



Secondary students' attitudes to animal research: examining the potential of a resource to communicate the scientist's perspective

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Abstract

A DVD resource that provided a scientist's perspective on the use of animals in research and teaching was evaluated with a questionnaire that asked students' views pre and post their access to the resource. Thirty-nine secondary students (Y10-Y13) took part in three different teaching programmes that provided information about animal research and allowed them to explore the issues. Students' opinions about the use of animals for research and teaching were measured by matched pre and post questionnaires and open responses they made to justify their positions. The findings showed that students' views on animal research are strongly held and they express their views with emotion. The resource helped students to realise the complexity of the issue and provided them with knowledge to write more nuanced justifications. This resource was focussed on providing students with cognitive input and this evaluation indicated that equal attention should be provided to the affect component of attitude formation.

Keywords student attitudes, animal research, animal testing, pedagogy.

Introduction

Testing of animals has hit the headlines with New Zealand wide protests against the Psychoactive Substances Act (2013) that allows the testing of party pills on animals only when there is no alternative. Hundreds of protesters rallied against the law which does not impose a blanket ban on animal testing for party pills (FuataiTeuila, 2013). Such widespread interest in using animals for recreational drug testing, is reflected in political support not just by the Green Party but also by Act and Labour. In particular recreational drug testing using dogs and rats may be reconsidered by Parliament (Davison, 2013).

This issue is of relevance to students both within formal and informal education. There is a space for learning about how animals are used in research, testing and teaching within the New Zealand Science Curriculum [NZC] (Ministry of Education, 2007) when student are required to explore and reflect on socio-scientific issues in order to make scientifically-evidenced based decisions. And the issue has relevance in their informal learning as is evident in the numbers taking part in these New Zealand marches.

Research on students' attitudes towards using animals in research, testing and teaching (RTT) has shown that they have strong opinions and often hold negative attitudes that can form barriers to learning (Holstermann, Grube, Bogeholz, 2009). Furthermore, Skitka, Bauman and Sargis (2005) state that strong attitudes are resistant to change, and when they are connected to moral convictions- such as the use of animals in research - they can be perceived as being held by everyone (Universalism) as factual beliefs. Furthermore such beliefs engender strong emotions such as empathy, compassion and moral outrage.

Previous New Zealand research on 14-15 year-old secondary girl-students' awareness of, attitudes towards, and opinions about, the use of animals in RTT (Birdsall&France, 2011) showed that these

students' awareness was not consistent with the reality of animal research, either of its impact on the animals, or the particular species involved. This research showed that their concern and justification was expressed in terms of emotion and feelings of compassion and empathy for the experimental animals. As Serpell (2004) comments, such emotional perspectives can obliterate other attitudinal modifiers such the benefits of animal research in medical research. He commented that the tension about the use of animals is more evident when experimental animals are perceived to have similar cognitive abilities or be perceived as companion animals in other situations.

These views of how experimental animals should be treated was researched by Knight, Nunkoosing, Vrij&Cherryman, (2003) who carried out in-depth interviews with seventeen adults to find out their attitudes about the use of animals in research. They identified a range of empathetic views about animals that ranged from a belief in animal sentience with an acknowledgement that animals experience pain and suffering that can be measured by behaviour and levels of stress hormones, to a belief in animal mind where people believe that animals possess similar thought processes to humans. This research demonstrated that people's attitudes were often contradictory and depended on the context. They noted that people often worked backwards in their justification of their position by seeking information that supported their position rather than forming an attitude based on information. This process of selective justification was especially evident when these adults attempted to weigh up the costs against the benefits of using animals in medical research.

There is a perception that there is a great divide of opinion about the use of animals in research between animal researchers and those people who are animal rights' supporters. Knight, Vrij, Bard and Brandon (2009) identified a range of justifying arguments that have been employed by these apparently polarized groups. The justifications that scientists used were personal relevance of their own research, a view that there was a lack of scientifically sound alternatives, and a knowledge of the overall benefits that ensue from such research. Animal rights' welfarists justified their opposition to the use of all animals in research with an expressed empathy with the plight of animals, a belief in animal mind and a view that humans and animals have equal rights. These researchers provided questionnaires to representatives of these two groups (155 scientists, 159 animal welfarists and 58 laypersons). Rather than confirming a view of scientists being uncaring and universally rejecting a belief in animal mind this research showed that the scientist group were multi-dimensional in their attitudes to animal use in research whereas animal welfarists were uni-dimensional in their opposition. For example although all groups recognised animal sentience and ranked animals in terms of a phylogenetic scale according to their level of cognition, the scientist and layperson's responses were more dependent on context. Although scientists and laypersons acknowledged a hierarchy of cognition amongst animals and recognised animal sentience, the lack of alternatives in medical research and a need to use animals as close as possible to humans in medical research mediated this group's qualified acceptance of animal research. In comparison the animal welfarists were unanimous in their opposition in all situations.

Just as Knight et al's., (2009) research provided insight into the thinking underlying people's views about animal research, the New Zealand research carried out by Author and Author (2011) also demonstrated the complexity of these students' attitudes to RTT. What was very evident was their lack of information about legislation and regulations governing such research in New Zealand. This information gap was the impetus to develop a resource that would access such information as well as providing an opportunity for students to hear from scientists how they tackled the issue of using animals in their research.

