
Dissection as an Instructional Technique in Secondary Science: Choice and Alternatives

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This article examines the role of dissection in the teaching of secondary biology and environmental science, within the context of the development of attitudes toward animals. Retrospective data concerning their experience in high school with dissection for 191 undergraduate education students are described, and their reported use of alternatives to invasive animal study are evaluated in relation to specific educational objectives in secondary science. It was found that most students were required to perform dissections, that many but not most experienced negative and stable emotional reactions, and that teachers employed limited alternatives to dissection in their classes. The implications of this for secondary science teaching and for teacher education are discussed.

Dissection for the primary purpose of studying the anatomical structure of animals has been used for centuries in science education, and remains an important part of secondary biology and environmental science in North America and elsewhere (Leib, 1985). Recently the practice of dissection has come under increasingly critical scrutiny by educators and psychologists concerned about the sacrifice of animals for teaching purposes (Morton, 1987; Rowan, 1984; Shapiro, 1987).

Three broad aims are encompassed within secondary science teaching. These are: (i) an understanding of the process of scientific inquiry, (ii) the acquisition of skills considered essential for work in science and technology, (iii) the development of a sensitivity about science and its influence on, and response to societal issues and values. Laboratory-based activities, including dissection, have been generally assumed to enhance "scientific thinking" which is presumed to involve analytic and organizational abilities, as well as practical investigative skills. However, there is a need for research to document such assumptions (Hofstein & Lunetta, 1982).

The central affective goal in the secondary science curriculum is that learning should engender a "reverence for life". This includes teaching students appropriate care

for animals, skills in handling them and returning them safely to the natural environment, and the maintenance of their health, comfort and lives (National Science Teachers Association, 1980). The humane treatment of animals and the development of positive, caring attitudes, is a recurrent theme in curricular documents across North America. Science teachers themselves remain responsible for decisions concerning the types of animal study to employ in the classroom, commensurate with the cognitive and affective development of students (Boylan & Bowd, 1985).

Critics of dissection have argued that it is contrary to the aim of engendering a respect for life (Russell, 1980). There is some evidence that it may create negative emotional reactions in students, distance them affectively from animals, and teach them to regard animals as expendable tools (Bowd, 1988; Heim, 1981; Kelly, 1986; Russell, 1980). However, there is only limited data concerning students' emotional reactions to dissection, the degree of choice permitted them in employing the method, and the actual implementation of alternatives by teachers. For these reasons, as well as the ethical issues raised by animal suffering and death, it is important for teachers to be informed of alternatives to dissection and to employ them appropriately.

Method

Undergraduate education students attending a mandatory course in educational psychology at an Ontario university took part in the study. Participation was voluntary, and no available students declined. Of 250 enrolled, 191 in attendance took part (115 females, 76 males). Median age of participants was 24 years (range 21-46). The majority of students (67%) had completed grade 12/university entrance level biology or environmental science, 24% had completed these subjects to grade 11 and only 9% had completed them to less than a grade 11 level.

Participants completed a self-report, anonymous questionnaire in class. Directions indicated that the questions were designed to explore the use of dissection and alternatives to it at high school. Age and gender were requested, and respondents were asked to indicate the level of education received in secondary biology or environmental science.

Seven items which followed dealt with students' experiences with dissection. Objective response items addressed whether the student had used dissection, whether it was compulsory in some or all relevant courses, whether the individual had chosen not to enroll in a course because dissection was required, the range of animals used and the

employment of alternatives and supplements in class. Two open-ended items were used to seek information about the respondents' feelings about performing dissection at the time, and whether those feelings had altered.

Results

The substantial majority of students surveyed (88.4%) reported having carried out dissection in high school. Dissection is part of the biology and environmental studies syllabus at the grade 11 and grade 12/university entrance levels in Ontario. Students were asked to indicate whether they had decided not to enroll in a high school science course because it would involve dissection, and 10.5% indicated this to be so.

Participation in dissection was a requirement for most students surveyed. Sixty-nine percent indicated that it was a compulsory element of their courses, 6% stated that it was voluntary in some courses in which they had enrolled, but compulsory in others, and 19% reported that participation had been voluntary.

The most commonly used species for dissection are invertebrates and amphibians, although some mammals, largely rodents, are also widely employed.

Participants were asked to recall and describe their emotional reactions when they first took part in a dissection procedure. Their open-ended responses were classified as

Table 1.
Reported frequency of species used in dissection

Type of animal	Percentage reporting use
Worm/other invertebrate	61.0
Frog/other amphibian	81.4
Fish	27.9
Bird	5.8
Rat/other rodent	30.2
Other mammals/separated organs	41.3

Table 2.
Emotional Reactions to Dissection Experience

Type of reaction	Percentage	
	Initial	Current
Positive/neutral	29.7	5.2
Negative	26.7	9.9
Mixed	38.4	2.9
None described	5.2	-
Unchanged from initial reaction	-	82.0

negative (e.g. "I felt disgust"), neutral/positive (e.g. "I just felt it was a way to teach us", "I was fascinated") or mixed (e.g. "I was interested and curious, but also felt revulsion, especially because of the smell of formaldehyde"). The classification of statements into three categories was in part determined by the data. A significant number of participants provided responses which were non-evaluative, along with a combination of positive and negative reports.

