consciousness of the possible alternatives for animal experiments. Second, the student must be conscious of the necessity to consider whether to start a veterinary research considering both ethical and social responsibilities. Thirdly, the student must learn to weight the interests of the animals to the public interest, take a responsible position and act to this. Fourthly, the student must be able to inform and advise organizations about the responsible manner to keep animals. Fifthly, students must be able to inform the society on a responsible matter about the use of animals in experiments, the possibilities and impossibilities of alternatives for animal experimentation and address the welfare or lack of welfare of experimental animals.²⁹

Students of the courses will be asked to participate in this research by completing two surveys anonymously. They are orally informed of the voluntary nature of filling out this form to help the Department improve the quality of teaching and to evaluate their attitudes towards animals. One questionnaire is distributed at the first day of the course, before the start of the first lecture and the second one is given on the last day of the training. The questionnaires are distributed on paper (See table 1 for the 39 propositions of the questionnaire) Answers are given using a five-point Likert scale and the completion will take up to ten minutes per questionnaire which included a total of two sections. The first section consists of ten demographic questions to find out the human attributes and cultural factors of each student which can influence their attitude (gender; date of birth; highest degree; highest degree in; occupation; employer; nationality; upbringing; diet; pet-ownership). The second section consists of the adapted PPP-score with ten propositions per subscale of Pets, Pests and Profit animals and nine propositions about laboratory animals, giving a total of 39 propositions about the attitude towards animals. The different animal categories resemble the attitude modifying effect of animal attributes named earlier in the "Introduction" section.

In the Netherlands the species intended when using the word 'pets' are mainly dogs, cats, birds, rodents, rabbits, ferrets and some reptile and fish species. In 2010 the Netherlands counted 29,7 pets³² 'Pests' are imagined as free-living mice and rats, but in some provinces also foxes and mole rats and rabbits. 'Profit' species are imagined as cattle, poultry, sheep, pigs, goats and other commercially valued species. In the Netherlands more than 450 million agricultural animals are kept.³³ It is commonly known and depends on the person you question if a horse is considered as a pet or a profit animal. The term 'Laboratory animals' used in

this questionnaire does not only regard to laboratory rats, mice, hamster, guinea pigs and rabbits, but also larger animals like dogs, goats or even primates used in animal experiments.

Table 1: Distributed Questionnaire Items and Rating Scale in each of the participating courses. It includes the adapted PPP-scale¹⁸ and supplementary category of laboratory animals.

Please answer each question according to the following scale 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree to 5 = Strongly Agree	
Pets	
1. Sick animals have a right to veterinary care	
2. Pets have the right to live their lives free from fear and distress	
3. I think of my pet as a member of my family (or would if I had one)	
4. I find my pet a source of emotional comfort (or would if I had one)	
5. All pets need some attention every day	
6. Pets should have a regular health check	
7. Pets have the right to access fresh water and to a diet that maintains their full health	
8. I get concerned when my pet goes off its food (or would if I had one)	
9. Pets should be provided with an appropriate environment including shelter and a comfortable resting area	
10. Pets have the right to freedom from pain, injury or disease	
Pests	
1. Pest species have the right to access fresh water and to a diet that maintains their full health	
2. Whilst we need to deal with problematic pest species humane methods should be found to do so	
3. Pest species have the right to live their lives free of discomfort	
4. Pest species have the right to live their lives free from fear and distress	
5. Pest species should have the freedom to express their natural behaviors	
6. Pest species have the right to freedom from pain, injury or disease	
7. Killing pests that damage human property (e.g., mice) is necessary	
8. It is acceptable to personally kill pest animal in whatever manner I choose	
9. It is acceptable to personally kill feral animals in whatever manner I choose	
10. Pest species have no value and should be removed by whatever means necessary	
Profit	
1. Humans have a right to use animals as a food	
2. Live transport of animals is an acceptable source of income (e.g. transport company or chauffeur)	
3. It is acceptable to use animals for human profit	
4. Hunting for profit (e.g. food, money) is morally wrong and should be stopped	
5. It is (was) cruel to keep birds in cages simply to mass produce eggs	
6. It is OK to use animals to test products such as cosmetics and household cleaners	
7. Intensive, factory farming is necessary in today's world	
8. Live transport of animals should be banned	
9. The regulations around humane killing and abattoirs are not strict enough	
10. I would be willing to pay more for "animal welfare friendly" products (e.g., eggs; meat)	
Laboratory Animals	
1. We should not have strict regulations regarding animals used in research, because research will move to countries with less strict guidelines	
2. It is acceptable to use animals to develop a cure for cancer	
3. Animals should not be exposed to stress as part of the education of biomedical Bachelor student veterinary medicines	
4. It is acceptable to inflict severe pain to rats to develop a proper pain medication	
5. It is acceptable to inflict severe stress in rats to develop a cure for post traumatic stress disorder.	
6. It is acceptable to perform animal experiments to find a cure for upcoming allergies in western society	
7. Animals should not be exposed to the pain of an injection for the education of biomedical masters students	
8. It is good that all countries in Europe will work with a European law for the protection of animals in research	
9. It is acceptable to inflict severe pain to rats to develop medication for dogs	

Statistical analyses

All data were entered and checked in Excel 2010 and converted into a SPSS 20 worksheet. Figures of the results were made using SPSS 20. Some items in the questionnaire were positively worded and some negatively worded. For analysis of the data, all negatively worded items were reversed so that a higher number of responses on the Likert-scale would represent a more pro-animal treatment attitude. The maximum score for each item is 5. First the scores are calculated for every animal subscale separately giving a maximum score of 50 for the Pets, Pest and Profit categories and a maximum of 45 for the Laboratory animal subscale. This is summed up to calculate the total score with has a maximum of 195. Only students that fully completed the forms will be used for analyses and only those students that participated twice remained in the study. Because not all the students participated (twice), or filled in all items, the group sizes varied. The two questionnaires of the same students before and after attending a AISS course were matched using the date of birth, course participation date and demographics factors.