Even though it is acknowledged that education in science is not a strong predictor of more informed views of how people perceive animal welfare (Furnham, McManus & Scott, 2003) this educational intervention was based on an assumption that such information would contribute to attitude formation (Wood, 2000). Because the tripartite theory of attitude includes a cognitive and affective input that is associated with behavioural responses (Pardo, Midden & Miller, 2002) this intervention was assumed to fulfil the cognitive role and the teaching activities would enable students to reflect on their emotional reactions to these experimental situations.

Consequently this educational intervention was based on an assumption that knowing more about the subject under discussion would predicate more positive feelings and behaviour intentions about the subject. This intervention is based on the prediction that the links between these three components: knowledge (cognitive), feeling (affective) and behavioural (tendency towards action) could be influenced by students' learning (Klop & Severiens, 2007).

However it cannot be presumed that there is a direct relationship between knowledge development, affective involvement and attitudinal change. To explain this apparent inconsistency Johnston and Reid (1981) have developed an educational model that explains that cognitive based attitudes are more susceptible to change than personally developed attitudes (Figure 1).

This model is based on their observations that although cognitive attitudes can develop rapidly as a result of teaching, personal attitudes often remain untouched by curriculum input. They suggest that we all have an inbuilt self-contained 'attitude corpus' that contains a system of beliefs and behaviour that arises from childhood influences, social upbringing and deep-seated cultural influences. They assert that this corpus is frequently derived from a limited cognitive base and, because it is often derived emotively rather than logically, it is strongly held and provides a protective framework against a range of daily cognitive and affective inputs. They surmise that this framework, built on the ideas of Katz and Sarnoff (1954), provides an internal consistency and security against this barrage of inputs. They visualise this 'attitude corpus' as a barrier. This theoretical model is further elaborated by supposing that the protective wall of our 'attitude corpus' is not of equal height (See Figure 1). Consequently cognitive-based attitudes will be 'protected' with a lower wall and be more susceptible

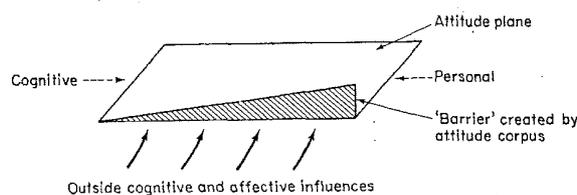


Figure 1. A model for attitude change (Johnston & Reid, 1981, p.210)

to change than affective-based attitudes based on religion or culturally held beliefs sitting behind a 'higher' wall. Consequently it could be easier to change a person's views about climate change if their attitude was based inadequate cognitive evidence but an attempt to change a person's views on their diet could be difficult without strong input and reference to the cultural and social issues related to their choice of foods.

Johnson & Reid (1981) predicted that this model could provide some direction for the development of curriculum materials. Underpinning the development of this resource it was surmised that including the scientist's voice as well as background information about the research under discussion would provide cognitive input as well as personal input. It was hoped that scientists explaining how they conducted animal research would provide an affective input as well as structured opportunities for students to express and reflect on their views. Consequently the resource was constructed so that both cognitive and affective aspects of the issue of animal research could be utilised in this learning experience.

The New Zealand Board of the Australian and New Zealand Council for the Care of Animals in Research and Teaching (ANZCCART) proposed that they develop a resource for schools to encourage informed discussion of this issue. They asked prominent New Zealand scientists and experienced secondary science teachers to contribute to the resource - *Caring for the Animals we Use in Research and Teaching*, (Author & Wyatt, 2010).

Description of the teaching intervention

This resource comprised a series of DVD clips showing scientists in their workplaces explaining their research, interacting with the experimental animals and talking about how they cared for them. These clips were supported with education material that provided the vocabulary and science concepts underpinning the research as well as teaching strategies designed to support the discussion of the issues of using animals in RTT.

During this intervention all students watched a video that provided an overview of animal research in New Zealand and a video discussion about the rules and regulations governing animals involved in this activity.

In addition, teachers selected the following videos and associated teaching activities:

- Year 10 students explored research on human infertility where a scientist described how transgenic mice were used to trace the activation of the neuropeptide (Kisspeptin) production via a fluorescing gene in mouse-brain tissue. The class were given eight still pictures from the video and required to make power point presentations that paid attention to the statement 'Using animals for science is acceptable only when harm done to the animal is less than the benefits of their use'. These positions were debated with two groups taking opposing views- one agreeing and the other disagreeing. This teaching strategy provided students with opportunities to explore the resource for positive and negative views to substantiate their power-point presentation. With this activity they were not required to provide their personal views but it was hoped that exposure to this resource could enable them to reflect on the cost benefits of such research from these two perspectives.
- Year 12 students viewed a scientist talking about animal-behaviour experiments that informed his design and development of a predator-proof fence to keep native fauna safe from introduced predators. Predators were used to test the efficacy of the fence. Testing involved catching wild animals (possums, stoats, cats, rats and mice), keeping them in captivity for a short period, releasing them near the fence and testing their ability to pass through and over the fence. At the final stage of this experiment the animals were euthanized because pest animals are not allowed by law to be kept in captivity and then released. Students played a DVD game where information about the ethical capture and use of animals was provided and pests in New Zealand were identified. Then a structured discussion (Goldfish Bowl) about the benefits of having a pest-free New Zealand occurred. The focus of this teaching programme was for students to explore their ethical position on the killing of wild animals rather than releasing them into the wild. It was anticipated that these students would weigh up the cost benefits of pest control against their views on the killing of these animals.
- Year 13 students were provided with the entire DVD about these research programmes and were required to choose one example of a scientist talking about their research. For example the development of new cancer drugs, the effects of pre-natal nutrition on lambs, or the genetic causes of obesity. All of these video clips showed animals undergoing and displaying the visual effects of animal experimentation. Students were required to identify the costs and benefits of such research and identified how these scientists reflected the philosophy of The Three R's - replacement, reduction and refinement, in order to minimise the impact on experimental animals when designing their experiments (Robinson, 2005). This teaching focus was designed to provide substance to an examination of the biology and ethical issues of a selected area of biological research. For example one student examined cancer research and Professor Bill Wilson's use of 'nude mice' in his research. These year 13 students used this material to support their cognitive understanding of the issue and it was hoped that they would critique this issue by also introducing their personal views to give weight to their arguments.

