

**Dissection in Massachusetts Classrooms:
Correlation of gender, teacher attitudes, and conscientious objection**

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ABSTRACT

This study examines the relation of animal dissection to gender imbalances in the sciences by examining whether student gender affects several factors in classroom dissections. Findings suggest that in Massachusetts, conscientious objection to dissection occurs in most classrooms, the majority of objectors are female, and most are granted alternatives, though a small fraction representing hundreds of students, are not. This study suggests that legislation to allow students alternatives to dissection would be acceptable to the majority of science teachers.

INTRODUCTION

In 1987, a fifteen-year-old vegetarian refused to dissect a frog, was denied an alternative by her principal, and subsequently sued her California school system (*New York Times*, 1987). The student, Jenifer Graham, maintained her First Amendment right to freedom of religion would be violated if she were forced to dissect (*USA Today*, 1987). Interest in ethical components of cutting cadavers for biological study had originated ninety years earlier, when England's first female physician, Anna Kingsford, rallied against the use of animals in medical education (Vyvyan, 1989). Not before Graham's case, however, had conscientious objection to dissection been upheld as a civil right (Francione and Charlton, 1992). Following the lead of the courts, California, Florida, Illinois, Louisiana, Maryland, New York, Pennsylvania, and Rhode Island have since adopted dissection-choice laws (Ethical Science and Education Coalition, 2001; Illinois Compiled Statutes).

Recent interest in alternatives to dissection has prompted articles in education journals (e.g., Balcombe, 1997a; Allchin, 2000) and the popular press (e.g., Anderson, 1999; Pring, 1999; Smith, 1999; Coleman, 2000; Lingblom, 2000). This literature confirms that conscientious objectors are a diverse group. Some students object to dissection for religious reasons – for instance, some Muslim students will not dissect fetal pigs – whereas others oppose the killing of animals, the removal of animals from their habitats (Rosenberger, 1998), or disrespectful treatment of the dead (Doster *et al.*, 1997). Because of student diversity, no “litmus” test can evaluate the sincerity of an objection. For example, some conscientious objectors are vegetarians; others eat meat.

Educators currently use slides, models, videos, and computer programs, as well as dissection, to teach anatomy. A meta-analysis of research evaluating the validity of alternatives found that

non-animal alternatives have equivalent or superior educational value to dissection or live animal laboratories (Balcombe, 2001). Despite viable alternatives, forced dissection still occurs in high school classrooms. According to Cunningham (2000: 197), teachers who refuse to provide alternatives do so based on the following beliefs:

1. Traditional animal laboratories are indispensable to science education and necessary to the future of scientific research.
2. No adequate alternatives exist to animal labs, and forcing the teacher to abolish these labs is a threat to academic freedom.
3. Reducing student opposition to an animal lab is a matter of clearly explaining its rationale.

Gender issues in science education

Anecdotal evidence suggests more girls than boys refuse to dissect. Statistically, fewer women than men pursue advanced science degrees, and in most science fields, women are a minority (National Science Foundation, 1998). Some academics speculate these may not be independent phenomena: forced dissection may deter some girls from pursuing science careers.

In middle school, girls perform equally well, or better, than boys; however, gender disparities in students' *interest* in science begin to emerge at this age (Catsambis, 1995) and become solidified by a student's senior year of high school (Oakes, 1990; AAUW, 1992). A meta-analysis of science-education research from 1970 to 1991 showed that school-age boys have a more positive attitude toward science in general than girls. (Weinburgh, 1995). More recent studies confirm these findings (Greenfield, 1997). Although high school achievement, parental attitudes, and socioeconomic factors influence whether students pursue science and math majors

in college, no combination of these accounts for the gender gap in the sciences (Baker & Leary, 1995).

Dissection generally is less appealing to girls than boys (Dawson, 2000). In one of the few studies examining student attitudes toward dissection, a greater number of girls than boys reported feeling dissection is unnecessary or wrong; additionally, more girls reported it made them “feel squeamish” (Lock, 1994). The reasons for this may be two-fold: 1. Students who don’t believe in the usefulness or purpose of a certain activity – such as dissection – dismiss lab as a waste of time (Weinburgh & Englehard, 1994); and 2. Some girls do not want to participate in dissection because it is “cruel” or “gross” (Baker & Leary, 1995; Burkham, *et al.*, 1997). Dissection sometimes conflicts with girls’ interest in science and their belief in its purpose which is “often based on a desire to help people, animals, plants, or the earth” (Baker & Leary, 1995; Jones *et al.* 2000).

