

# Teaching Slaughter: Mapping Changes in Emotions in Veterinary Students during Training in Humane Slaughter

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## ABSTRACT

As part of their training, Dutch veterinary students learn how to carry out the humane slaughter of livestock, which many students consider emotionally challenging. The aims of this study were to plot changes in self-reported emotions in veterinary students at different time points during an educational program on humane slaughter using emotion cards and to assess the change in reported emotions after adding a video and a short period of self-reflection to the program. Emotions were mapped in five groups of students at the beginning, middle, and end of the program by asking them to select from 40 cards depicting emotions in photo and text. Then two changes were made to the course program: a video of an expert slaughterman stunning and bleeding a bovine was shown, and the students were requested to spend 2 minutes picturing themselves carrying out the same procedures. To evaluate the effect of these improvements to the course, the following five groups of students were asked in the same way to indicate their emotions at the same three time points. Adding the video and short period of self-reflection did not change the emotions reported by students. Our results indicate that instruction in humane slaughter techniques involves a significant mental challenge for students. The use of emotion cards by teachers could provide useful insights into emotional aspects of the more challenging programs for students.

**Key words:** humane slaughter, stunning, learning, emotion, veterinary, student

## INTRODUCTION

In the Netherlands, all veterinarians are authorized by law to carry out the emergency slaughter of production animals on farms or elsewhere, and official veterinarians are responsible for meat inspection in slaughterhouses. To cater for these authorizations, students of veterinary medicine participate in a program of theoretical and practical training on stunning and bleeding of cattle in their final year of the Master's program. Bovines are chosen as the subject because in veterinary practice most emergency slaughter is carried out on cattle farms. Anecdotal and experiential evidence suggests that this program has a profound effect on the students' well-being, with students sometimes showing a strong emotional response (e.g., crying) and very occasionally refusing to take part in the activity, which means they cannot graduate. It is clear that emotions are relevant to the process of learning to slaughter cattle.

A course on humane slaughter is clearly a demanding situation for veterinary students, in which positive emotions related to learning a new skill are at risk of being outweighed by negative emotions related to killing a living creature. Most aspects of the veterinarian's job are aimed at improving the health of animals; learning about *humane slaughter*, therefore, involves crossing an emotional threshold. Another aspect of a veterinarian's work that concerns killing animals is euthanasia, which is well known to cause occupational stress<sup>1</sup>; research confirms that about 25% of

veterinary students find euthanasia stressful.<sup>2-4</sup> Research with practicing veterinarians and para-veterinarians has shown that up to 11% experience moral stress when faced with euthanasia.<sup>5</sup> In cases in which healthy animals have to be culled—during a disease outbreak, for example—perpetration-induced trauma stress (PITS) can occur.<sup>6</sup> Veterinarians have a greater chance of disagreeing with convenience euthanasia if they are female, young, recently qualified, and work in a small team.<sup>7</sup> Euthanasia of companion animals is less gory than the slaughter of a bovine and, in many cases, aims to alleviate suffering. In these two respects, one might expect humane slaughter to be even more stressful to veterinary students than euthanasia and therefore makes the topic worth investigating.

In psychology, emotions are defined as promoters of interests.<sup>8</sup> Most psychological theories regard emotions to have developed through natural selection (i.e., evolution), to direct behavior to prevent risks and engage in favorable opportunities.<sup>9,10</sup> An evolutionary approach to psychology is increasingly seen as essential to explaining human behavior.<sup>11</sup> From an evolutionary perspective, emotions are functional systems in a functional brain rather than mere stimulus-response patterns.<sup>10</sup> Emotions have recently been placed central to motivation<sup>12</sup> and sense-making,<sup>13</sup> both of which are fundamental to learning. For example, Langebæk et al.<sup>14</sup> investigated how learning could be improved by increasing positive emotions—which refer to engagement

and feeling up to a task—and diminishing negative emotions, which refer to strain, possible exhaustion, and risk of burnout. In this study, “being able to prepare properly” was identified by veterinary students as the most important source of positive emotions and “lack of self-confidence” was cited as the most important source of negative emotions.<sup>14</sup>

Comprehending and controlling emotions is of vital importance to the practicing veterinarian,<sup>15</sup> and a degree of emotional detachment can occur during the training of veterinarians.<sup>16</sup> There has been a call for enhancing the emotional component of veterinary training because it would increase the effect of training and improve career competence.<sup>15</sup> Teachers may regard emotions as problematic to learning a new technical skill. However, from a psychological perspective, it is clear that learning slaughter techniques is not merely a matter of diminishing negative emotions, but of facilitating a mental step. For example, learning and retention can be aided by controlled exposure to a stressor that is relevant to the context.<sup>17</sup> An evolutionary perspective presumes that feeling different emotions while experiencing or learning something new is functional, rather than a hindrance.

To improve the learning effect of the humane slaughter course at Utrecht, we sought a way to increase positive emotions and to reduce negative emotions in students by adapting the program. We wanted to enable students to prepare themselves better for the act of stunning and bleeding cattle by offering them an activity that would inform them and also enhance their self-confidence, as proposed by Langebæk et al.<sup>14</sup> We therefore added a short video showing an expert stunning and bleeding a bovine to familiarize students with the actions they would be learning to carry out.

The aims of this study were to plot changes in self-reported emotions in veterinary students at different time points during an educational program on humane slaughter using emotion cards and to assess the change in reported emotions after adding a video and a short period of self-reflection to the program.