In each of these teaching situations the intervention occurred over a fortnight. There was no attempt to standardise the content of the teaching programme. It was noted that all of these teachers used the

DVD and teaching activities to contextualise this issue of animal experimentation and they created opportunities for their students to reflect on the complex relationship of animal use in science. They provided opportunities for students to view the DVDs and planned their teaching so that students could discuss the ethical issues and current regulations as well as reflect on these scientists' views.

Research design

This research was designed to provide some initial information about the response of students to this resource. The research question: 'What is the effect of a classroom-based intervention on students' developing understandings of the ethical use of animals in scientific research?' was posed to provide data about the scientist's role. Even though all the students were required to provide written material to fulfil their academic requirements it was anticipated that their personal views on the use of animals in RTT would be identified an anonymous questionnaire.

An anonymous questionnaire previously used for an attitudinal study (Author&Author, 2011) was adapted and administered pre and post the intervention to secondary students from two co-educational schools (one urban and the other country based). Although this aggregated data was anonymised, students were asked to provide a self-identifying symbol on their questionnaires so that the researchers could match pre and post responses. This self-identification allowed the researchers to provide some background detail when students' were asked to justify their positions as identified on a Likert scale.

Content description of the questionnaire

The questionnaire asked students' opinions about: their concern about the use of animals for RTT generally and in specific contexts; their knowledge of and confidence in the regulations protecting animals being used in RTT; and their views of the trustworthiness of people carrying out animal experiments.

It consisted of a mixture of open-ended responses and Likert-scaled responses to attitudinal statements. It was hoped that the open-ended questions would uncover details of students' cognitive and affective responses. The Likert-scale responses provided an indication of their level of concern (1 'very concerned' to 5 'not concerned at all'); or their level of acceptance of a situation (1 'always okay' to 3 'never okay'); or their level of agreement (1 'strongly agree' to 5 'strongly disagree'); and their confidence in people or regulations (1 'very confident' to 5 'not confident at all').

Another section of the questionnaire provided information about students' interactions with animals, for example whether they owned a pet and their commitment to animal rights by belonging to such organisations and how they supported such organised activities.

Student sample

Details of the student sample are shown in Table 1. Only the matched sets of student responses were used. Other students either did not include a self-identifying symbol or only one questionnaire was returned.

Table 1. Description of a sample of students taking part in the intervention

Number of students	Year Group	Age Range	Gender	School locality
				Decile rating
17*	Year 10	14-15 years	9 Male	Urban
			7 Female	8
15**	Year 12	16-17 years	2 Males	Rural
			11 Females	3
7	Year 13	17-18 years	1 Male	Rural

6 Female

3

* 1 student did not disclose their gender

**2 students did not disclose their gender

Decile rating indicates the extent to which it draws its students from low socio-economic communities. The lower the decile rating the more funding it receives from the Ministry of Education as there is a presumption that the school's community is less able to provide financial support.

Data analysis

Matching pre and post intervention data from 39 students (see Table 1) were analysed using the data analysis software package IBM SPSS to provide descriptive data that tracked attitudinal changes as well as any emerging themes to the open-response data (IBM Corporation, 2010). These descriptive statistical data were presented as numbers and percentages and, where appropriate, the mean score for each question.

The open-ended responses were used to provide examples of the variety and complexity of the justifications these students used.

Findings

In the following account the aggregated data from the pre and post questionnaires are provided to show the overall data set, followed by examples of students' open responses in order to provide more detail about their thinking about some of these issues.

Students' concerns about the use of animals in research or testing:

This question identified students' level of concern pre and post the intervention and are displayed in Table 2.

A case could be made that the intervention had some effect on students' attitudes with 20/39 (51.3%) being concerned in the pre test and 13/39 (33.3%) identifying their concern in the post test. However what is more informative than the slight change in the mean are the students' justifications for their attitudes pre and post the intervention as they provide information about how they are thinking. Consequently for each set of paired quotes, each student's response is accompanied with an attitude score (X) in order to track their changing views or in many cases the complexity of reasoning for their unchanged attitudes.