Offner (1995) estimated that 3 to 5% of students offer unsolicited objections to dissection; however, other literature suggests that a significantly greater number of students object to dissection but do not voice their complaints. Doster *et al.* (1997) found that 22% of 85 students agreed with the statement, “I am opposed to killing animals” (in the context of dissection), and 26% responded that they were undecided. Teachers and administrators sometimes foster an atmosphere that is unreceptive to ethical considerations of dissection (Balcombe, 1997a; Cunningham, 2000).

Published research to date has not measured the frequency of conscientious objection, the proportion of conscientious objectors that are female, or the likelihood that students who object are granted alternatives. The present study fills this gap. Through a written survey, the influence of gender on teacher attitudes and student objection were examined to test the

following hypotheses: Female students will object to dissection more often, and teachers will not grant all students alternatives to dissection. Student objection to dissection will occur more often in classrooms of teachers with positive attitudes toward alternatives than in the classrooms of teachers with negative attitudes.

Massachusetts is an ideal location for this research because it lacks dissection-choice legislation, therefore a wide array of various dissection policies exist among individual school systems. The study is timely because dissection-choice legislation is under consideration at the Statehouse.

METHODS

Subjects

Subjects included all (2,080) life science teachers certified by the Massachusetts Department of Education with addresses in the United States. A cover letter and two-page survey were sent to all subjects in the first week of July, 2001. Surveys were not coded to check for response, therefore, three weeks later, a reminder postcard was sent to the entire list. Responses received by October 11, 2001 were included in the analysis.

Survey tool

The two-page questionnaire determined demographics, attitudes, and the incidence of conscientious objection to dissection. Teachers were asked why they did or did not offer dissection and why they did or did not provide alternatives to dissection. Questions also measured teacher attitudes regarding the validity of dissection alternatives, teachers'

recollection of the number and gender of conscientious objectors in their classrooms in Massachusetts, and the level of support for dissection-choice legislation.

We acknowledge the term “conscientious objection” denotes a broad spectrum of moral, ethical, and aesthetic arguments against cutting animal cadavers. For the purposes of this study, conscientious objection is identified as a “discomfort or moral objection to dissecting animals.” Alternative projects include videos, slides, plastic models, and computer programs, as well as non-anatomy projects, the observation of dissection, or any other activity that replaces an actual dissection.

Analysis

Data on attitudes toward animal dissections and alternatives were gathered by measuring the perceived importance of dissection, asking teachers to compare alternatives to actual dissections, gauging whether dissection was used and whether alternatives were available, and registering the level of support for dissection-choice legislation.

Descriptive and inferential statistics were used for data analysis. A two-tailed, t-test was used to examine differences between male and female teachers, while chi-square was used to test significant correlations among gender, attitudes toward dissection and alternatives, and the prevalence of conscientious objection to dissection.

RESULTS

Surveys received and demographics

A total of 708 replies were received (34% return rate). Of these only 667 were considered; others were invalid because they were incomplete or noted the presence of certification but no classroom experience.

Of those considered, 352 respondents (52.8%) were female and 309 (46.3%) were male. Six (0.9%) did not indicate their gender. Respondents' ages ranged from 24 to 74 with a mean age of 49; they reported teaching biology from 1 to 42 years with an overall mean of 18.1. Women taught, on average, fewer years than men (15.2 years versus 21.2 years, respectively). Female teachers were, on average, slightly younger than male teachers (mean 47.8 years versus 51.2 years, respectively, X^2 (df=5) = 31.6, $p < 0.01$).

Teacher attitudes

When asked how important (1 essential - 5 unimportant) dissection is to teaching biology, means were similar for women (2.65) and men (2.46); however, male teachers reported that dissection is "essential" significantly more often than female teachers did (27.8% vs. 17.4%, respectively, $p < 0.03$). Approximately 54% of teachers indicated that dissection was important or essential (Table 1).

In all, 78.1% of respondents said they offered dissection at least once over their last five years of teaching, and of these, 78.1% offered alternatives. Neither gender nor age correlated with whether teachers offered dissections or alternatives. When asked how alternatives compared to dissections, computer simulation was ranked as comparable or superior to dissections by 50.8% of respondents. Female teachers were significantly more positive about computer programs than male teachers were (Figure 1a); however, no gender difference was found in attitudes toward videos (Figure 1b), slides (Figure 1c), and models (Figure 1d).

