Research Paper

Changes in Attitudes to Nature in University Students

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Abstract
Development of positive attitudes towards the environment is an important element in environmental education. We investigated whether students at Deakin University who took the first year level unit SQE112 'Ecology and the Environment' developed any changes in attitudes to nature. Students completed a questionnaire before and after completing the unit of study. The questions provided information on six categories of attitudes towards wildlife. We found students who had taken SQE112 developed significantly more positive attitudes to wildlife in four of these categories (*biocorrect, exploitation, natural stewardship* and *pest rights*) but not in the categories *controlled breeding* and *animal rights*. In contrast, a control group of year one students showed no significant changes in attitudes to nature. Students who studied SQE112 had higher attitude scores initially than the control group, suggesting they were more positively disposed to the environment and chose a course which reflected this greater interest in environment. There were no significant differences in attitude change for students enrolled in SQE112 at metropolitan and regional campuses, although regionally based students initially had much lower scores on the *exploitation* scale. Our results are very similar to those found for USA students.

Key Words: Environmental education, nature, student attitudes

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INTRODUCTION

Environmental education in the sense of educating *for* the environment involves development of appropriate *attitudes* towards the environment. Whilst measurement of students' skill and knowledge acquisition is reasonably straightforward, the measurement of attitude change is somewhat more problematic.

One subset of environmental attitudes which has received considerable attention recently relates to wildlife. For example, Purdy and Decker (1989) developed the Wildlife Attitudes and Values Scale which measured non-economic social values of wildlife. Results of this test have been successfully used to assist in planning and implementing management actions and in communicating management needs to the public. Kellert and his colleagues have used questionnaires to categorise re-

spondents' attitudes to nature into nine categories which make up a typology of attitude scales (Kellert 1980, Kellert 1996).

Recently Caro *et al.* (1994) surveyed students before and after they had taken a unit in Conservation Biology at the University of California to see if there had been changes in the students' attitudes to nature. They modified Kellert's nine category attitude scales of values pertaining to wildlife and assessed student attitudes in six categories. Caro *et al*. (1994) found statistically significant shifts in attitudes in four categories: *biocorrect* reflecting a biocentric view in which all life has equal value (Oelschlaeger 1991), *exploitation* where humans use wildlife to the detriment of the species and their habitats, *natural stewardship* - careful management to enhance animals' survival and welfare, and *pest rights* -in which pest animals such as ants and mice have equal rights to other fauna. They found students showed no change in attitudes related to *controlled breeding* (use of animals in research and leisure) and *animal rights* (animal liberation and welfare issues).

SQE112 Ecology and the Environment is a popular year one unit at Deakin University which includes such topics as introductory ecology, history of the environmental movement, environmental ethics, attitudes, law and economics, as well as case studies in environmental management. It is a core unit in several degree programs, including those in Conservation Ecology, Park Management, Environmental Management, Integrated Catchment Management, Eco-Communication and Environmental Engineering and is also taken by students as an elective. Traditional assessment instruments such as tests, practical exercises, computer simulation exercises and debates can be used to assess student competencies, knowledge and skills. However, they cannot tell us if students have developed positive attitudes towards the environment. We therefore surveyed students who took SQE112 (and those who did not as a control group) before and after they had done the unit. We also aimed to see if students who attended a regional campus (Geelong) differed in their attitudes to nature from those who studied at the metropolitan campuses in Melbourne. Finally, by using an adaptation of the survey used by Caro *et al.* (1994), we hoped to compare attitudes to nature of Australian and USA students.

MATERIALS AND METHODS

Students voluntarily and anonymously completed a questionnaire (Appendix) in the first and last weeks of semester. The questions were modified from those used by Caro *et al.* (1994) to use Australian examples. We also reduced the number of questions to 25 (from 45) because of limitations in availability of access to the subjects. Respondents answered each question in one of seven ways on a graded scale from strongly approve through to strongly disapprove (see Appendix). In a number of questions, answers were in the opposite order to see if there were students who simply responded with a "strongly approve" to every question.

Each question was assigned to at least one of the six attitude scales used by Caro *et al.* (1994). Some questions assessed students' views on a number of scales. For example, Q.8 asked:

> Toads are commonly used in Australian universities to teach principles of cardiac, pulmonary and neuromuscular physiology because amphibians are believed to provide ideal models. Toads are an introduced pest species. Although teaching procedures are humane (the toad brain is destroyed), people argue it is an inappropriate use of living material. Do you support the continued use of "live" toads in teaching biology?

Responses to this question contributed to the overall score for four scales: biocorrect, exploita-

tion, pest rights and animal rights. Table 1 shows the allocation of each question in the survey to the six attitude scales.

A 'strongly approve' response scored one point, 'approve' two and so on to 'strongly disapprove' seven. For questions 10, 13, 16 and 25 the order was reversed.