Table 2. Concern about the use of animals for research or testing purposes (RT)
-pre and post intervention-(numbers) and percentages

	1 Very concerned	2	3	4	5 Not concerned at all
Pre -intervention					
How concerned are you about animals being used in research and testing	(5)	(15) 38.5	(14)	(5)	(0)
	12.8		35.9	12.8	0.00
	Mean 2.49				
Post -intervention					
How concerned are you about animals being used in research and testing	(4)	(9)	(15)	(9)	(2)
	10.3	23.1	38.5	23.1	5.1
	Mean 2.89				

The following quotes accompanied by attitudinal scores show the complexity of their thinking about this issue.

Empathy for animals coupled with belief in animal mind was apparent in this Y10 student's initial level of concern (very concerned - 1) when she commented that animals would feel just like her.

I think animals deserve to be treated humanely. I can't imagine being tested on myself, so imagine how the animals feel. (PreS13Y10)

Her attitude did not change (very concerned - 1) post the intervention and she introduced another facet of her antagonisms that is animal rights.

I don't like the idea of animals being tested on. They have rights, we need to respect that (PostS13Y10)

Initially Student S19 Y10 gave a negative response (very concerned - 1) and his justification identified his belief in animal mind, *I think animals are beings* (Pre). His change of attitude to (concerned - 2) may not be significant as his response indicated that he had shut down when asked to justify his views after the intervention.

I don't know(PostS19Y10)

Likewise the following justifications are more indicative of S9Y10's viewpoint than her change in attitude from (concerned - 2) to a more neutral view (3). She continued to use animal freedom rights as her justification.

Because they have the right to be free (PreS9Y10)

Because I think they should be free (PostS9Y10)

These three student justifications provide examples of students' belief in the mental abilities of animals. Their statements indicate that they believe animals are self-aware and are capable of experiencing emotions. It could be deduced that these students have a strong emotional response to this issue.

Then there are the justifications that indicate that the student feels powerless and they respond by expressing little or no concern. Initially this student made the comment

I think it's wrong but I don't really care. I can't help it(PreS14Y10)

where he justifies his response (not concerned - 4) suggests an abrogation of responsibility. His post intervention value of (not concerned at all - 5) after he has been exposed to the scientists' input showed that he felt powerless when he made the following comment

I can't help what happens (S14Y10).

Rather than feeling negative and powerless another male student S17Y10 is pragmatic and neutral (3) about the issue of animal experimentation both pre and post the intervention.

I think it is bad and it is also necessary (PreS17Y10)

That's life (PostS17Y10)

Another response provides evidence that exposure to the scientists' laboratory procedures had some influence on S25Y12's view of animal research where she changed her view from (very concerned - 2) to a neutral stance of (3). Of interest is that her justification was more nuanced. Her pre statement of:

Because animals are important and shouldn't be harmed or put at any risk as they can't make their own decisions (PreS25Y12)

Indicated a blanket empathy and some evidence of a belief in animal mind in that she felt that in this situation animals were unable to make decisions. The post intervention response showed her appreciation of the complexity of the issue as she recognised how animal research helped find cures for diseases. However these benefits could not subsume her concern about the scientist carrying out cancer research on a mouse:

Because I believe that some animals should be used to help find cures for diseases, but then I also feel it's wrong to deliberately infect an animal with cancer (PostS25/Y12).

Previous research (Skitka et al., (2005) has shown that having access to information may not always change attitudes and this example shows that S36Y13's access to more information meant that his justification acknowledged the complexity of the issue even though he remained resolutely negative to the issue by choosing (concerned - 2) pre and post the intervention. At first he stated

I'm concerned about animals being used for research and testing and I don't think it's the right thing to do, but I don't know enough information to make a statement (PreS36Y13).

Exposure to more detail about animal research procedures provided him with information to identify the boundaries of his acceptance of the use of some animals in RT. His justification showed that he identified areas where he could accept such activity but there were other areas, for example non-essential testing, where he drew the line:

I think that as long as humans need to progress and improve on medical research, animals will keep on being used because there's no other way to test and experiment. I don't agree with animals being used for research in fields like cosmetics because making an animal suffer and have an unfulfilled life just to make us look prettier is pointless and selfish. (Post S36/Y13).

Students' views about animal use for education in schools

It was interesting to note that after the intervention students' level of concern about the use of animals in teaching increased. There were fewer students taking a neutral position (3) with the numbers who were less concerned remaining the same.

Table 3. Concern about the use of animals for teaching – pre and post intervention – (numbers) and percentages

	1 Very concerned	2	3	4	5 Not concerned at all
Pre -intervention.					
How concerned are you about animals being used in teaching	(3)	(5)	(16)	(10)	(5)
Mean 3.23	7.7	12.8	41.0	25.6	12.8
Post -intervention.					
How concerned are you about animals being used in teaching	(4)	(10)	(10)	(8)	(7)
Mean 3.1	10.3	25.6	25.6	20.5	17.9

These data showed that prior to the intervention 8/39 (20.5%) expressed concern, but after the intervention this rose to 14/39 (35.9%) with a change in the mean towards a more neutral stance. Some justifications were about the activities of fellow students, rather than the role of the teacher or the sourcing of these animals. Although sourcing of dead animals was an issue, it appeared that if these students believed that if their dissection animals or animal parts had been killed for some other purpose, or had met an accidental death, their use in teaching was acceptable.

The following quotes illustrate how these students become more aware of the issue of using animals in their classrooms.

Children should not be trusted with the lives of animals. (PostS1Y10)

They could be harmed from students. (PostS18/Y10).