When asked to gauge their support of a bill that would require that teachers offer alternatives to students who do not want to dissect, 63.6% of teachers were supportive or strongly supportive of the bill. Female teachers reported higher levels of support for the proposed legislation (70.0%) than male teachers (57.5%) did (Table 2), but there was no age correlation ($p=0.85$).

Teachers varied tremendously in the numbers of conscientious objectors they reported. Over the last five years of teaching, respondents reported a mean of 10 (range 0-225, median 5), with female teachers reporting fewer students than male teachers did (9.0 versus 11.8, respectively; $t_{[502]}=1.67$, $p = 0.10$; Figure 2).

Student objection

Teachers reported that nearly three times as many female students objected (7.7) than male students (2.74) (median 4 versus 1, respectively; range 0-150 versus 0-100, respectively; Figure 2). Respondents reported most students were granted alternatives, and that female and male students were granted alternatives at similar frequencies (96.8% versus 98.1%, respectively). Teacher gender did not appear to influence whether students of one gender were granted alternatives more often than the other.

Teacher attitude and student objection

Data were examined to determine whether teacher attitude correlated to the number of students objecting to dissection. Teachers who offered alternatives reported greater numbers of students objecting to dissection ($n=395$ teachers, mean 11.4 students) than teachers who did not ($n=110$ teachers, mean 5.6 students). However, 56 of the 110

teachers reported they did not offer alternatives because “no student approached me for an alternative.” When these cases were removed, the mean number of students objecting increased from 5.6 to 7.8. As a consequence of smaller sample size, this mean (7.8) is not statistically different from the mean number reported by teachers that offered alternatives (11.4).

Teachers who “strongly supported” dissection-choice legislation reported a mean of 15 students objecting in their classrooms, whereas those “strongly opposed” reported a mean of 9 students. While this finding did not reach the standard level of significance ($t_{(df=190)} = 1.648, p = 0.10$), it does suggest a possible trend.

DISCUSSION

This study shows that there are differences between girls and boys in whether they object to animal dissections. Encountering a student with a conscientious objection to dissection is part of nearly every teacher’s experience, and a majority of teachers comply with students’ requests for alternatives. However, a small but significant number of students object to dissection but are not granted alternatives.

Teacher attitudes and student objection

It is meaningful that one-quarter of teachers, both female and male, selected indicators that dissection was not important, given both the activity’s prominence in public schools and certain claims of consensus among biology teachers (Offner, 2001).

Dissection was offered at least once in the last five years by three-quarters of respondents; however, there is no way to differentiate middle school from high school teachers. The

Massachusetts curriculum guidelines leave little time for dissection at the middle school level where anatomy is not an important component. Therefore, the frequency at which dissection is offered at the middle school level is likely to be declining and probably fewer than three-quarters of middle school teachers now offer dissection in a given year.

Although no specific hypotheses about age-effects were generated, we did expect to find that younger teachers would have more likely offered alternatives than older teachers did. Surprisingly, no age difference was evident. This suggests that attitudes in teacher education toward dissection and alternatives may not be changing, despite the move toward alternative ways of teaching anatomy in post-secondary institutions. For example, half of American medical schools – including Harvard and Yale – now teach aspiring doctors without animal labs (PCRM, 2002).

Of note, nearly 63% (35) of those teachers who reported in the first part of the survey that “no student approached me for an alternative” later reported that at least one student approached them over the past five years because they were “uncomfortable or had a moral objection” to dissection. Therefore, there was some inconsistency in reporting. If this were rectified, a correlation between teacher gender and student requests may emerge, given that teacher gender correlated with attitude in these findings.

Possible Limitations

The response rate (34%) for the survey was limited due to two factors: the survey was distributed during the summer, and there was some confusion among middle school teachers about whether they should complete the survey, because the initial mailing was addressed to high-school biology teachers. However, the survey was sent to the entire sampling frame, and therefore, a

34% response rate represents a full one-third of Massachusetts life science teachers. While results may or may not be extrapolated to the entire population, they are certainly valid for the large portion of the population that responded.