More students completed the pre unit survey than the post unit survey. This was because of other clashing activities at the time of the last lecture at Geelong. The sample sizes of valid questionnaires are given in Table 2.

Data were entered into an SPSS data file and checked for accuracy of data input, missing values, outliers and the normality of distribution including skewness and kurtosis. A reliability of measures test was conducted followed by a comparison of means using a one-way ANOVA and post hoc Scheffé test (Zar 1986). Reliability tests on the scales were performed using the unweighted

Table 1 Survey questions assigned to the six attitude scales

Scale	Questions in survey
Biocorrect	1, 3, 5, 8, 9, 13, 17, 20, 23, 24
Exploitation	2, 4, 5, 8, 12, 23, 24
Natural Stewardship	4, 7, 10, 19, 25
Pest Rights	6, 8, 14, 20, 22
Controlled Breeding	15, 18, 23
Animal Rights	5, 7, 8, 9, 11, 15, 16, 18

Table 2 Sample sizes of completed questionnaires

Student group	Pre sample size	Post sample size
Control group	**64**	**63**
Test group (those taking SQE112)	**336**	**189**
Urban (Melbourne)	236	157
Regional (Geelong)	100	32

Cronbach's alpha. This gives a multivariate measure of correlation across items in the scale which measures how tightly each subject is grouped in the various questions. Values in which α exceeds 0.5 are required for sufficient reliability (Caro *et al*. 1994).

RESULTS AND DISCUSSION

All scales showed normal distributions with the exception of "Controlled Breeding" and "Natural Stewardship" which were slightly negatively skewed. The overall reliability co-efficient α was 0.89 which indicates the different questions consistently assessed the same attitude in respondents.

The mean scores for student responses in each of the six attitude scales are presented in Table 3.

With the exception of "Controlled Breeding," students taking SQE112 scored higher scores in each attitude scale than the control group in the pre survey. This is not surprising. It suggests that students who enrol in such courses as Conservation Ecology and Environmental Management already have developed positive attitudes to the environment. The control group consisted of students enrolled in Media Studies (metropolitan) and in Mechanical Engineering and Mechatronics (Geelong). Perhaps the higher score for "Controlled Breeding" attitude scale in the control group (compared with the experimental group) is related to our only having

Table 3 Mean scores for answers to the questions relating to the six attitude scales for those studying SQE112 (Treatment Group) and those not taking SQE112 (Control Group)

Scale	Treatment Group		Control Group	
	Pre	Post	Pre	Post
Biocorrect	4.32	4.46*	3.96	3.88
Exploitation	4.44	4.64*	4.11	4.05
Natural Stewardship	5.26	5.32*	4.83	4.90
Pest Rights	3.53	3.72*	3.39	3.28
Controlled Breeding	4.27	4.53	4.38	4.18
Animal Rights	3.96	4.09	3.80	3.77

* Mean Scores differ significantly between pre- and post- surveys for students who studied SQE112 ($p<0.05$). All other comparisons showed no significant differences in mean scores.

Table 4. Mean scores for answers to the questions relating to the six attitude scales for those studying SQE112 at Melbourne (metropolitan group) and at Geelong (regional group).

Scale	Metropolitan Group		Regional Group	
	Pre	Post	Pre	Post
Biocorrect	4.40	4.45	4.13	4.67
Exploitation	4.56	4.02	3.75	4.69
Natural Stewardship	5.28	5.29	5.22	5.43
Pest Rights	3.58	3.73	3.43	4.27
Controlled Breeding	4.35	4.53	4.10	4.35
Animal Rights	4.01	4.09	3.88	4.33

three questions about humans breeding animals for our leisure and scientific pursuits.

Results from the ANOVA show the only significant differences between pre and post groups ($p < 0.05$) were for the cohorts who studied SQE112 (the treatment group) in the scales "Biocorrect," "Exploitation," "Natural Stewardship" and "Pest Rights." Although the differences between mean scores for "Controlled Breeding" were large for both the treatment and the control groups, the very high variability in responses meant the differences were not significant. It is also of interest to note that whereas means scores for the treatment group all increased (although only significantly in four of the attitude scales), those of the controls decreased with the exception of "Natural Stewardship." which was not significant ($p = 0.12$). One interesting difference, however, was in the pre unit survey of students in questions relating to exploitation of wildlife. Regionally based students scored significantly lower on questions related to hunting, multiple use of forests and use of animals in research than their metropolitan counterparts. By the time they had finished the course, however, their views However, we should remember that none of the changes in attitude in the control group were statistically significant.

Table 4 compares scores for SQE112 students studying in Melbourne (the metropolitan campuses) and at Geelong (a regional campus).