In the following situation a Year 12 student shifted her opinion from having less concern about this aspect of her education (not concerned - 4) when she stated:

As long as they don't suffer when they are killed and we aren't just cutting for fun – I'm not very concerned. (PreS34Y12)

To justifying her change in attitude to (concerned - 2). The following quote indicated that she had critically considered the issue of dissection in her science course and had begun to appreciate the complexity of the issue.

I am concerned because I think students should access to animals and study, but I don't feel comfortable with dissections because it feels you are going too far and not respecting nature, although many things can be learnt with kinds of investigations so there's no easy answer. (Post S34Y12).

The next section of the questionnaire provided data about whether the information about the regulations protecting animals influenced these students' responses. They were asked about their awareness of the regulations and whether they were adequate to protect animals' undergoing

experimentation. Further exploration of this level of confidence was to express their level of trust in the bodies and individuals that are bound by these regulations.

Regulations, confidence and trust

Students were asked about their knowledge of the rules and regulations applying to the use of animals in RTT by answering yes or no. A small number of this group knew of the regulations (8/39) with the rest (31/39) not being aware of such legislation. The intervention did improve these students' knowledge of the regulations with 27/39 identifying an awareness of the rules in the post intervention questionnaire.

Even though these students felt better informed about the regulations enforcing the ethical use of animals, when asked to estimate their level of confidence that there were sufficient rules and regulations, the following Tables 4-8 show that there are a sizeable percentage of students who remained unconvinced.

Table 4. Confidence in rules and regulations - pre and post intervention - (numbers) and percentages

	1 Very confident	2	3	4	5 Not confident at all
Pre -intervention.					
How confident are you that there are sufficient rules and regulations in place that apply to the use of animals in research, testing and teaching in New Zealand	(5)	(5)	(16)	(8)	(3)
Mean 2.97	12.8	12.8	41.0	20.5	7.7
Post -intervention.					
How confident are you that there are sufficient rules and regulations in place that apply to the use of animals in research, testing and teaching in New Zealand	(8)	(17)	(9)	(3)	(1)
Mean 2.26	20.5	43.6	23.1	7.7	2.6

* Missing from the system Pre (2) and Post (1)

Because of missing data the means in Table 4 cannot provide any evidence of a change in attitude however S2Y10's responses indicate that she became better informed about the government rules and regulations. She initially commented

I don't know much about animal testing prior to this intervention (PreS2Y10)

and post intervention gave voice to the view that

I am now less worried about animal testing as after learning about it, it seems the rules behind testing animals are good and well enforced. (PostS2Y10).

But when students were asked to tick the box that best agreed with their opinion about the statement 'I don't really trust the regulations for controlling the use of animals for research, testing and teaching purposes', it became apparent that there was still a sizeable group who did not trust in the regulations. Table 5 shows that the number/percentage of students not trusting the regulations prior to the intervention (19/39- 48.7%) only slightly dropped (16/39 - 41.0%) post this intervention. Although these numbers showed a small decrease, there were more students disagreeing with this statement post the intervention (pre 4/39 to post 12/39). Although this small sample cannot be used to make any definite statements, perhaps it does show that when students have a strong opinion they may continue to hold it quite strongly despite being given more information about what actually happens.

Table 5. Trust in regulations for controlling the use of animals in RTT- pre and post intervention – (numbers) and percentages

	1 Strongly agree	2	3	4	5 Strongly disagree
Pre -intervention.					
I don't really trust the regulations for controlling the use of animals for RTT purposes	(2)	(17)	(16)	(4)	(0)
Mean 2.56	5.1	43.6	41.0	10.3	0.0
Post -intervention.					
I don't really trust the regulations for controlling the use of animals for RTT purposes	(5)	(11)	(11)	(9)	(3)
Mean 2.84	12.8	28.2	28.2	23.1	7.7

Even though many of these students did not trust the regulations to control the use of animals in RTT, the following Table 6 shows that their trust in scientists not causing unnecessary suffering had increased with the percentage agreeing with this statement rising from 43.6% to 58.9%. However the small variation in the mean indicates that there were a group that remained unconvinced.

Table 6. Trust in scientists not causing unnecessary suffering - pre and post intervention – (numbers) and percentages

	1 Strongly agree	2	3	4	5 Strongly disagree
Pre -intervention.					
Scientists would not cause unnecessary suffering to the animals being used in research and testing.	(3)	(14)	(11)	(8)	(3)
Mean 2.85	7.7	35.9	28.2	20.5	7.7
Post -intervention.					
Scientists would not cause unnecessary suffering to the animals being used in research and testing.	(7)	(16)	(3)	(11)	(2)
Mean 2.61	17.9	41.0	7.7	28.2	5.1

Comments reflecting this increased trust in scientists were:

Most animals used in research have been used in experiments which are approved by an ethics board/committee. (PostS37Y13)

I now know that they check with an ethics committee to ensure it is healthy and safe so I'm not as concerned. (Post S41Y13)

But when students were asked whether they agreed or disagreed with the statement 'I think that some research and testing of animals goes on behind closed doors without an official licence' (Table7),it appears that some students had not been persuaded to change their minds.In fact there were only six students who disagreed with the statement and the figures for rest of the options showed that the numbers of students remained relatively constant.