In order to be able to compare the supplementary 9 propositions of the laboratory animal subscale with the other animal categories (consisting of 10 propositions each), all the attitude scores were calculated in percentages of the maximum possible score for each subscale. These attitude scores and results were tested on normality with the Shapiro-Wilk test, which is a powerful normality test for sample sizes of more than $N=30$.³⁴ Repeated Measures analysis of variance was used for the comparing of the pre- and post-course total attitude scores. The Friedman test was used for the comparisons of scores of the different animal categories, because the Pets score was not normally distributed. When $p<0.05$ a Wilcoxon matched-pairs signed ranks test was performed for comparison between groups. Differences between male and female students for the attitude scores were evaluated using either the Wilcoxon-Mann-Whitney U test for non-normally distributed data or independent Student's *t*-tests for normally distributed data. Other demographic variables (diet, pet ownership, nationality and upbringing) were tested using analysis of variance with post-hoc tests including the Bonferroni correction for multiple comparisons, but only if data were normally distributed (Pest-, Profit-, Laboratory animals- and Total scores). For non-normally distributed data a Kruskal-Wallis test was performed (Pets scores). Where $p<0.05$ a pairwise comparison was made using Mann-Whitney U tests. Significance was set at $p<0.05$ for all tests. Data are expressed as mean \pm 1 SD.

III. RESULTS

Student Demographics

Table 2 shows a summary of the demographic factors of all students participating in this study. It does not contain every student participating in the AISS courses (154), but only the students that remained in the study with the strict rules of: filling in the questionnaire completely, before and after attending the course. A total of 88 students remained, which is 57,1% of the total participants in the courses. From these; 10 students were from the EW-, 51 from the LAS- and 27 from the VP-course. (58.8%, 54.3% and 62.8%, respectively.)

Table 2 reflects the notable greater participation of females in all of the three courses. ($N=66$; 75%). The students were brought up evenly in the city ($N=41$; 46.6%) or village ($N= 45$; 51.1%), some lived in both ($N=2$; 2.3%). Most of the students were meat-eaters ($N=71$; 80.7%) or were vegetarian ($N=10$; 11.4%), only one student of the LAS course was vegan and remarkably six students filled in to be not a strict vegetarian or eats consciously less meat, this without being a prescribed answer of this item in the questionnaire.

Most of the students grew up with a pet as a child ($N=37$; 42%), 18 students currently owns a pet and 23 students currently owns a pet, but also grew up with one in their childhood (26.1%). Just a small amount of ten students never owned a pet in their life and all these students participated in the LAS course.

A higher proportion of the students were Dutch ($N=66$; 75%), 14 students (15.9%) were from European countries other than the Netherlands (Poland, United Kingdom, Portugal, Germany, Italy, Greece, Turkey and Ukraine). Eight students were from countries outside of Europe, namely Israel, United States, Thailand, Costa Rica, Iran, India.

Table 2: Demographic factors of Ethology and Welfare (EW), Laboratory Animal Science (LAS) and Responsible Use of Experimental Animals (VP) course students. The last row includes a count of total participants.

	Course			
	EW	LAS	VP	Total
	Count	Count	Count	Count
N Remaining Participants/total enrolled; (%)	10/17 (58,8)	51/94 (54,3)	27/43 (62,8)	88/154 (57,1)
Gender: Male/Female	1/9	18/33	3/24	22/66
Upbringing: City/Village/Other/Both	5/5/0/0	32/18/0/1	4/22/0/1	41/45/0/2
Diet: Meat-eater/Vegetarian/Vegan/Not Strict	6/3/0/1	43/4/1/3	22/3/0/2	71/10/1/6
Pets: Currently Owns/Grew up with /Never owned/Currently Owns & Grew up	3/2/0/5	9/25/10/7	6/10/0/11	18/37/10/23
Nationality: Dutch/European/Other	8/2/0	31/12/8	27/0/0	66/14/8

Attitudes toward Animals

Attitude Scores towards different animal categories (Pets, Pest, Profit, Laboratory animals)

A significant difference was found between different animal categories when comparing each of the mean scores in percentages. See figure 1. (Kruskal-Wallis test $\chi^2(df=3, N=88)=191,35, p=0.000$). Students had significant higher attitude scores on the Pets subscale in comparison to the Pest, Profit and Laboratory subscales. (Wilcoxon-Mann-Whitney test $Z=-7,63, p=0,000$; $Z=-8,12, p=0,000$; $Z=-8,143, p=0,000$, respectively. Mean ranks for Pets, Pest, Profit and Laboratory animals respectively 3,89; 2,85; 1,76 and 1,50). We also found a significant difference between the Pest subscale and the Profit and Laboratory animal subscale. (Wilcoxon-Mann-Whitney test $Z=-7,07, p=0,000$ and $Z=-7,77, p=0,000$). The Laboratory animal score did not show a significant difference with the Profit subscale (Wilcoxon-Mann-Whitney test $Z = -1,75, p = 0,081$).

Mean Attitude Scores before and after compared for each course.

Figure 2A to 2E show the total attitude score per participating course in percentages. The total score is calculated by summing up the different scores of each animal subscales (Pets, Pest, Profit and Laboratory animals). No statistical increase of attitude score could be measured when comparing the pre-course scores to the post-course scores in total (Figure 2E) (ANOVA $F(1,85) = 0.49, p = 0.484$).

We found a course interaction in the total attitude scores, which meant there were differences between the answering of the questionnaire by the students in the courses. (Figure 2E) (ANOVA $F(2,85) = 3.49, p = 0.035$). The EW course was statistically different from both the LAS and VP course with mean differences of 10.85% ($p = 0.045$) and 14.18% ($p = 0,010$) respectively, on the total attitude score.

A course interaction was found by two of the animal subscales namely the Profit subscale and the Laboratory subscale. (ANOVA $F(2,82)=3.825, p=0.026$ and $F(2,82)=3.797, p=0.026$ respectively)

Specifically the Laboratory Animal Science (LAS) course had no effect on the scores of the Laboratory animal subscale, (Student's t test $t(50) = -1,13, p = 0,265$) See also figure 2D.

Relationship between Demographic Factors and Attitude Scores

Due to the course interaction described above, we included the different courses in the statistical analysis of the gender differences. We found that females had a significant higher total attitude score ($71.03\% \pm 6.51$) versus males ($67.33\% \pm 6.85$) (ANOVA $F(1,82)=8.267, p=0.005$) and also found a gender-course interaction. (ANOVA $F(2,82)=3.168, p=0.047$) (Figure 3A) Due to this interaction, further analysis was performed and showed that the differences between gender in the total attitude score are due to the differences between males and females in the VP-course only. There was a significant gender difference in the VP-course, (Student's t test $t(25)=-3.247, p=0.003$) and these female and male students scored significantly different on the Profit subscale and on the Laboratory animal subscale. (Student's t test $t(25)=-2.080, p=0.048$, and $t(25)=-4.815, p=0.000$ respectively.) See also figure 3B and 3C. The EW course had too few males ($N=1$) to perform reliable statistics. No gender difference was found in the total attitude score of the LAS course

(Student's *t* test $t(49)=-0.931, p=0.356$), which confirms that the gender differences in the total attitude score are caused by the gender difference in the VP-course.