Although some of the mean scores which changed over the 13 week semester looked greater for one cohort than for the other (e.g. for "Exploitation" the mean score for the metropolitan group declined 0.54 whilst the mean score for the regional group increased by 0.94), none of the differences between the two groups was statistically significant. Indeed, the largest difference between scores for metropolitan and regional students was for the "Controlled Breeding" scale ($F = 2.45$)

were more similar. Pre unit scores for regional students were lower than those of metropolitan students in all categories, although again, the differences were not statistically significant at the 0.05 level.

The results from Deakin students are similar to those from students attending the University of California. All of the attitude scales scores increased after the US students had completed their course, but as with our study, only increases in the "Biocorrect," "Exploitation," "Natural Stewardship" and "Pest Rights" scales showed statistically significant rises ($p < 0.05$). The initial scores for each category were reasonably similar, with the Australian students having lower scores for the "Biocorrect" and "Exploitation" scales but higher scores for the "Controlled Breeding" and "Animal Rights" scales.

Caro *et al.* (1994) also investigated differences in scores for each of the attitude scales between men and women, between undergraduates and postgraduates taking the course, and between those students with a science background versus a non-science background. They found

a) women enter the programs with more positive environmental attitudes than men, but by the end of the course these differences have disappeared;
b) undergraduates had higher initial scores than postgraduates initially and demonstrated larger increases in score than postgraduates;
c) students from non-science backgrounds had higher scores for the "Animal Rights" scale both before and after taking the unit. There were no differences in scores between the two student groups for the other five attitude scales.

Unfortunately, Caro *et al.* (1994) did not have a control group and thus it is possible other influences (besides their taking Conservation Biology) produced the increases in scores on attitudes to nature.

Our results suggest that students who take SQE112 Ecology and the Environment acquire more positive attitudes towards wildlife, when such attitudes are defined in terms of their adopting stronger biocentric attitudes. These in turn are defined in terms of students adopting attitudes which could be described as more positively biocorrect, less exploitative, demonstrating more care about rights of animals, taking a greater responsibility for nature and showing consideration for animals which have been bred for human use. We have also demonstrated that students who take this unit of study have more positive attitudes to nature initially than those who do not, and that there are no significant differences in changes in attitudes to nature after taking SQE112 for students from metropolitan as opposed to regional campuses. Overall, the results are similar to those for students surveyed in the USA.

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APPENDIX

Survey on Attitudes to Nature

Recently an article was published in the journal *Conservation Biology* in which students at the University of California (Davis Campus) were surveyed on their attitudes towards nature before and after they had undertaken a course in Conservation Biology in year 3 or 4 of their course. The aim of the research was to see if students' attitudes to nature changed as a result of the course.

We would like to undertake a similar study of first year students, before and after your year 1 Ecology & Environment unit. For each question please tick one of the following possible responses:

- strongly approve
- approve
- mildly approve
- indifferent
- mildly disapprove
- disapprove
- strongly disapprove

of the activity described.

1. Cattle grazing in Australia's semi-arid rangelands is thought to have contributed to the reduction of biodiversity by cattle compacting soils, causing erosion, overgrazing, and competing with native fauna for food. However, cattle grazing has brought money and employment into 'unproductive' parts of the country. Do you approve of continued cattle grazing in semi-arid rangelands?

2. Duck hunters claim their actions have prevented the loss of many wetland habitats in this State and that wetland fauna conservation has been enhanced as a result. Hunters also claim they cull birds which would otherwise die from other causes, and that waterfowl hunting is strictly controlled by wildlife authorities. Others, however, claim duck hunters frequently kill non-target protected wildlife, they sometime maim ducks and the birds suffer trauma and pain, and that lead-shot pollutes our wetlands. Do you approve of duck-hunting?

3. Sometimes kangaroos become pests to landholders, destroying crops, breaking fences and competing with domestic stock for food and water. In such circumstances, officers from the Department of Conservation & Natural Resources inspect the situation and may issue permits for a number of kangaroos to be shot. The carcasses cannot be used for commercial gain. Do you approve of landholders being able to shoot 'problem' wildlife?

4. The Victorian Government has recently approved applications for strip mining in a forest surrounded by farms and townships, despite protests by conservationists and residents that the forest's aesthetic and wildlife values will be affected. Do you approve of mining in State Forests?

5. Horse racing employs large numbers of people world-wide and is enjoyed by millions, but infrequently horses get injured and have to be destroyed. Do you agree with horse racing?

6. The Rusden campus is built on many ant colonies, including the introduced Argentine ant. Ants frequently invade the classrooms and laboratories. A simple way of getting rid of the ants is to lay out boric acid which ants take to their nests. This kills the colony. Do you approve of killing ants?