Table 7.Belief that research and testing goes on behind closed doors - pre and post intervention – (numbers) and percentages

	1 Strongly agree	2	3	4	5 Strongly disagree
Pre -intervention.					
I think that some research and testing of animals goes on behind closed doors without an official licence.	(14)	(12)	(7)	(4)	(2)
	35.9	30.8	17.9	10.3	5.1

Mean 2.18					
Post -intervention.					
I think that some research and testing of animals goes on behind closed doors without an official licence.*	(11)	(13)	(8)	(3)	(3)
	28.9	34.2	21.1	7.9	7.9
Mean 2.31					

* 1 response missing from the Post

This distrustful view of 'some' scientists and situations was expressed by a student in Year 12 who wrote:

I feel animals are still being poorly experimented on. (PostS22Y12)

This viewpoint continued to be expressed when students were asked to provide an opinion about whether New Zealand rules were enforced and if inspections would uncover any mistreatment. Their responses in Table 8 show a grudging acceptance that rules are enforced but this intervention did not make an appreciable difference in the numbers of students showing agreement. Especially noticeable are the unchanging numbers of students who still disagreed with this statement.

Even though students' trust in the inspection system did increase post the intervention from 4/39 (strongly agreeing - 4) to 10/39, there it was not reflected in the mean with a group of students that remained unconvinced. For example 10/39 students prior to the intervention either (disagreed - 4 or strongly disagreed - 5) and 7/39 post the intervention.

Table 8. Rules are enforced and inspections would uncover mistreatment - pre and post intervention - (numbers) and percentages

	1 Strongly agree	2	3	4	5 Strongly disagree
Pre -intervention.					
I expect that the rules in New Zealand on the use of animals for RTT are well enforced. * 1 missing	(6)	(16)	(11)	(4)	(1)
	15.8	42.1	28.9	10.5	2.6
Mean 2.42					
Post -intervention.					
I expect that the rules in New Zealand on the use of animals for RTT are well enforced.	(9)	(12)	(13)	(3)	(2)
	23.1	30.8	33.3	7.7	5.1
Mean 2.41					
Pre -intervention.					
The inspections where animals are kept and how they are looked after would uncover any mistreatment that may be occurring at animal research and teaching institutes.	(4)	(9)	(16)	(6)	(4)
	10.3	23.1	41.0	15.4	10.3
Mean 2.92					
Post -intervention.					
The inspections where animals are kept and how they are looked after would uncover any mistreatment that may be occurring at animal research and teaching institutes.	(10)	(10)	(12)	(6)	(1)
	25.6	25.6	30.8	15.4	2.6
Mean 2.43					

This underlying unease about rule and law enforcement was reflected in the statement:

It is okay, but there will always be people who manage to break the law. The information we got made it seem like it was absolutely fine. (Post S32Y12)

Even though this small-scale study has shown that these students have conflicting opinions about the enforcement of rules and regulations the next section provides data to show that context did influence their opinions.

Contextualised decision-making

What is very apparent is that these students were able to discriminate between different RTT situations. For instance Table 9 shows that the majority of students had already made up their minds about the use of animals in research when it was for medical research purposes. This level of agreement (1 – strongly agree/2- agree) when medical research was involved was at 61.5% pre the intervention and 65.8% from the post intervention questionnaire.

Although the data in Table 9 shows that students are consistent in their opinion about using animals for medical research this was not matched when students were presented with different situations (see Table 10).

Table 9. Acceptance of RTT on animals when it is for medical purposes - pre and post intervention - (numbers) and percentages

	1 Strongly agree	2	3	4	5 Strongly disagree
Pre -intervention.					
The use of animals in research is acceptable so long as it is for medical research purposes.	(8)	(16)	(11)	(3)	(1)
Mean 2.31	20.5	41.0	28.2	7.7	2.6
Post -intervention.					
The use of animals in research is acceptable so long as it is for medical research purposes.	(13)	(12)	(10)	(3)	(0)
* one missing Mean 2.07	34.2	31.6	26.3	7.9	0.0

Statements shown in Table 10 provided different experimental contexts, and students were asked to decide the degree of acceptability by choosing the statements (Always Okay, Sometimes Okay, Never Okay and Unsure). Percentages rather than numbers have been used for this table. The pre and post questionnaire data are identified by using coloured pre and post percentages. Student agreement over 40% has been highlighted and these highlighted data provide the background to the comments that accompany some of these positions.

Table 10. Comparison of percentages finding different situations where animals used in RTT is always okay, sometimes okay, never okay or unsure - pre and post intervention - percentages