No significant difference was found between the scores of males and females on the Pets subscale. (Wilcoxon-Mann-Whitney test $Z=-0.32, p=0.747$ with Mean Ranks of 42.98 and 45.01 respectively) and no course effect was found either (Kruskal-Wallis test $\chi^2(2)=0,851, p=0.653$). No gender or course differences are found on the Pest subscale as well. (ANOVA $F(1,82)=2.924, p=0.091$ and $F(2,82)=1.301, p=0.278$, respectively)

No significant difference was found between people with differences in pet ownership and their total attitude score in percentages. (ANOVA $F(3,84) = 1.70, p = 0.172$)(Figure 4A)

The next demographic variable we are interested in considers differences in diet (Figure 4B). Vegetarians scored significantly higher on the total score in comparison to meat-eaters, with mean difference of $8.77\% \pm 2.09$ and a *p*-value of $p=0.000$. There was also significant differences considering students' diet in the Pest, Profit and Laboratory animal categories (ANOVA $F(3,84) = 2.836, p=0.043$; $F(3,84)=10.62, p=0.000$ and $F(3,84)=6.06, p=0.001$). Vegetarians scored higher on the Pest, Profit and Laboratory animal subscale in comparison to meat eating students $p= 0.029, p=0.000$ and $p=0.001$, respectively). There was no significant difference in attitude score between different diets in the Pets subscale (Kruskal-Wallis test $H(3) = 3.24, p = 0.356$).

A significant difference was found in nationality on the total score in percentage (ANOVA $F(2,85)=5.33, p=0.007$) This difference is due to differences between European and Dutch students (Student's *t* test $p=0.005$). See also figure 4C for the results. When looking at the different animal categories, differences were found in the Pets score ($H(2)=21.76, p=0.000$) and the Pest score (ANOVA $F(2,85)=4.73, p=0.011$). Dutch and European students differ in the Pets score (Wilcoxon-Mann-Whitney test $Z=-3.71, p=0.000$, respectively with Mean Ranks 35.75 and 61.58) and a trend was found between the Dutch and European students on the Pest score ($p=0.055$).

No difference was found in attitude scores between students brought up in a city or a village. (ANOVA $F(2,85)=4.461, p=0.108$)

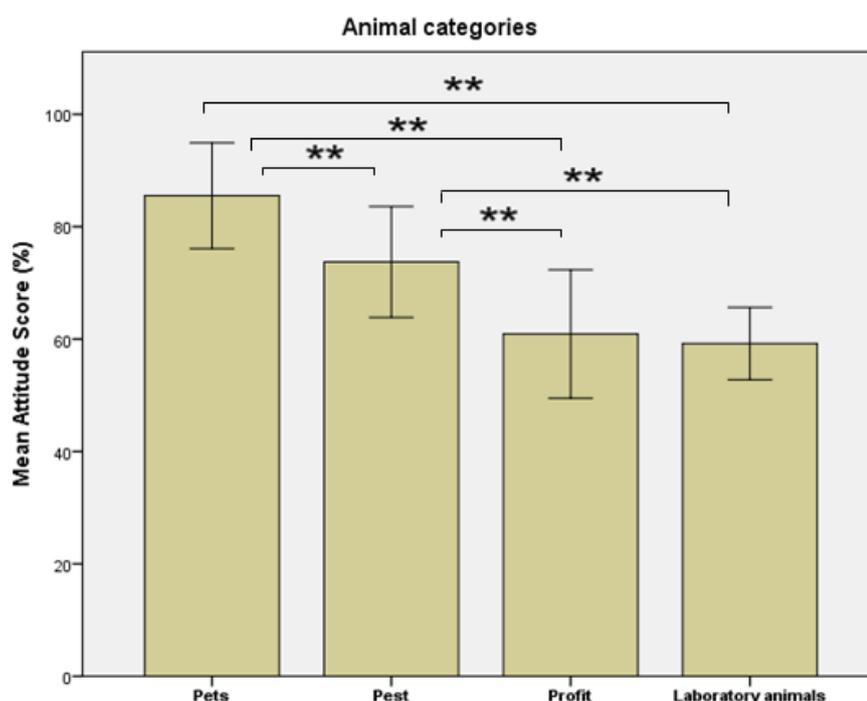


Figure 1: Relationship between the Mean (of pre- and post-course) Attitude Score in percentages in the Pets, Pest, Profit and Laboratory animal categories with of all the students. N=88
Error bars: ± 1 SD. * $p<0.05$, ** $p<0.01$