## MATERIALS AND METHODS

The Dutch veterinary curriculum is divided into a 3-year bachelor’s program and a 3-year Master’s program. In the final year of the Master’s course students participate in a week-long program on humane slaughter techniques, including the proper and safe use of the captive bolt and the correct technique for sticking and bleeding of cattle. The aim of the program is to ensure that students will be

competent to carry out emergency slaughter if called upon to do this during their career as a practitioner. This part of the program covers about 20 hours of tuition spread over three working days and includes legislation and hygiene topics as well as specific instruction on humane slaughter. On Day One, lessons in the classroom are followed by practice using captive bolts on heads of cadavers in an anatomy lab. On Day Two, students carry out stunning and sticking of adult bovines in a small commercial beef and pork slaughterhouse under the supervision of the teacher (a veterinarian) and the slaughterer. Two days later, at the end of the program, the course is evaluated in the classroom.

## Participants

Ten groups of veterinary students in the final year of their training were involved in the study (93 students in total). At the beginning of the program, students were informed that at certain time points they might voluntarily and anonymously indicate their emotions by selection of emotion cards. No students declined to take part.

Because of the relative similarity of veterinary training programs in western Europe (the 3-year bachelor’s and the 3-year Master’s), there is little reason to believe that Dutch students in their final year of training differ significantly in knowledge and experience from students elsewhere in Europe. Our findings may therefore apply to other countries.

## Study Design

We asked 10 groups of students following the humane slaughter program to note the emotions that they experienced at that moment by selecting from 40 emotion cards. This occurred at three time points during the program (see [Table 1](#)):

- T1—at the beginning of the theory session when students had up to that moment only seen the title of the program “Introduction to Humane Slaughter”;
- T2—at the end of the theory session in which students received instructions on safe use of the captive bolt and knife for sticking cattle and an unloaded captive bolt had been passed round the class, but before practicing on the head of a cadaver; and
- T3—at the end of the program, 2 days after students had carried out stunning and sticking at the slaughterhouse.

Students were sitting slightly apart with a print of the emotion cards before each student, and they placed marks on a checklist to indicate which emotions were salient. Since

**Table 1:** Schedule for the humane slaughter program

Day	First five groups (March)	Second five groups (April–May)
Tuesday	T1. Emotions experienced before instruction	
	Theory lesson: “Introduction to humane slaughter”	Theory lesson: “Introduction to humane slaughter” with the addition of a film and a moment of reflection
	T2. Emotions experienced after instruction	
	Practicing use of captive bolt on a cadaver head	
Wednesday	Slaughterhouse experience including performing stunning and bleeding cattle	
Friday	T3. Emotions experienced two days after slaughterhouse experience	

each student was marking a paper and not selecting the cards from a pile, it was not possible for the other students to see their choices, so as to avoid social bias as far as possible.

Five groups of students followed the conventional program. The following five groups followed a program to which a 5-minute video presentation was added during the theory session between T1 and T2. The video showed the stunning and bleeding out of beef cattle carried out at normal speed in a clean slaughterhouse by an experienced slaughterman using the same equipment that the students would be using.<sup>18</sup> The accompanying soundtrack included background noise in the slaughterhouse and no commentary. Immediately after watching the video in class, students were asked to take 2 minutes to imagine they were carrying out the same actions.

Changes in the emotions selected by the students were analyzed to find out whether watching the video of an expert carrying out the task of stunning a bovine and reflecting on carrying out the task oneself would have any effect on the emotions of students at T2 and/or T3.

### Identification of Emotions through Self-Report of Emotion Cards

A set of 40 “Face your Emotions” emotion cards, developed by author MH for use in management training courses, was used to assist students in indicating which emotions they experienced. The emotions represented by the cards are presented in Figure 1. Each card shows the name of the emotion and an image of its facial expression.

As part of the process of creating the cards, each emotion was defined in terms of circumstances that arouse the emotion, which behavior it activates, and which interest this promotes. The images and definitions on the cards were based on definitions found in the psychology literature<sup>8,19,20</sup> and were tested and improved upon during several training and coaching sessions for management professionals.

Emotions on the cards are divided into four categories, as presented in Table 2: (a) reflexes, involving a quick, primarily unconscious reaction to circumstances; (b) the more conscious process of integrating information in one’s self-image and worldview; (c) emotions that form part of goal-directed social strategies, but which result in automated behavior and facial expression; and (d) values and connection to objectives.

### Statistical Analysis

Data were entered into MS Excel and exported via a tab-delimited text file to the statistical program R (version 3.1.2)<sup>21</sup> for data handling and construction of the final data set. For each student and at each of three time points the choice for the emotion cards was recorded and coded (1 if a card was chosen, 0 if not chosen). The data records contained information for each of the three time points (i.e., three records per student), resulting in 246 records. Only the 19 emotion cards that were selected in at least 5% of the records were included in the analysis because cards with low prevalence can have a disproportionately large effect on the results.



**Figure 1:** The set of emotion cards used in this study depicted 40 emotions grouped into four categories, using text and photographs.

[Credit: © Face your Emotions, courtesy of M. Hulsbergen]

**Table 2:** Emotions depicted on the 40 emotion cards by category

Category of information processing	1	2	3	4	5	6	7	8	9	10
Reflexes	Surprised	Stage fright	Irritated	Fright	Tense	Panic	Exposed	Disgust	Anger	Passion
Integrating information in self- and world-image	Joy	Worried	Fear	Desire	Disappointment	Hurt	Jealous	Grief	Wonder	Inspiration
Strategy controlled social mindsets	Friendly	Cheery	Polite	Cunning	Combative	Rejection	Suspicion	Aggression	Alert	Aware
Values and connection to objectives	Compassion	Insecure	Determined	Proud	Ruthless	Doubt	Despair	Shame	Guilt	Enlightened

The frequency with which the emotions were scored at the three time points (T1 before theory, T2 after theory, and T3 after practice) by the students of both courses (regular and improved) was summarized by cross tables and compared by the Fisher's exact test for descriptive purposes.