Situation	Percentage			
	Always okay	Sometimes okay	Never okay	Unsure
Research into life-threatening diseases such as cancers	61.5	30.8	5.1	2.6
	43.6	46.2	7.7	2.6
Testing the safety of chemicals used in the home such as disinfectants	7.7	38.5	43.6	10.3
	7.7	46.2	41.0	5.1
Testing the safety of cosmetics such as skin care products	2.6	35.9	53.8	7.7
	0.0	46.2	41.0	12.8
Testing the safety of food products, e.g. whether shellfish are fit for human consumption	20.5	56.4	12.8	10.3
	23.1	43.6	23.1	10.3
For teaching purposes such as dissecting rats in school classes	41.0	41.0	15.4	2.6
	28.2	43.6	20.5	7.7
For producing more productive farm animals- such as increasing milk production per cow and wool production	33.3	38.5	20.5	7.7

per sheep.	30.8	51.3	15.4	2.6
For finding out answers to help control health issues like obesity and hair loss	15.4	59.0	17.9	7.7
	23.1	59.0	17.9	0.0
For developing measures to control pests such as possums (post 1 blank)	23.1	48.7	12.8	15.4
	30.8	46.2	17.9	2.6
For improving reproduction in animals, such as increasing lambing rates	25.6	41.0	17.9	15.4
	35.9	46.2	17.9	0.0
For improving livestock welfare- such as preventing disease in cattle herds or preventing stress in transported animals.	38.5	43.6	10.3	7.7
	46.2	46.2	7.7	0.0
Research into debilitating diseases such as Alzheimers' and Multiple Sclerosis	43.6	33.3	12.8	10.3
	35.9	41.0	15.4	5.1
For teaching and learning purposes such as school science projects	28.2	46.2	12.6	12.8
	20.5	53.8	15.4	10.3

It could be said that the 'okays' have it when students are considering life-threatening diseases such as cancer (92%). However when more details of the research procedures were explained in the resource it seems to have transferred some students' opinion from 'Always okay' to 'Sometimes okay'. After this exposure to the reality of animal experimentation it appears that some students were not able to unconditionally condone this activity. The following statements reflect this diversity of views, and that one student was influenced by seeing the mouse with cancer tumours:

I think that testing on animals is done for a good purpose. For example the scientists in the video gave mice cancer to find a way to cure the cancer even though the mice are not harmed by the research. (Post S30Y12).

It was gross seeing the rats with tumour. And it was really sad to see. (Post S21Y12).

The disease context also provides the tick of acceptance when students supported research into Alzheimers and Multiple Sclerosis.

Another area of high acceptance after the intervention was research that is focussed on improving livestock welfare (82.1% pre to 92.4% post). It would be useful to explore the influence of locality with this group of students with 22/39 living in a rural area, as there appeared to be a high acceptance of animal research both before and after the intervention. The following comment illustrates that this student, who was from a rural school, recognised the need for such activity although her approval was qualified:

Some testing is necessary to help improve the lives of people/animals. But I still don't agree with some testing. (Post S21/Y12)

This level of approval of animal research (pre 71.8 to 82.1% post) continued when related to animal production for example increasing milk and wool production. Using animal experimentation to improve lambing rates also had a high level of approval post the intervention (82.1%). These high levels of approval could also be attributed to 22/39 students living in a rural area where animal husbandry and production were relevant issues.

Where some students seemed to draw the line was the use of animals to test the safety of chemicals used in the home and in cosmetics. These activities scored a high percentage of 'Never okay'. For example in some situations students have selected the 'Sometimes okay' category when their opposing views have been tempered by information about ethical procedures from scientists. But the prevailing view of these students is to limit this type of animal experimentation. The following comments reflect their distaste for what they thought unnecessary activities:

I don't like animals being harmed for something that is not essential. (Post S35 Y13)

But what of education? These students seem to have confidence in their teachers providing animals that have been killed humanely. We suggest that attention be given to the numbers of students who choose the 'Never okay' column and this aspect needs more research. The 'Never okay' group found the prospect of animal dissection very off-putting. It is pertinent to note that the percentage of this group saying 'Never okay' to dissection increased from 15.4% to 20.5% after the intervention. As well as demonstrating their abhorrence to such an activity these students provided some very perceptive comments about how animals are used in their classes:

The testing of animals in school usually involves repeating tests that have already been done resulting in unnecessary cruelty to the animals. (Post S2Y10).

I think they are already dead, from humane or natural causes, then it is better. I do not condone boiling worms, or gassing locusts for dissections. But obviously animals are needed for knowledge and learning. (Post S20Y12).

Students' relationship with animals

The last group of findings reflected the complex interactions that students have with animals. These students have both companion and working relationships with a range of animals and this could be explained with two groups of students coming from a rural area. There was a high level of animal interaction within this group with 34/39 students saying they were responsible for a pet, with 19 dogs, 2 farm dogs, 23 cats, a lamb, 3 cows, a donkey and a goat, 4 horses, an alpaca, 3 birds, a rabbit and frogs, fish and lizards making up the menagerie.

Even more significant was their involvement in animal welfare and animal rights' organisations with 17/39 stating they belonged to an organisation. Eleven students were members of the SPCA (Society for the Prevention of Cruelty to Animals). Four students stated they belonged to organisations that actively campaigned for animal rights- for example CARE (Christian Animal Rights Effort), PETA (People for the Ethical Treatment of Animals), SAFE (Save Animals from Exploitation). Two students belonged to Greenpeace and Conservation International. These students provided information about how they supported these organisations with eight giving money, nine buying a product not tested on animals, seven buying a pet from the SPCA, and ten having signed a petition.

Discussion

So what sense can we make from these questionnaire analyses and justifications? This educational intervention was modelled on Johnston and Reid's (1981) assertion that the cognitive component of attitude may be influenced by access to information and teaching. It was hoped that the questionnaire would provide evidence that this cognitive input had some impact on students' attitudes. Although the descriptive statistics do provide some evidence that changes in attitude have occurred what is more interesting is an analysis of these students' justifications.