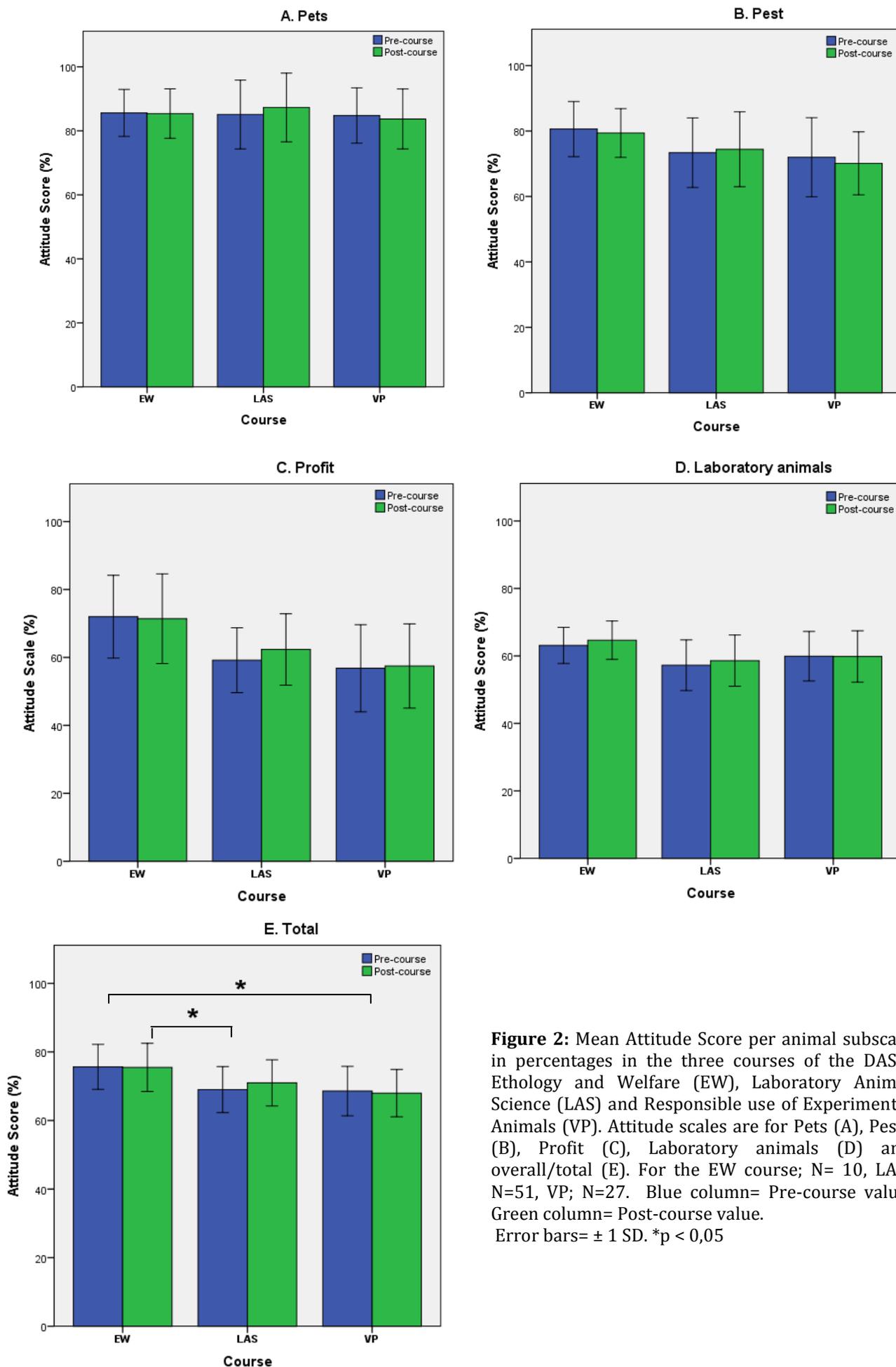


Figure 2: Mean Attitude Score per animal subscale in percentages in the three courses of the DASS; Ethology and Welfare (EW), Laboratory Animal Science (LAS) and Responsible use of Experimental Animals (VP). Attitude scales are for Pets (A), Pests (B), Profit (C), Laboratory animals (D) and overall/total (E). For the EW course; N= 10, LAS; N=51, VP; N=27. Blue column= Pre-course value. Green column= Post-course value. Error bars= ± 1 SD. *p < 0,05

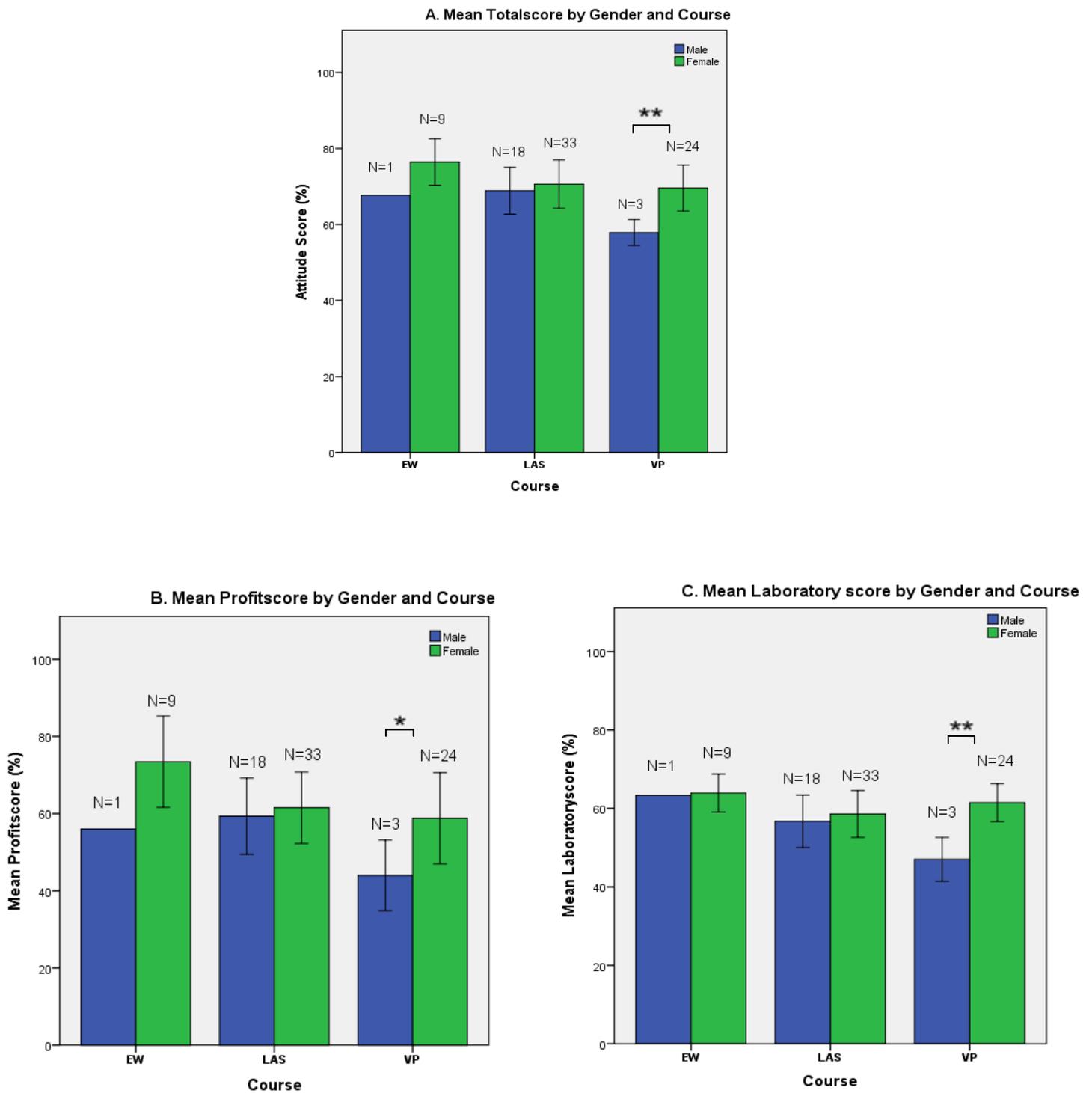


Figure 3: Mean attitude scores in percentages in the three courses of the AISS; Ethology and Welfare (EW), Laboratory Animal Science (LAS) and Responsible use of Experimental Animals (VP) in relationship with gender.

(3A) Mean total attitude score by gender and course.