The data were analyzed according to the method of Kienstra et al.<sup>22</sup> using correspondence analysis (CA)<sup>23</sup> and applying IBM SPSS-routine ANACOR. CA is a statistical tool for the descriptive analysis of data. The students' profile of emotions (chosen cards) has a multidimensional structure, and CA can be used to reduce the dimensions. CA is a popular tool to visualize the multidimensional structure of the data, but the results can also be used as input for consecutive analysis. Students with equal chosen card profiles will have equal dimension coordinates from the CA analysis. When a student chooses different cards at the three time points (the emotional status changes), the result will be three different dimension coordinates so in a two-dimensional graph the student will have a different position in time.

The results from the CA analysis (the row/student and column/card coordinates of the first two dimensions) were exported to program R (version 3.1.2)<sup>21,24</sup> for further analysis. The students' coordinates (three per dimension per student) were used to visualize the mean coordinates of the chosen cards and the change in mean coordinates in time for each of the students in both dimensions.

A linear mixed model<sup>24</sup> was used to analyze the students' profiles (row coordinates for Dimension 1 and Dimension 2, respectively) as proxy for the (latent) outcome variable "emotional status" with time (T1, T2, and T3), course (regular and improved), and the interaction between both, gender (male, female), Master's study (Companion Animal Health Master, and Master of Equine Health) and age (centered around 25 years) as explanatory variables. Student number was added as a random effect to account for three correlated observations for each student. To adjust for differences in variability at the time points (higher at T3) in coordinates of Dimension 1, a variance model was added to adjust the model. In the model for Dimension 2 a variance adjustment was done for gender (females showed higher variability).

Model assumptions were checked by visual inspection of residuals plots and no departure was observed. The Akaike information criterion (AIC) was used to select the best model.

### Ethical Considerations

Participation in the selection of the emotion cards was voluntary, and participants were ensured confidentiality. The procedure was explained to the participants in advance, and they were informed that their participation was voluntary and that they could withdraw at any time without consequence. It was also made clear that participation or information given would in no way influence their grades. The forms on which the participants noted the emotions were coded so that the results were anonymized. The key to the codes was kept separately and was known only to the principal researcher. The study was carried out in compliance with Dutch privacy law (*Wet bescherming persoonsgegevens*).

## RESULTS

### Characteristics of the Students

Eleven of 93 participants supplied incomplete data at one or two stages; 9 students missed a measurement stage because of changes in the teaching schedule due to a national holiday, and 2 individual students were not present at one of the stages of the study because of personal reasons unrelated to this study. This resulted in a total of 82 participants in two groups (pre- and post-improvement of the course), with 41 students in each group.

The 82 participants consisted of students from two different Master's tracks. Sixty-three were students of the Companion Animal Health Master (CAH) and 19 students of the Master of Equine Health (EH). Ten participants were male and 72 female. Students were on average 24.2 years old, with a median age of 24.0 years and a range between 22 and 31 years of age.

In the group before improvement of the course, 9.8% of the participants were male, versus 14.6% in the improved course group ( $p = 0.74$ ). In the group before improvement, 75.6% of participants were CAH students versus 78% in the

improved course group ( $p = 1$ ). The distribution of age of participants was similar in both groups ( $p = 0.70$ ).

The frequency of each reported emotion by the students of both courses was compared at all time points (T1–T3), and the results are presented in Appendix 1.

### Emotions Recorded by Students on the Regular Course

In the groups before the adaptation of the course, the three most frequently chosen emotion cards at T1 were: Tense ( $n = 26, 63.4\%$ ), Aware ( $n = 25, 61\%$ ), and Insecure ( $n = 23, 56.1\%$ ). At T2, the most frequently selected emotions were the same: Aware ( $n = 28, 68.3\%$ ), Tense ( $n = 27, 65.9\%$ ), and Insecure ( $n = 19, 46.3\%$ ). At T3, reported emotions were different: Aware ( $n = 28, 68.3\%$ ), Wonder ( $n = 14, 34.1\%$ ), and Tense ( $n = 12, 29.3\%$ ). Of the 40 cards, 14 cards were not selected at any time point: Stage fright, Irritated, Exposed, Anger, Passion, Joy, Desire, Hurt, Inspiration, Cheery, Cunning, Combative, Suspicion, and Aggression.

### Emotions Recorded by Students that Followed the Improved Course

In the improved course, the three emotions most frequently chosen by students at T1 were Tense ( $n = 35, 85.4\%$ ), Insecure ( $n = 21, 51.2\%$ ), and Determined ( $n = 21, 51.2\%$ ). Emotions reported most at T2 were Tense ( $n = 37, 90.2\%$ ), Worried

( $n = 23, 56.1\%$ ), and Aware ( $n = 22, 53.7\%$ ). Emotions reported most at T3 were Aware ( $n = 27, 65.9\%$ ), Tense ( $n = 25, 61\%$ ), and Determined ( $n = 19, 46.3\%$ ). Of the 40 cards, 10 were not selected at any time point: Exposed, Anger, Passion, Joy, Disappointment, Hurt, Inspiration, Cheery, Cunning, and Combative.