A larger variety of negative responses to dissection was apparent in comparison with those classified as neutral and positive. Concern for animal welfare and conservation was expressed by some: "Bullfrogs will become endangered eventually," "Animals are feeling creatures, not laboratory tools," "I am a vegetarian and don't believe in killing animals at all." Others referred to the instructional worth of dissection: "I didn't learn anything because we were bored and just fooled about," "I didn't like dissection because it seemed like a waste of time." A large number of negative responses concerned physical sensations such as odour: "I hated it because of the smell," "Having to cut animals open disgusted me: the slimy feel of doing it put me off." Most positive comments focussed on interest aroused in biology through a method seen as practical and involving direct activity.

The current feelings of students when recalling their involvement were also obtained and classified in the same way. The data reported in Table 2 indicate that approximately 30%

of respondents report experiencing no form of negative emotional reaction to dissection, and are either positive or neutral about the procedure. While 27% report negative feelings exclusively,

a further 38% report negative feelings combined with positive, most often that their curiosity and interest was aroused. Thus, more than half experience negative feelings, and about one fourth report negative reactions alone. Most students indicated that their feelings had remained unchanged from the reported earlier reactions.

A majority of participants reported experience with some alternatives or supplements

Table 3.
Experience with Alternatives to Dissection

Alternative	Percentage reporting experience
Charts and diagrams	56.4
Models	54.1
Human physiological measures	31.3
Videotapes or films	19.2
Internal microphotography	14.5
Transparent organisms	14.5
Computer simulations	2.3

to dissection (see Table 3). About half reported the use of models, charts or diagrams in the science classroom, usually in addition to dissection, rather than as a replacement. Human physiological measurement, such as heart rate and respiration, was used by about one-third of respondents. However, only relatively small proportions reported experience with more sophisticated alternatives such as computer simulations, internal microphotography films, and videotaped demonstrations.

Discussion and Conclusions

There are two methodological limitations to the present study which imply that caution should be exercised in generalizing from the data reported. As a retrospective survey, it must be recognized that memory distortion may bias data. Respondents were asked to recall experiences which occurred, on the average, six years previously. However, it should be noted that the response rate to all items was 100%, including open-ended items, suggesting that participants experienced little difficulty in recalling the information requested.

Most participants in this study attended high school in the province of Ontario, with approximately 10% having attended school elsewhere in Canada. Secondary biology and environmental science curricula in Ontario are comparable with those in other jurisdictions in Canada and the United States in regard to aims, objectives and methods. However, caution should be exercised in generalizing across education systems.

The data suggest that most students are not permitted choice regarding participation in dissection when it is a scheduled part of their secondary science program. It is likely that teachers mandate participation because they have not been sufficiently sensitized to the central aim of the life sciences at the secondary level, the encouragement of a reverence for life. It may also be the case that many are unaware of alternatives, or have not been encouraged to employ them. The British Veterinary Association Animal Welfare Foundation has observed that "a very large part of school biology need not involve dissection at all, and teachers should use the many alternatives which are now available... since the enforced practice of dissection can be upsetting to many students" (British Veterinary Association, n.d.).

The data presented here confirm that many students, and not a small minority, experience negative feelings about dissection, and that these reactions are long-lasting. It is apparent that negative emotional responses to dissection have several sources and do not simply reflect an ethical position favoring the humane treatment of animals. In particular, students may express a desire not to participate based upon feelings

commonly referred to as “squeamishness,” and not because these feelings are accompanied by a logical set of ethical beliefs. This observation raises an interesting question: Should students be excused from dissection simply because they do not like it? Certainly this would not be considered an adequate reason by many educators who may cite initial negative reactions in other areas (mathematics, for example), which disappear with mastery. The most compelling reasons for abandoning dissection at the secondary level are pedagogical as well as ethical. The method is ineffective in achieving stated objectives, contrary to basic goals in the teaching of natural science, and easily replaced by superior alternatives.

Teachers need to be made aware of these facts, particularly in relation to the likelihood that the vast majority of students forced to perform dissections in high school will not be entering professions where such skills will be applied. Sharpe (1988) notes that many British educational institutions have endorsed the *Students' charter of rights to violence-free science*, a statement endorsing the right of choice without academic penalty. The present data tend to support the value of choice in reducing negative emotional outcomes among students.

The present data suggest that teachers tend to regard alternatives as supplements to dissection. This may be because they make less use of the more sophisticated technological innovations now available. Teachers' limited use of alternatives implies that science methods courses in teacher education institutions should include training in this area. This should supplement current emphases on field-based and ecological study, as the focus continues to shift away from the laboratory to the investigation of life in the natural environment.

Note

1. Parts of this paper were presented at the annual conference, Canadian Society for the Study of Education, Quebec City, 1989. Correspondence should be sent to Alan D. Bowd, School of Education, Lakehead University, Thunder Bay, Ontario, Canada P7B 5E1.

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