7. Until new techniques are developed, it is vital to continue to use cats and dogs in biomedical research for the development of new treatments. Former pets, now in the council pound (or Lost Dogs Home) are a cheap and easy source of material instead of breeding the animals specially for research. Do you approve of their use in this manner?

8. Toads are commonly used in Australian universities to teach principles of cardiac, pulmonary and neuromuscular physiology because amphibians are believed to provide ideal models. Toads are an introduced pest species. Although teaching procedures are humane (the toad brain is destroyed), people argue it is an inappropriate use of living material. Do you support the continued use of "live" toads in teaching biology?

9. Dolphins that perform tricks for the public undergo extensive positive but also some negative reinforcement during their training. However, dolphins provide enjoyment for thousands of people each year. What is your view on keeping dolphins in captivity so they can perform for the public?

10. At Mount Hotham a road divides the habitat of the rare Mountain Pygmy Possum. Tunnels have been constructed under the road so possums can move between the divided portions of their habitat. Such access is essential for the conservation of the possums. It has been argued that construction of tunnels be extended to other species in new areas, but this involves substantially increased costs to taxpayers. Do you approve of new tunnels?

11. Zoos have roles in education, species conservation, research and entertainment. Yet zoos confine many wild-caught animals. Do you support the idea of zoos?

12. State forests are multiple use resources, in that they are used for timber production, water catchments, wildlife habitat hiking and other passive recreational pursuits. However, they are also used for mining, bee keeping, hunting and four wheel driving. Proponents of multiple use claim the long-term future of the forests is secure since they will "pay their way". Do you agree with multiple use of forests as described here?

13. Styrofoam coffee cups and food containers produce chlorofluorocarbons when they degrade. These contribute to stratospheric ozone depletion. This ozone protects us from high energy radiation which can have serious deleterious environmental effects. A colleague goes out of his way to hassle your friends about using styrofoam cups whenever he sees them use them. He also refuses to buy food served in these containers. Do you approve of his actions?

14. Ultraviolet lamps are used to attract and destroy insects (including moths) which cause annoyance at night. Do you approve of their use?

15. Game birds are bred in Britain on farms and then released to moorland habitats in autumn so that hunters can shoot them. Hunting provides much needed income to the Scottish economy. Do you approve of these breed and release practices?

16. Animal welfare groups illegally enter scientific laboratories to destroy equipment and release experimental animals. Do you support this practice?

17. In the USA cheap beef in many hamburgers comes from cattle raised in Central and South America on lands which have been deforested for grazing. In order to increase hamburger consumption (at lower cost to consumers) the use of beef from these areas should be encouraged.

18. Laboratory animals are bred for the purpose of medical and scientific research which has very important ramifications for our society. Do you support breeding animals (primates, dogs, rats) for this purpose?

19. Wildlife recreation areas sometimes include lakes where many forms of water sports are popular. To stop lakes from filling up with weed and algae, which foul propellers, herbicides are used annually. However, this kills much of the aquatic flora and fauna in those lakes. Do you subscribe to this management policy?

20. Common Brushtail Possums frequently live in roofs of suburban houses. They often annoy householders because of noise, stained ceilings and odour. Professional pest controllers trap possums, take them to the RSPCA which then

releases them to bushland. However, research indicates that most of these animals will die within one week, often painfully from predation or starvation. Do you approve of possums being trapped and released into the bush?

21. The Dugong is a threatened species. In some indigenous cultures of northern Australia and Papua New Guinea great status is given to hunters who catch a Dugong and hunting these animals has great cultural significance. Do you agree that indigenous people should be allowed to continue to hunt Dugongs even though they are threatened with extinction?

22. Smallpox was a disease which only affected humans. It caused hundreds of thousands of painful deaths up until the mid twentieth century when a campaign to eliminate it was established by the World Health Organization. The smallpox virus has now been eradicated worldwide but exists in two protected laboratories for scientific study. Would you support destroying the two remaining stocks of smallpox?

23. Humans have been directing the breeding of dogs to achieve particular characteristics for many generations. For instance, border collies and kelpies have been bred to be working dogs, Labradors to be guide dogs, greyhounds for racing etc. Other breeds have been developed for their aggression (guard dogs) or show dogs with distorted features (such as bulldogs which acquire respiratory difficulties; one breed lacks fur completely). Do you approve of continued artificial selection in dogs by humans?

24. In Queensland there is a ban on hunting crocodiles. However, people are occasionally attacked by crocodiles. The offending crocodile is usually hunted and shot to prevent further occurrences. Do you agree with this practice?

25. Powerful Owls are Australia's largest owls; they are also declared *rare* species. A family of these owls lives at Warrandyte State Park using possums for food. It has been estimated the family needs about 275 possums a year. To alleviate predation pressure on this native wildlife, people have suggested park staff put "possum sized" chunks of meat in trees to provide alternative food sources for the owls. Do you agree with this suggestion?