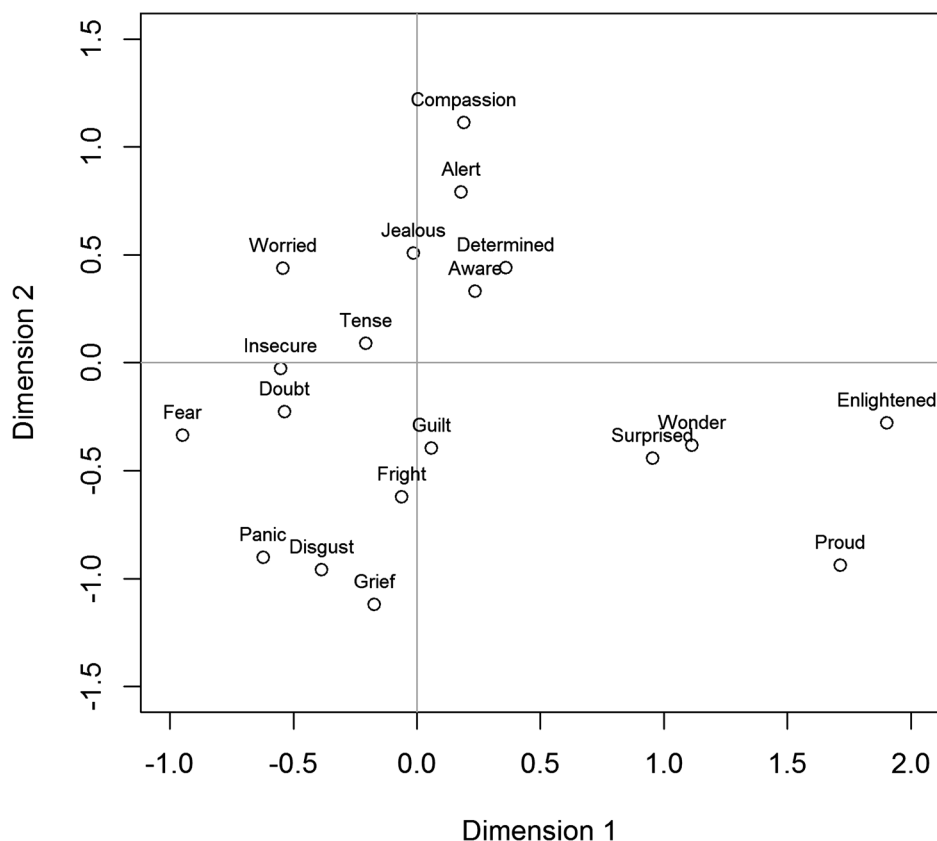
### Comparison of Emotions Recorded in the Regular and Improved Courses

The frequency of emotions reported by the two groups of students was compared at all time points T1–T3 (Appendix 1). Differences ( $p < 0.05$ ) were found in Tense at all three time points (higher frequency in the improved course), Fear at T1 and T2 (higher frequency in improved course), Disgust at T1 (more frequent in the regular course), and Determined at T1 (more frequently in the improved course).

### Selected Emotion Cards Summarized in Two Dimensions by Correspondence Analysis

Dimensions 1 and 2 from the CA capture 11.9% and 9.8%, respectively, of the total variance in the data. These two dimensions represented the profile (correlation) of chosen emotion cards by each student during the course. The estimated scores of cards chosen by at least 5% of participants were plotted in the two dimensions, as shown in Figure 2. Emotions grouped closely together were frequently chosen

Cards chosen by > 5% of participants



**Figure 2:** Scatter plot of the selected emotion cards on two dimensions produced by the correspondence analysis (CA). The position of the card is the mean position for all students who chose this card.

at the same moment by the same students. The emotion cards for Wonder, Surprised, Enlightened, and Proud are located in the same area as opposed to the other cards in Dimension 1. In Dimension 2 there is no clear grouping of emotion cards but most of the cards placed in extreme positions, such as Compassion, Alert and Jealous are opposed to Grief, Proud, Disgust, and Panic.

Table 3 shows the results from the final statistical model on both dimensions. The variables course (regular versus improved) and age were removed from the model as they did not explain the change between different time points in the first and second dimensions respectively. The best statistical model for Dimension 1 contained time and gender, and the model for Dimension 2 also contained age.

The change of position of all students on the two dimensions during the course are presented in Figure 3A (T1 to T2) and Figure 3B (T1 to T3). In general, the change from T1 to T2 is mostly in Dimension 2 while the change from T1 to T3 is mostly in Dimension 1.

Between T1 and T2, there was little change in the mean coordinate on Dimension 1 (Figure 3A, horizontal shift), but the mean coordinate on Dimension 2 (Figure 3A, vertical shift) increased by on average 0.39, which represents a movement away from Disgust, Panic and Grief toward Aware, Alert, Compassion, and Determined.

Between T1 and T3, the mean coordinate in Dimension 1 increased on average 1.31. This means a movement away from Fear, Panic, Disgust, and Worried toward Wonder, Surprised, Enlightened, and Proud (Figure 3B, horizontal shift). In the same time period, the mean coordinate on Dimension 2 showed a small non-significant change (Figure 3B, no vertical shift). Females had on average a