(3B) Mean Profit score by gender and course.

(3C) Mean Laboratory score by gender and course.

Blue column= Male value. Green column= Female value.

Error bars= ± 1 SD. * $p < 0,05$, ** $p < 0,01$

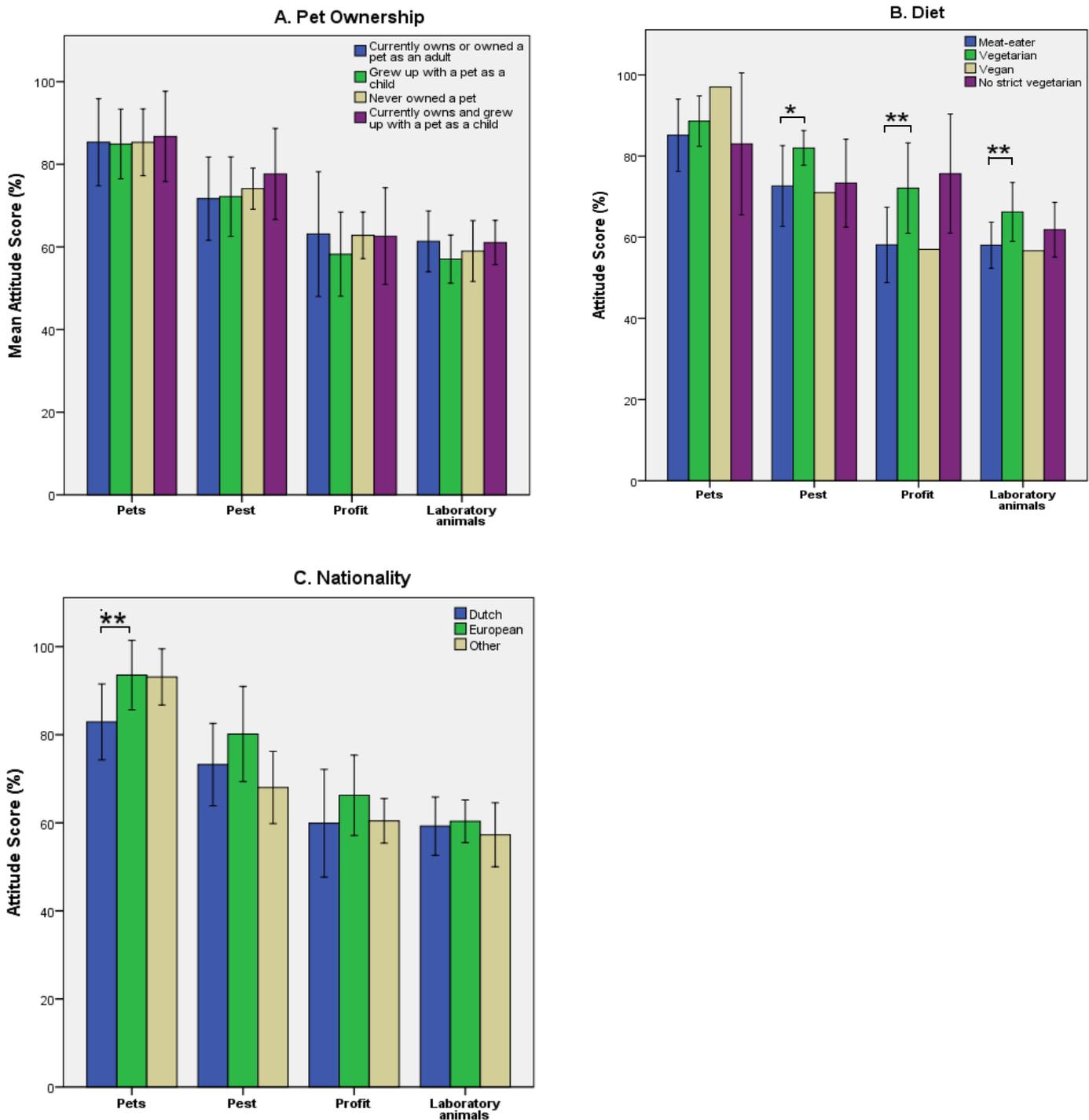


Figure 4: Relationship between the mean Attitude Score in percentages in the Pets, Pest, Profit and Laboratory animal categories with Pet Ownership (A), Diet (B), Nationality (C). For the Pets, Pest, Profit and Laboratory animal subscales respectively:

(4A) N= 18 currently owns a pet, N=37 grew up with a pet, N=10 never owned a pet and N=23 currently owns and grew up with a pet.

(4B) N=71 meat eater, N=10 vegetarian, N=1 vegan, N=6 no strict vegetarian.

(4C) N=66, Dutch, N=14 European, N=8 Other.

Error bars= ± 1 SD. * $p < 0.05$, ** $p < 0.01$

Table 3: The mean scores of all participating students, the minimum and the maximum score, including the standard deviation. Scores are displayed in percentage of the highest possible score per category. Pets, Pest and Profit subcategories have a maximum score of 50, and Laboratory animals 45.

	Mean score	Minimum – Maximum	Standard Deviation
Pets score	85.5%	49% - 100%	9.4%
Pest score	73.7%	49% - 98%	9.9%
Profit score	60.9%	28% - 94%	11.4%
Laboratory animals score	59.2%	41.1% - 81.1%	6.4%

III. DISCUSSION

The significance of the Attitude Score and the effect of education

It is not easy to evaluate the education given by the AISS based only on the achieved attitude scores. This is because the final attitude score of a student is not like any other grade at University in which the highest grade is the most desired one. There is no definite 'good' or 'bad' attitude score, but in essence there is an expectation to find the students granting a specific score to certain propositions in a responsible and professional manner, proper for its context and taking their future career into account. This does not mean that students may not have an own point of view, but it is expected that the students are able to reflect their own opinion about animal welfare of animals kept under human supervision and all the course objectives set by AISS (named earlier in the 'Study Design, Study Participants and Course Descriptions' section) and change their view when it seems ultimately morally wrong in current society.

Hypotheses

This study started with six hypotheses. As mentioned in the "Introduction", we treat animals differently based upon their use by humans. The same can be concluded from the results of this study. Just like the related study of Hazel et al. (2011)⁵, we found that attitudes towards animal vary according to the category of animals students talk about; Pets, Pest, Profit, and in our study also Laboratory animals respectively. This hypothesis was supported, with the highest mean score seen on the Pets subscale (42.76). The high score indicates that students are more concerned about their pets in comparison to the other animal categories, probably because people are easily attached to them, or as Serpell. (2004)¹⁰ described, is it possible for people to identify with these animals more easily than with Pest, Profit or Laboratory animals (recall the 'animal attributes'). This theory can be supported in more detail with the results of the third proposition of the Pets scale, which asks the students whether they see their pet as a family member. (See also Table 1) Looking only to the pre-course scores: 61 people (out of 88) agreed (agreed/strongly agreed), 17 students were neutral and only 10 students did not agree (disagree/strongly disagree) with this proposition. Besides, 69 students find their pet a source of emotional comfort (item number four of the questionnaire).