Johnston and Reid (1981) talk about the barrier created by the 'attitude corpus' that needs to be surmounted for attitude change to occur. They suggest that cognitive influences could be easier to change than affective influences. Although some students' justifications took into account the cognitive input from this ANZCCART resource and the associated teaching, their attitude level remained unchanged. What did change was their justification where they recognised the necessity for some animal research but restated their strongly held views. Perhaps these equivocal responses could be explained by their strongly held 'attitude corpus' that drew on the affective component of attitude.

This research provides examples of students' justifications being linked to their moral convictions with their assertions of animal equality and a belief in animal mind. As well as a moral tone some statements were strongly emotive for example

Because I hate the thought that animals may be harmed for things that might not matter (PreS6Y10).

As Skitka et al., (2005) commented attitudes that are rooted in moral convictions can be resistant to change and these moral certitudes can be expressed with strong emotion. This was the case with some of these students providing justifications that put them in the same camp as these experimental animals by imagining themselves in this situation.

I think animals deserve to be treated humanely. I can't imagine being tested on myself, so imagine how the animals feel (PreS13Y10)

While another student's justification relates to fairness when she stated *Because what did the animals do to us? (Pre S5Y10)*.

It also appears that students' views on animal research are contextualised. Although they are generally accepting of animal research that supports medical research, they are less enthusiastic about using animals for testing the safety of household products and developing cosmetics. These complex and contextualised responses were similar to previous research where it was found that New Zealand students often used an instrumental qualifier to justify their opinions (Birdsall & France, 2011). This student illustrates the complexity of their thinking where the response is linked to the context.

I think that in some cases it is necessary, but I also think that there are cases where it is absolutely not needed e.g. make-up production (PostS20Y12).

Ajzen (2001) comments that when there is a high personal relevance attitude strength is increased. In this research this student's response shows her connection with personal relevance

I do feel sorry for the cats or domestic animals used but I understand they are not harmed and it is benefiting me, others and the animals (Post S40Y13).

A large proportion of students have close relationships with animals and experience the complex interactions that people have with companion animals. Although the justifications do not include particular reference to their pets or the farm animals they are interacting with, there appeared to be an acceptance of animal research when it is associated with agricultural activity.

It appears that the rules and regulations about animal research can be made plain to students but this increased awareness does not result in an increased confidence that these rules are enforced. More important is many students' disbelief that such rules are universally followed and that rogue scientists' behaviour be identified and regulated. Ballantyne and Packer (2005) suggest that in order to change this deeply held perspective there would need to be an opportunity to challenge these beliefs with a target activity.

What is disconcerting is that in some instances students' attitudes towards animal research and animal use in teaching became more negative following the intervention. This trend could be explained in that students' opinions reflected their increasing awareness of the complexity of the problem.

Critical features of a pedagogy to inform views on the use of animals in RTT

This research substantiates previous findings about the complexity underpinning people's views of animal research. Rather than providing an avenue to influence students' attitudes the necessity of animal research this intervention provided students with more information with which to justify their stance. As Knight et al., (2003) commented such attitudinal change about animal use is dependent on context and personal factors.

Johnstone and Reid's (1981) model that provided the justification for attention a cognitive and personal input however this data indicates that such an intervention needs even more attention to affective factors. We suggest that the development of curricula materials need to include activities where students can explore the makeup of their 'attitude corpus'. For example they could have an opportunity to state their beliefs and compare themselves with people from different societal backgrounds. For example a list of statements about animal research can be organised from least acceptable to most acceptable and students can be asked to draw a line of their tolerance/intolerance. Furthermore students can be asked to put themselves in other people's situations and then think about where this line of acceptability would occur (France, Mora & Bay, 2012).

We suggest that video resources need to provide examples of scientists and technicians expressing their attitudes to animal husbandry and the complexity of such close interactions. Barley's (2005)

description of the how animal research laboratories care for their animals would provide resources to counteract some students' uni-dimensional view of how animals are treated. Access to Royal Society SPCA awards to laboratories carrying out animal experimentation could provide information about how scientists are researching ways to replace, reduce and refine the ways animals are used.

The following elements (in no particular order) could be added to this DVD resource in order to help students reflect on their views about animal research with the aim of providing other perspectives. These elements could be:

- DVDs where technicians talk about how they care for the animals in the laboratory.
- DVDs to show the Three Rs of replacement, reduction and refinement in action.
- An activity to explore the convictions of animal rights' activists and the moral power that they consider gives them the authority to act.
- Provide a model to identify cost/benefit analysis for a variety of research situations.
- Provide opportunities for students with strong views about using animals in RTT to present and explain their viewpoint.

However these activities could be considered surface window dressing to the deep pedagogical problem that many students have strongly negative views about the use of animals in RTT. Their views are strongly held, their responses are emotional and their opinions are worth attention.

This intervention has showed us that rather than changing students' minds with cognitive information - that is the experiences from and information about scientists working with animals- we need to pay attention to the affective component of attitude formation (Ajzen&Fishbein, 1980). We need to develop a pedagogy that will ensure students' opinions provide a meaningful contribution to an informed debate about this socio-scientific issue. Certainly this research shows that there is a need for a pedagogy that allows space for students to examine and reflect on the personal factors that influence their attitudes about animal use in research, testing and teaching. This research provides evidence that we have only just scratched the surface of the pedagogical issues involved.

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