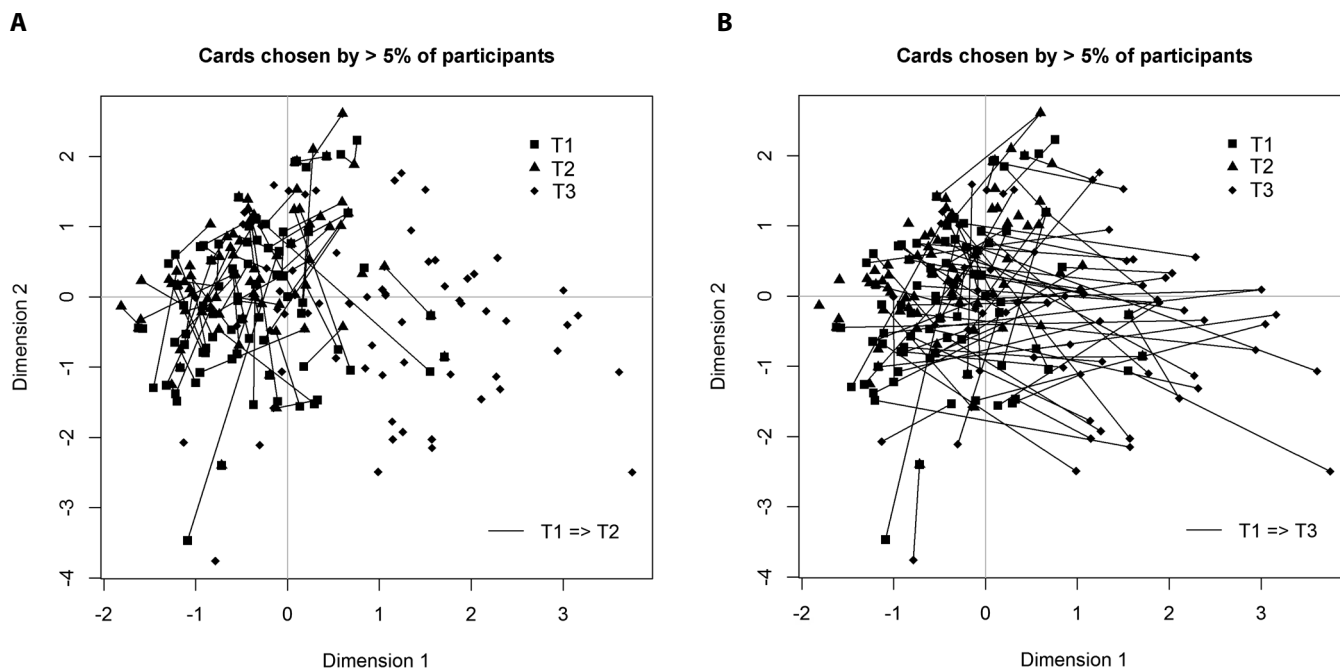
**Table 3:** Parameter estimates for the effect of time, gender, and age on the position of students in Dimensions 1 and 2, respectively, in the final statistical model

Parameter	Estimate	95% CI	
		Lower limit	Upper limit
Dimension 1	0.06	-0.35	0.46
Constant*			
T2	+0.01	-0.10	+0.11
T3	+1.31	+1.05	+1.56
Female	-0.47	-0.91	-0.04
Dimension 2	0.39	-0.07	0.85
Constant†			
T2	+0.39	+0.18	+0.60
T3	+0.01	-0.21	+0.22
Female	-0.63	-1.11	-0.15
Age	-0.12	-0.22	-0.02

\*Mean for reference = T1, male

†Mean for reference = T1, male, age centered to 25 years

0.47 lower coordinate in Dimension 1 and a 0.63 lower coordinate in Dimension 2 compared to the mean coordinate of males, meaning a shift in the direction of Panic, Fear, Disgust, and Grief. For increasing age, the mean coordinate in Dimension 2 decreased (-0.12/y).



**Figure 3:** Scatter plots of scores of individual students on the two dimensions produced by correspondence analysis (CA). Lines represent the change of score between two time points within individual students (A) between T1 (beginning) and T2 (the halfway point in the program), and (B) between T1 and T3 (end of the program).

## DISCUSSION

The emotions recorded by the students changed during the course in humane slaughter. However, the adjustments to the course (adding a video of stunning and a period of self-reflection) did not result in a significant difference in reported emotions between the two groups of students. That the addition of a video and self-reflection did not produce a significant effect was unexpected. However, this result coincides with the findings of a study in which a virtual reality slaughterhouse was developed for final year veterinary students in Denmark.<sup>25</sup> Here, no statistical difference was found in emotions reported by students who experienced the virtual slaughterhouse and students in the control group, who did not, even though students reported positive feelings about being able to experience the virtual slaughterhouse.<sup>25</sup>

The CA<sup>22</sup> estimated a first dimension explaining 11.2% and a second dimension explaining 9.8% of the variance in the data over the three time points (total 21% explained variance). Plotting the students and their individual reported emotions on these dimensions provides an insight into the mental process students go through during the three stages of the course. From the beginning of the course (T1) to immediately after the theoretical instruction (T2), emotions reported by students move principally in Dimension 2, a trend away from Grief, Disgust, Panic, and Fright toward Compassion, Alert, Jealous, Worried, Determined, and Aware (Figure 3A). This could be interpreted as students distancing themselves (Disgust) from a threat (Fright) that they did not feel up to (Panic) and which forced them to give up on something important (Grief). Then students took responsibility (Compassion) to commit to a challenging task (Determined), which required focus (Alert), in preparation for which they ran through extreme scenarios (Worried).

From after the theory lesson (T2) to the end of the course (T3), students' emotions moved principally on Dimension 1 (Figure 3). This is a trend away from Fear, Panic, Worried, and Doubt toward Enlightened, Proud, Wonder, and Surprised (Figure 2). This could be interpreted as students at first experiencing a threat (Fear, Panic) and questioning whether they want to carry out the task (Doubt) because they fear an unwelcome outcome (Worried). Then, at T3 a burden had dropped from their shoulders and they became interested (Enlightened), they look back at something they cannot explain but is not threatening (Surprised), which led to new associations (Wonder) and new accomplishments (Proud).

There are several possible reasons for not finding an effect of the changes in the educational program. First, the students who followed the improved course were 3 months further advanced in their education.<sup>16</sup> These students have followed courses in a different order and have also been together longer, which might mean they experience the activity differently or have a different group dynamic from the other groups of students. This could also explain why different emotions are reported at T1—before the changes in the course could result in an effect. But the observed emotions differing between the regular and improved course may be caused by multiple testing which increases the type I error (finding a difference, given truly no difference) but after applying a Bonferroni correction, none of the cards are differently distributed anymore at T1.

A second explanation may lie in the impact of the measurement method itself. Being asked to reflect on their emotions regarding humane slaughter at T1 may of itself have a significant effect on students' emotions. This may have overshadowed the effect of the newly introduced video.

A third explanation may concern the timing of the measurements. A video was shown to introduce technical skills. However, this video exposed students to the potential shock of seeing a bovine being slaughtered for the first time. While this was aimed to increase resilience, building up resilience takes time,<sup>26,27</sup> and the selection of emotions at T2 may have come too soon to allow for this. Also, although at T3 students were asked to recall their emotions just after slaughtering, it is possible that T3 may have been too long after the act of slaughter to accurately recall those feelings.