Remarkably, student scores towards Laboratory animals and Profit animals are not significant different as shown in table 3, with scores of 59.2% and 60.9% respectively. We might conclude from this result, when talking about animals that humans use for specific purposes, that these students do not have different attitudes towards these categories. However, notice that the lowest attitude score in the whole study was scored by one of the students on the Profit subscale, 28% (of 100%). (Table 3)

A lower score of the students, whether it is compared to the Pets subscale or to the own subscale, does not necessarily mean that students are not concerned about these animals. Recall from the "Introduction" section that in Dutch society unless the concern for animals and the upcoming parties that stands up for the rights and welfare of animals, different attitudes exist towards the different animal categories. Students are just more concerned about pets and are prepared to do more for their welfare, just like the example of physiotherapy for dogs. Students are concerned about the other animal categories, but just in lesser extent. In our theory it depends upon the situation if people are more or less concerned about animals in these categories. Most of the time when it comes to testing medicines and therapies we accept animal experiments, but when it comes to food industries the animal suffering is more easily accepted. The same can be seen in the present study when looking more closely to the independent propositions of the questionnaire. When looking

more closely to what students answered pre-course, most of the students agreed with the use of animals to develop a cure for cancer (70 out of 88 students; only 1 student disagreed). In contrary to the propositions about inflicting severe pain and severe stress to rats to develop a proper pain medication or a cure for post-traumatic stress disorder respectively, which were not that generally accepted (22 and 26 students respectively). Most students were actually neutral about these propositions (38 and 37), and 28 and 25 students did not find it acceptable. Looking more closely to the other part of the statement about profit animals, 51 students agree with humans having the right to use animals as food and only 9 students disagreed, while 28 students are neutral. Also 44 students find it acceptable to use animals for human profit. So while it seems the students do not see these categories as different, we may look more critically to this outcome. It depends more or less on the specific situation if students are more or less concerned about these animal categories. This could be an example of the two different roles of attitudes as mentioned in the "Introduction" section, between the 'local evaluation guide' and the 'global evaluation guide'. In general (global) students of these courses might disagree to animal experimentation, unless a certain aim of the experimentation (cure for cancer) changes this attitude (local). More room on the questionnaire for students to comment on their chosen score can therefore be a great source of information about the barriers for choosing to agree or disagree.

Students score significant higher on the Pest subscale than on the Profit subscale (and Laboratory animals). This result was also found in the study of Hazel et al. (2011)⁵ in their cohorts of veterinary medicine and animal science students. This finding is ascribed to a developing utilitarian perspective due to the increasing exposure to profit animals in the students' degree; the same could be true for our veterinary cohort (VP-course). In Figure 3B and 3C we can see that students of the VP course had somewhat lower attitude scores towards the Laboratory and Profit subscale in comparison to the EW and the VP course. Although this was not statistically confirmed. This utilitarian perspective may have an impact on their attitudes toward these animal categories and account only for students participating in comparable educational programs, because this finding was not found in a community sample performed by Taylor et al. (2009)¹⁸.

Another reason for the difference may be derived to the content of the questionnaire, which can be considered as a limitation of this study. The elements of the PPP-questionnaire of Hazel et al. (2011)⁵ have proven to be correlated with the original AAS by Herzog et al. (1991)²⁶, which is a validated scale to measure attitudes⁵; this means that it is not possible to change the propositions easily without losing this validation. But in despite of these correlations, there are major differences between propositions in each of the animal categories. For example, in the Pest subscale more items focus on the basics of animal welfare (free from discomfort, stress, pain, possibility to display natural behavior), while in the Profit subscale propositions are about all sorts of topics (laws, societal issues, hunting). One theory is that the propositions of the Pets subscale are more 'obvious' propositions for students to agree with, in comparison with the given Profit propositions. Examples are the following: "Pests have the right to freedom of pain, injury and disease." versus "Live transport of animals should be banned." These questions differ in context. The question arises why there is no proposition about the freedom of pain, injury and disease on the Profit subscale too, in order to be able to compare these outcomes.

As mentioned in the "Introduction", a change in attitude shift is recognized in the last decades. People are getting more concerned about animals. A shift that makes it almost obliged for veterinary faculties to add new courses to curricula about animal welfare and animal ethics to make sure graduated veterinary students are capable to respond to the developing needs of knowledge in their profession about animal welfare and animal ethics.² Lord et al. (2010)⁴ describes the increase of confidence of veterinary students by learning about animal welfare courses and an increase in comfort when being confronted with animal welfare issues. This might be due to an attitude change and therefore it was hypothesized in this study that a course covering topics of animal welfare and animal ethics may shift the attitude more towards animals. Evaluating the results of this study, no post-course increase of attitude scores was found. Actually, no effect was found at all. One possible reason for this can be the short duration of the courses (one to four weeks, respectively) which is possibly too short for a clear attitude shift. Also, the score on the Pets subscale is already high in the pre-course evaluation and cannot rise any further (ceiling effect) as is also reported by others.¹⁸

Evaluating the categories of Pests, Profit and Laboratory animals, students could already have a clear vision about the current animal welfare and ethics. If this is the case, the students may prove to know about these topics before attending the course and no 'eye-openers' are present in the education of AISS. It can be concluded from this study that the education of AISS has no effect on the attitudes of students towards animals, but our method using the current questionnaire and scales, can also be the wrong method to measure this effect. A good addition in favour of this research would be to ask the students themselves if they believe their attitude changed due to the education or not.

Statistical analysis showed a difference between the EW and both the LAS and VP courses which is explainable. Of course there is a big difference between the amount of participating students in the different groups (EW, N=10 versus LAS, N= 51 and VP, N=27) and demographic factors can be differently divided between the groups as well, for example the students that never owned a pet are all in the LAS course. Another difference is that in the EW course, students are not trained to be able to do animal experiments by themselves in contrast to the other courses, in which some students may already work with animals, (e.g. laboratory work or internships) which may alter their attitude towards animals differently. As a result, the kind of students of the Ethology and Welfare course differs from the other two courses. Students of EW have chosen specifically for this elective course as it was not an obligatory part of their studies and in this course welfare is prioritized. As 'welfare' is in the name of the course, students choosing for this course may be more committed to the health and welfare of animals or be more conscious or concerned about the current animal welfare. In contrast, students participating in the LAS course or the VP course focus more about the use of animals in research and maybe have due to this a lesser commitment to animals in comparison to the students of the EW course just because they may also assign more value to research outcomes. Students of the LAS courses may be more interested in research and animal experiments that are used in their future career.