### Limitations of This Study

To select a particular emotion card, a participant must have reached a threshold level of the emotion. It is likely that the threshold differs between individuals. The meaning of specific emotions will also differ between students, and it is unclear to what extent self-censorship and social desirability have an effect on the cards selected by students.

### Limitations to Measuring Emotions

Emotions in veterinary students have been investigated before; for example, the development of empathy toward animals over the various years of study<sup>16</sup> and emotions experienced during the first live animal surgery.<sup>14</sup> Although emotions appear important to explaining behavioral aspects during training and education, research on this topic is scarce. A possible reason for this is that emotions are difficult to define and measure. In psychology, over 90 definitions of "emotion" have been used.<sup>19</sup> Advances have been made in neurology; however, no area in the brain has yet been linked to any distinct observable behavior or previously categorized mental process.<sup>28,29</sup> We do not have clear definitions or characteristics of specific emotions because, as Barrett<sup>30</sup> states, emotions are an ontologically subjective category of which the meaning depends in part on the individual's experience. To advance knowledge of the role of emotions in education, a structure is needed.

An often-used method of structuring emotions is by distinguishing "positive" and "negative" emotions. Increasing "positive" emotions leads to engagement, focus, and learning.<sup>14</sup> In the present study on humane slaughter, "positive" emotions are notably scarce. "Joy" is not reported by any of the participants at any of the time points by either group; neither is "Passion" or "Inspiration." Perhaps these emotions are regarded as too "positive" to report during this course, which involves killing a living creature. "Wonder" and "Proud" are reported at T3, 2 days after the slaughterhouse in reference to the moment right after slaughtering. "Compassion" and "Determined" are reported at T2 after the technical introduction, but while "Determined" may be experienced as positive as participants take responsibility and commit themselves, "Compassion," if felt in relation to the animal, is also likely to refer to loss.

Being able to slaughter humanely and in emergency situations is an important part of the veterinarian's training. However,

keeping animals healthy is the aim of most other aspects of a veterinarian's job. This means that training students in slaughter techniques will always involve more "negative" than "positive" emotions. Preparing for slaughter is a process of sense-making, which is an emotional process.<sup>13</sup> Therefore, to teach students slaughter, it is important to understand which emotions they experience. Our results confirm, as was found in research on the medical instruction of veterinary students,<sup>14</sup> that instruction in humane slaughter techniques involves a significant mental challenge. The structure of emotions in the cards that we used, with emotions as promoters of relevant interest, may be a step toward advancing our ability to identify what this challenge entails.

Stress is a natural part of education, as it arises from a mismatch between perceived demands and perceived abilities to cope.<sup>31</sup> Veterinary education is very demanding in respect of the academic level of education, workload, and certain ethical dilemmas<sup>4,32,33</sup> and therefore, unsurprisingly, a large number of the studies published on emotion in veterinary students focuses on stress.<sup>3,4,32,33</sup> A study in Australia revealed that 70% of students felt overwhelmed by the workload, leading the study's authors to propose the adoption of a more understanding and compassionate atmosphere in the classroom.<sup>32</sup> Other studies have suggested improving students' resilience to stress by teaching them to recognize stress signals and by teaching them to cope with specific stressors, such as the death of an animal.<sup>32</sup> Encouraging self-care behavior, time-management training, and self-monitoring, as well as increasing social coping, are also seen to be helpful in reducing stress in students.<sup>33</sup>

Training in humane slaughter is distinct from other parts of the curriculum in the personal development it demands of students. What our study might add to the initiatives described above is that identifying specific emotions can help individual students to gain a perspective on their personal development, including what they find difficult and why. In this article we have identified shifts in emotions, revealing that specific interests are apparently at stake. This information could be used to adapt the instructional design. In line with emotion management techniques to deal with stress, we propose that adding an exercise to humane slaughter courses in which students select salient emotions would increase the ability of students to recognize and deal with stress. It would also enable students to reflect on their emotions with each other, which would help sense making<sup>13,34</sup> and, therefore, learning.

## CONCLUSION

Measuring emotions by self-report using emotion cards provided insights into the mental process students go through during a course on humane slaughter. Adding a video of the stunning and bleeding task followed by a period of self-reflection did not change the emotions reported by students. In courses that can evoke strong emotions, paying attention to these emotions in a structured way may help the learning process.

## ACKNOWLEDGMENTS

The authors thank Prof. P.G.M. van der Heijden, Utrecht University, for his advice on the statistical analysis.


## REFERENCES

- 1 Scotney RL, McLaughlin D, Keates HL. A systematic review of the effects of euthanasia and occupational stress in personnel working with animals in animal shelters, veterinary clinics, and biomedical research facilities. *J Am Vet Med Assoc.* 2015;247(10):1121–30. <https://doi.org/10.2460/javma.247.10.1121>. Medline:26517615
- 2 Herzog HA Jr, Vore TL, New JC Jr. Conversations with veterinary students: attitudes, ethics, and animals. *Anthrozoos.* 1989;2(3):181–8. <https://doi.org/10.2752/089279389787058019>.
- 3 Killinger SL, Flanagan S, Castine E, et al. Stress and depression among veterinary medical students. *J Vet Med Educ.* 2017;44(1):3–8. <https://doi.org/10.3138/jvme.0116-018R1>. Medline:28206849
- 4 Weston JF, Gardner D, Yeung P. Stressors and protective factors among veterinary students in New Zealand. *J Vet Med Educ.* 2017;44(1):22–8. <https://doi.org/10.3138/jvme.0116-014R1>. Medline:28206841
- 5 Rohlf V, Bennett P. Perpetration-induced traumatic stress in persons who euthanize nonhuman animals in surgeries, animal shelters, and laboratories. *Soc Anim.* 2005;13(3):201–19. <https://doi.org/10.1163/1568530054927753>. Medline:16270455
- 6 Whiting TL, Marion CR. Perpetration-induced traumatic stress - a risk for veterinarians involved in the destruction of healthy animals. *Can Vet J.* 2011;52(7):794–6. Medline:22210948
- 7 Hartnack S, Springer S, Pittavino M, et al. Attitudes of Austrian veterinarians towards euthanasia in small animal practice: impacts of age and gender on views on euthanasia. *BMC Vet Res.* 2016;12(1):26. <https://doi.org/10.1186/s12917-016-0649-0>. Medline:26847551
- 8 Frijda NH. *The emotions.* Cambridge: Cambridge University Press; 1986.
- 9 Gendron M, Barrett LF. Reconstructing the past: a century of ideas about emotion in psychology. *Emot Rev.* 2009;1(4):316–39. <https://doi.org/10.1177/1754073909338877>. Medline:20221412
- 10 Cosmides L, Tooby J. The evolutionary psychology of the emotions and their relationship to internal regulatory variables. In: Lewis M, Haviland-Jones JM, Barrett LF, editors. *Handbook of emotions.* 3rd ed. New York: Guilford Press; 2008. p. 114–37.
- 11 Buss DM, editor. *The handbook of evolutionary psychology.* Revised edition. New York: John Wiley & Sons; 2015. <https://doi.org/10.1002/9781119125563>.
- 12 Pink DH. *Drive: the surprising truth about what motivates us.* New York: Riverside Books; 2009.
- 13 Maitlis S, Vogus TJ, Lawrence TB. Sensemaking and emotion in organizations. *Organ Psychol Rev.* 2013;3(3):222–47. <https://doi.org/10.1177/2041386613489062>.
- 14 Langebæk R, Eika B, Tanggaard L, et al. Emotions in veterinary surgical students: a qualitative study. *J Vet Med Educ.* 2012;39(4):312–21. <https://doi.org/10.3138/jvme.0611.068R1>. Medline:23187024
- 15 Timmins RP. How does emotional intelligence fit into the paradigm of veterinary medical education? *J Vet Med Educ.* 2006;33(1):71–5. <https://doi.org/10.3138/jvme.33.1.71>. Medline:16767641





- 16 Paul ES, Podberscek AL. Veterinary education and students' attitudes towards animal welfare. *Vet Rec.* 2000;146(10):269–72. <https://doi.org/10.1136/vr.146.10.269>. *Medline:10749039*
- 17 Joëls M, Pu Z, Wiegert O, et al. Learning under stress: how does it work? *Trends Cogn Sci.* 2006;10(4):152–8. <https://doi.org/10.1016/j.tics.2006.02.002>. *Medline:16513410*
- 18 World Organisation for Animal Health (OIE) Training videos of the OIE Improved Animal Welfare Programme. Part 8: Penetrating captive bolt stunning [Internet]. OIE; 2015 [cited 2015 Jul 13]. Available from: <https://www.youtube.com/watch?v=kUQcKrIDTlo>.
- 19 Plutchik R. The nature of emotions: human emotions have deep evolutionary roots, a fact that may explain their complexity and provide tools for clinical practice. *Am Sci.* 2001;89(4):344–50. <http://www.jstor.org/stable/27857503>.
- 20 Ekman P. Emotions revealed: recognizing faces and feelings to improve communication and emotional life. New York: Henry Holt and Company; 2003.
- 21 R Development Core Team. R: a language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing; 2014.
- 22 Kienstra N, Imants J, Karskens M, et al. Doing philosophy effectively: student learning in classroom teaching. *PLoS One.* 2015;10(9):e0137590. <https://doi.org/10.1371/journal.pone.0137590>. *Medline:26379267*
- 23 Gifi A. Nonlinear multivariate analysis. New York: John Wiley & Sons; 1990.
- 24 Pinheiro J, Bates D, DebRoy S, Sarkar D; R Core Team. nlme: linear and nonlinear mixed effects models. R package version 3.1.2 [computer program on Internet]. (Accessed 2014-10-31) Available from: <https://cran.r-project.org/src/contrib/Archive/nlme/>.
- 25 Seguino A, Seguino F, Eleuteri A, et al. Development and evaluation of a virtual slaughterhouse simulator for training and educating veterinary students. *J Vet Med Educ.* 2014;41(3):233–42. <https://doi.org/10.3138/jvme.1113-150R>. *Medline:25000879*
- 26 Meichenbaum D. Stress inoculation training. New York: Pergamon Press; 1985.
- 27 Meichenbaum DH, Deffenbacher JL. Stress inoculation training. *Couns Psychol.* 1988;16(1):69–90. <https://doi.org/10.1177/0011000088161005>.
- 28 Lieberman P. On the nature and evolution of the neural bases of human language. *Am J Phys Anthropol.* 2002;119(35):36–62. <https://doi.org/10.1002/ajpa.10171>. *Medline:12653308*
- 29 Barrett LF. The future of psychology: connecting mind to brain. *Perspect Psychol Sci.* 2009;4(4):326–39. <https://doi.org/10.1111/j.1745-6924.2009.01134.x>. *Medline:19844601*
- 30 Barrett LF. Emotions are real. *Emotion.* 2012;12(3):413–29. <https://doi.org/10.1037/a0027555>. *Medline:22642358*
- 31 Looker T, Gregson O. Managing stress. London: Hodder & Stoughton; 1997.
- 32 Collins H, Foote D. Managing stress in veterinary students. *J Vet Med Educ.* 2005;32(2):170–2. <https://doi.org/10.3138/jvme.32.2.170>. *Medline:16078168*
- 33 Gelberg S, Gelberg H. Stress management interventions for veterinary students. *J Vet Med Educ.* 2005;32(2):173–81. <https://doi.org/10.3138/jvme.32.2.173>. *Medline:16078169*
- 34 Maitlis S. The social processes of organizational sensemaking. *Acad Manage J.* 2005;48(1):21–49. <https://journals.aom.org/doi/10.5465/amj.2005.15993111>.