As described in the "Introduction" section. Attitudes can be influenced by attitude modifiers like individual human attributes and cultural factors.¹⁰ The demographic variables in the first part of the questionnaire resemble some of these attitude modifiers and make it possible to evaluate the differences in attitudes due to these demographic factors.

In this study females of the VP-course scored significant higher on the total attitude score and on the Laboratory animal and Profit subscale than men (Fig. 3A). This result supports the findings in the study of Hagelin et al. (2012)²⁴, in which was reported that male students were more positive than female students about the use of animals in biomedical research and less concerned about pain and suffering of laboratory animals.²⁴

But we did not found gender differences in the other two courses.

The study of Paul & Podberscek (2012)⁶ focused on the possible hardening of veterinary students in their attitude towards animals during their education and found that males scored lower than females on an empathy scale. In our study we also found that males of the veterinary VP-course scored lower on the attitude scale, which could support the former finding. It would be therefore interesting to see if first year veterinary students of Utrecht University score higher on the attitude scale in comparison to the VP master students (fourth year students) as well, as is reported in the study of Paul & Podberscek (2012)⁶ too.

No significant difference was found in the other subscales, unlike is described in related studies and because of which is said that females have greater concern for animals than males.^{5, 6, 19, 25, 35}

In general, we must take into account that fewer males participated than females in this study. (N=22 males versus N=66 females). Thereby participated most of the males in the LAS course (18 of the total of 22, see also table 2) and only one male was in the EW course and the remaining three in the VP course. This makes it hard to properly compare females and males and to draw proper conclusions. It is possible that when a similar (and sufficient, let's say 66) number of males as females had participated, other results may have been found.

No differences were seen between people with differences in pet ownership. Based on the results of the study of Hazel et al. (2011),⁵ it was expected that people that owned a pet or have owned a pet as a child were more likely to score higher on the Pets subscale than students that never had owned a pet. Serpell (2005)¹⁹

also described that previous ownership of pets was associated with increased opposition to recreational hunting and the use of live animals in surgery teaching and more equivalent attitudes towards issues as the possibility of animals to experience pain and the unequal treatment of food and companion animals. Due to this we would have expected some differences on the Profit subscale as well. However this was not borne out in our study, which can be due to the low number of students that never owned a pet (N=10) and the fact that all these students were part of the LAS cohort.

Meat eaters scored significant lower on the Pest, Profit or Laboratory animal subscale in comparison to vegetarians. In this study, there were insufficient vegan students (N=1) involved to draw a proper conclusion about vegans and the other diet preferences. It was expected that vegetarians scored higher on the Profit subscale as was earlier reported by Taylor & Signal (2009)¹⁸, and it seems logically because most profit animals are consumed as meat. As we could see in our results, the reason for choosing a vegetarian lifestyle may have impact on the Pest and Laboratory animal subscale as well. Because the answer of being not a strict vegetarian was not standard, this answer was not compared due to unreliability. For example, if it was standard, maybe more students would have chosen for this option.

For the education given at AISS it might be interesting to see if students with a different nationality also have different attitudes towards animals than Dutch students. It can be interesting for the teachers to know about such cultural differences and it might be useful to them to be aware of these when a new international Laboratory animal science course starts. Izmirli & Phillips (2012)²¹, already concluded that culture and socioeconomic status have significant influences on attitudes towards animal welfare. They described differences in demographics between Turkey and Australia and demonstrated that different concerns for animal welfare between Turkish and Australian veterinary faculties exist.²¹ Also Phillips & McCulloch 2005²⁵ demonstrated that there are significant differences between students of different cultures and their perceptions of animal sentience and attitudes to reverence for animal life and animal suffering during life, which can also be derived from differences in culture.

The results of our study showed that there is a significant difference between Dutch and European students on the total attitude score. No differences were seen on the Profit or the Laboratory animal scores. It is remarkable that students from the other European countries have significant higher scores on the Pets subscale and a similar trend can be seen on the Pest subscale. Still we have to keep in mind that the sample groups are small and that students in de European group may differ in cultures and traditions as well.

The group from outside Europe contained only eight students and may also contain students that just answered the question on the questionnaire as 'other than Dutch' what means that these students may be Europeans as well, but just did not subscribed this. This is why the comparison might not give real reliable data and further investigation is needed underlining the differences of nationalities to be able to discuss this interesting part of attitudes better. Although differences in the way of keeping animals can differ between countries, but no attempt has been done in this research to compare all the different countries.

The fact that there is no difference between students brought up in a city or a village is interesting and suggests that this does not influence the attitude towards animals. One theory can be that the boundary between a city and a village is small and that no differences between these upbringings exist regarding attitudes towards animals. Just two students remained after the selection who said to have been brought up in both a city and a village. The significant difference found in this demographic variable will therefore be not reliable and this is why it is not mentioned in the "Results" section. In this study at the end no participant remained who was brought up in rural environment/countryside. This was not a standard answer on the questionnaire, but making this a possibility too would be a good addition to cover every upbringing possible in the Netherlands and to make the questionnaire more complete. For instance, Serpell (2005)¹⁹, found that students with a rural background were significantly less negative towards hunting, the use of live animals for surgery teaching and had more negative attitudes towards the need to teach 'animal rights' in veterinary curricula. However, the study of Hagelin et al. (2000)²⁴ found that the views about animal experimentation of students brought up in the countryside did not differ significantly from those of other students, but by adding this answer to our questionnaire these findings could be supported or not.

The questionnaire in this study also included items about students' employment and degree. Eventually we did not compare these demographics because students filled in such an amount of employments that it did not seem possible to create subgroups that covered all the employments correctly for statistical analysis. Also a lot of mistakes were made while filling in the form due to misunderstandings. It was not possible to extract the participants who said to 'work' at the University as a student, from the participants that really had a job at University (junior-teachers, teachers, veterinarians etc.) and this is why it was decided to make no comparisons after all. It also seems that there exists a misunderstanding in the questionnaire about the students' degrees. Participants struggled with filling in the degree they own and the degree they are currently studying for. Because it is possible a student had finished a different study before participating in the ones involved in this study, the problem is difficult to correct. Because of this we did not compare the differences in attitude scores between students' degrees.