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## APPENDIX I: FREQUENCY OF EMOTIONS REPORTED BY STUDENTS

**Table AI:** Number and percentage of emotion cards chosen per group of students at time points T1–T3

	T1					T2					T3				
	Regular		Improved		<i>p</i> *	Regular		Improved		<i>p</i> *	Regular		Improved		<i>p</i> *
<i>N</i>	%	<i>N</i>	%	<i>N</i>		%	<i>N</i>	%	<i>N</i>		%	<i>N</i>	%	<i>N</i>	
1. Surprise	8	19.5	3	7.3	0.19	5	12.2	2	4.9	0.43	7	17.1	6	14.6	1
2. Stage fright	0	0	2	4.9	0.49	0	0	0	0	n/a	0	0	0	0	n/a
3. Irritated	0	0	2	4.9	0.49	0	0	0	0	n/a	0	0	0	0	n/a

*continued*

	T1					T2					T3				
	Regular		Improved			Regular		Improved			Regular		Improved		
	N	%	N	%	p*	N	%	N	%	p*	N	%	N	%	p*
4. Fright	8	19.5	12	29.3	0.44	5	12.2	6	14.6	1	5	12.2	9	22	0.38
5. Tense	26	63.4	35	85.4	0.04	27	65.9	37	90.2	0.014	12	29.3	25	61	0.01
6. Panic	3	7.3	3	7.3	1	1	2.4	3	7.3	0.62	2	4.9	1	2.4	1
7. Exposed	0	0	0	0	n/a	0	0	0	0	n/a	0	0	0	0	n/a
8. Disgust	17	41.5	7	17.1	0.03	8	19.5	5	12.2	0.55	7	17.1	5	12.2	0.76
9. Anger	0	0	0	0	n/a	0	0	0	0	n/a	0	0	0	0	n/a
10. Passion	0	0	0	0	n/a	0	0	0	0	n/a	0	0	0	0	n/a
11. Joy	0	0	0	0	n/a	0	0	0	0	n/a	0	0	0	0	n/a
12. Worried	12	29.3	13	31.7	1	16	0.39	23	56.1	0.18	3	7.3	5	12.2	0.71
13. Fear	7	17.1	17	41.5	0.03	7	17.1	16	39	0.05	3	7.3	4	9.8	1
14. Desire	0	0	0	0	n/a	0	0	1	2.4	1	0	0	0	0	n/a
15. Disappointment	1	2.4	0	0	1	0	0	0	0	n/a	1	2.4	0	0	1
16. Hurt	0	0	0	0	n/a	0	0	0	0	n/a	0	0	0	0	n/a
17. Jealous	2	4.9	5	12.2	0.43	1	2.4	4	9.8	0.36	3	7.3	3	7.3	1
18. Grief	11	26.8	4	9.8	0.08	3	7.3	1	2.4	0.62	8	19.5	4	9.8	0.35
19. Wonder	4	9.8	3	7.3	1	4	9.8	6	14.6	0.75	14	34	12	29.3	0.81
20. Inspiration	0	0	0	0	n/a	0	0	0	0	n/a	0	0	0	0	n/a
21. Friendly	0	0	1	2.4	1	0	0	0	0	n/a	1	2.4	1	2.4	n/a
22. Cheery	0	0	0	0	n/a	0	0	0	0	n/a	0	0	0	0	n/a
23. Polite	1	2.4	3	7.3	0.62	1	2.4	1	2.4	1	0	0	0	0	n/a
24. Cunning	0	0	0	0	n/a	0	0	0	0	n/a	0	0	0	0	n/a
25. Combative	0	0	0	0	n/a	0	0	0	0	n/a	0	0	0	0	n/a
26. Rejection	1	2.4	0	0	1	1	2.4	0	0	1	1	2.4	1	2.4	1
27. Suspicion	0	0	1	2.4	1	0	0	0	0	n/a	0	0	1	2.4	1
28. Aggression	0	0	0	0	n/a	0	0	0	0	n/a	0	0	1	2.4	1
29. Alert	7	17.1	12	29.3	0.30	6	14.6	13	31.7	0.11	8	19.5	10	24.4	0.79
30. Aware	25	61	17	41.5	0.12	28	68.3	22	53.7	0.26	28	68.3	27	65.9	1
31. Compassion	9	22	9	22	1	8	19.5	8	19.5	1	6	14.6	5	12.2	1
32. Insecure	23	56.1	21	51.2	0.82	19	46.3	18	43.9	1	6	14.6	3	7.3	0.48
33. Determined	9	22	21	51.2	0.01	13	31.7	20	48.8	0.18	10	24.4	19	46.3	0.06
34. Proud	2	4.9	2	4.9	1	1	2.4	1	2.4	1	7	17.1	12	29.3	0.30
35. Ruthless	3	7.3	1	2.4	0.62	1	2.4	0	0	1	1	2.4	1	2.4	1
36. Doubt	17	41.5	19	46.3	0.82	15	36.6	15	36.6	1	8	19.5	5	12.2	0.55
37. Despair	4	9.8	1	2.4	0.36	1	2.4	1	2.4	1	0	0	0	0	n/a
38. Shame	3	7.3	4	9.8	1	1	2.4	1	2.4	1	1	2.4	0	0	1
39. Guilt	11	26.8	10	24.4	1	7	17.1	5	12.2	0.76	9	22	5	12.2	0.38
40. Enlightened	0	0	0	0	n/a	0	0	0	0	n/a	10	24.4	12	29.3	0.80

\* p values are obtained using the Fisher's exact test.