Limitations

The use of scales like the AAS- or PPP-scale in general has some disadvantages. A lot of factors, such as the attitude modifiers named earlier in the *'Introduction'* section can influence the final results. Even the fact that the students are able to discuss with each other about the propositions while completing the questionnaire makes it possible that these scales do not measure the real attitude of a person of its own, but the attitude of a couple, or group of persons. As we described in the *"Background Information"* section, in self-report measurements subjects may provide misinformation which will lead to unreliability's. We do not know if we measure what someone thinks is right and/or what someone actually does. Also known in the statistical field is the 'boredom effect' in a repeated-measures design. A participant may perform differently in the second questionnaire because they are tired or bored from having completed the first and same questionnaire earlier.³⁶ This could make that some of the students may not fill in the form truthfully and just write down some numbers to be done with it. By making participation voluntary this problem should be minimized.

But the voluntary nature lowers the threshold for students to fill in the questionnaire (twice) and it also makes it harder to perform a repeated measurement study. It happened that a participant only fills in the form at the beginning of the study, but not at the end. In despite of the good intentions by making the questionnaire voluntary, it must be taken into account that some students may feel obliged to fill in the form at the end of the course.

At the bottom of the questionnaire was room for students to comment on the scale, ask questions or mention other issues. The most common annotations were the lack of nuance in the given propositions. The questions are considered as too ambiguous and the use of the term 'tolerable' is favoured above the use of 'acceptable'. The fact that the questionnaire was written in English, while most of the students are Dutch could provide for a lower amount of useful questionnaires in this study. For example, a lot of students did not understand the word 'feral' in the ninth question of the Pest subscale, which makes this item left blank for many times (approximately 19 times). With the result of deleting the participant of the study when no attitudes score could be measured through this.

Students did not always understand the difference between the different animal categories. The main problem was particularly the subscale of Pest animals. This is probably because the Netherlands does not really have a pest animal which has a big influence on our (or a student's) daily life. Students are aware of rats living in old houses and/or dwelling around the canals of Amsterdam etc., but most of these animals do not harm any of them or may not even be noticed. This could be a difference in the results in comparison with the study of Taylor & Signal (2009)¹⁸, in which dingoes are named as a well-known pest animal in Australia.

It is also possible that the student just filled in to be neutral (3) because of a language barrier, which makes the final outcome of the attitude score less reliable. We also have to take into account that there can be differences in the understanding of each proposition between the students, due to the way some items are formulated. For example, in the sixth item of the Pets subscale, students have to agree or disagree with the following proposition: "Pets should have a regular health check." Students may have a different point of view about what a regular health check is. What is 'regular' or what exactly is meant by the questionnaire with a

'health check'? Another example could be different views of severe stress and severe pain, what must be taken into account when performing similar research. While these conceptions could differ between students, it might even be harder for the student to rate his own opinion with just the five (1-5) options. What number fits best to someone's opinion could be hard to decide. Also people can agree with having a dog get a regular health check, but not a goldfish, which is actually also considered as a pet. This gives some food for thought to adapt the response scale of a five-point Likert scales to a seven-point Likert scale. It could be considered to afford even more room for nuance and comments, by using open questions or the Visual Analogue Scale. VAS is also used in attitude measurements towards animal welfare.^{6, 25} A continuous scale is different from the discrete scale because it has no categorical answers but a continuous line with a specific scale. The two most opposite opinions are on either side of this line. Participants specify their level of agreement to a proposition by indicating a position along a continuous line with the specific scale.¹⁷ For every score the distance in between the centre of the cross and the left end of the response line must be measured. It will take more effort to calculate the attitude scores when the questionnaire is distributed on paper, but this way of answering to a statement gives the participant more room for nuance because of the many possibilities this method hands to give your opinion. This manner of answering will give more insight to what extent people agree with a specific item and what the reasons are to (dis)agree in order to acknowledge the barriers that exist for students to not agree with a specific statement.

At the end of the courses it often happened that the questionnaire had to be completed by students just after completing the exam. This is not beneficial for the return rate and a solution in the form of electronically distributed form could be considered in similar or following studies. It can also be considered to distribute the questionnaires consistently in the last lecture before the test.

In Box 2 are some opinions of students about the practical lessons of the LAS and VP courses, obtained by oral communication.

Students' thoughts

Oral communication with four students of a LAS course and two students of the VP course gave nice information about their opinion on the practical tutorials in their courses. In the VP and the LAS courses, the practical tutorial is the critical moment where the students' are confronted with the use of experimental animals. The first practical tutorial is about animal handling and the student learns to properly hold a rat, mouse, guinea pig, hamster or rabbit. Students feel sorry for the animals when they have to grasp them firmly in the skin of the neck and have to turn them over (gently). But in the second practical tutorial they notice that it is easier for them and even better for the animal, when they are able to hold the mouse firmly and inject quickly, without a lot of struggling so that the animal is quickly returned back into his cage. The students realize that the longer they handle the mouse, the more harm they cause to the welfare of the animal. Looking at the mouse back in the cage, showing to have probably abdominal pains due to the intraperitoneal injection, makes them realize they are responsible for the animals health and welfare and they should act responsible. In contrary other students think it is not necessary to perform this part of the practical tutorial. They say they already know how responsible they are and know their actions will harm the animal. Those are the students who do not understand why every single student participating in the course has to perform this task, especially when they do not want to do any research later.

Box 2 : Students' opinions about the practical tutorials in their VP or LAS course.

IV. CONCLUSION

One of the main conclusions that we can draw from the results of this study is that students do not change their attitude towards the use of animals after attending courses of the AISS at Utrecht University. Although the method used in this study might not be the proper method for measuring this effect. Students see animals differently depending on the category, where highest scores are received on the Pets subscale. Students have almost the same attitude towards animals used by humans for production purposes (profit animals) or used

for research or teaching (laboratory animals). Vegetarian students are more concerned about animal welfare and ethics in all the different categories except Pets. A gender difference is only found in the course with veterinary medicine students only, in which females score higher on the attitude subscales of laboratory and profit animals. Owning a pet or prior ownership of a pet as a child did not differ attitudes scores in comparison to students that never owned a pet. No difference in attitudes scores were found due to the upbringing of students, city versus village. Students from outside The Netherlands have more pro-animal attitudes, but further research underlining differences in demographic variables, comparing the different cultures and life-styles and ways of education, must be done properly to support this last finding.

V. ACKNOWLEDGEMENTS

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