It is possible that many fewer students are granted alternatives than teachers indicated. Although teachers who did not offer alternatives frequently reported that no student approached them for alternatives, it is unlikely that one-fifth of all teachers did not offer alternatives while 96% of students who expressed discomfort about dissection were granted alternatives. While data did not support the hypothesis that teacher attitude correlated with the incidence of conscientious objection, the discord between the number of teachers who did not offer alternatives and the overall high number of students who received alternatives suggests inaccuracy in reporting. This may be due to the inherent weakness of a retrospective approach where teachers are asked to recall instances from past years. Or, it may be a case of respondents using coping mechanisms to deal with the dissonance between what they think they do (or should do) and what they actually do.

Areas for future research

That the incidence of student objections may be underreported suggests that there may in fact be a significant relationship between teacher attitudes and number of conscientious objectors; this could be examined in future research. Additionally, since the range of objectors reported by teachers is so vast, there is likely to be some phenomenon that differentiates the classrooms of teachers who report as many as 250 conscientious objectors in five years from those classrooms of teachers who report no conscientious objectors at all. This could be explored through qualitative research.

Policy implications

Nearly two-thirds of biology teachers supported the intent of a state bill to allow students to “complete alternative exercises instead of dissection in public schools” with parent or guardian consent. This is intriguing, given that such bills have failed when introduced in Massachusetts, and that their opponents argue that teachers do not want government interference in their classrooms (Johnson, 2001).

Because the cost of specimens is high and because specimens are nonetheless often used in conjunction with alternatives, it is likely that the financial cost of alternatives does not prevent teachers who dissect from also providing alternatives. In fact, a cost comparison of specimens versus alternatives found alternatives to be significantly less expensive (Balcombe, 1997b). Purchasing models or computer programs for *individual* students, however, may be an economic burden. The most common alternatives cost \$30 to \$500, whereas individual specimens cost \$6 to \$43.

Furthermore, arguments against dissection-choice legislation have often rested on the assumption that teachers offer alternatives to any student who sincerely wants them. The findings are clear: Not every student is granted an alternative. If 90% of the 2,080 teachers certified to teach biology in Massachusetts currently teach in public schools, then the number of student objectors can be extrapolated to be 14,445 girls and 5,127 boys statewide per 5-year period, based on numbers reported by respondents (mean of 2.74 boys and 7.72 girls per teacher per 5-year period). Although more than 96% are given alternatives, if the remaining students are not, in the span of five years, approximately 462 girls and 97 boys will approach their teachers with objections to dissection but will not receive alternatives. It is possible that even greater

numbers of students harbor objections to dissection but do not feel comfortable expressing these feelings to teachers after they hear that classmates were refused.

Conclusions

This research found that conscientious objection occurs in most teachers' classrooms, the majority of conscientious objectors are female, most are granted alternatives, and a small fraction representing hundreds of students are not given alternatives. Approximately 51% of teachers deemed computer programs superior or comparable alternatives to actual dissections, and nearly two-thirds of biology teachers support dissection-choice legislation.

ACKNOWLEDGEMENTS

This research was funded by the Center for Animals and Public Policy, Tufts University School of Veterinary Medicine. We gratefully thank our colleagues in the Center, and all who participated in the study.

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Table 1 Attitudes of teachers towards dissection, by gender

IMPORTANCE OF DISSECTION	FEMALE	MALE	TOTAL
1 = Essential	59 (17.4%)	84 (27.8%)	143 (22.3%)
2	115 (33.8%)	88 (29.1%)	203 (31.6%)
3	78 (22.9%)	56 (18.5%)	134 (20.9%)
4	63 (18.5%)	54 (17.9%)	117 (18.2%)
5 = Unimportant	25 (7.4%)	20 (6.7%)	45 (7.0%)
Total	340 (100%)	302 (100%)	642 (100%)

$$X^2_{(df=4)} = 10.6, p = 0.03$$

Table 2: Offering of alternatives, by teacher gender and age, for those who used dissection

Alternatives Offered?	Yes	No
GENDER		
Female	213 (79.8%)	54 (20.2%)
Male	189 (76.5%)	58 (23.5%)
AGE		
20-29	8 (66.7%)	4 (33.3%)
30-39	69 (86.3%)	11 (13.8%)
40-49	129 (75.0%)	43 (25.0%)
50-59	262 (77.3%)	77 (22.7%)
60-69	37 (84.1%)	7 (15.9%)
70-79	1 (100%)	0

Gender: X^2 (df=1) = 0.80, p=0.37; Age: X^2 (df=5) = 6.32, p=0.28

Table 3: Support of Dissection Choice bill in Massachusetts, by teacher gender

ATTITUDE	FEMALE	MALE	TOTAL
Strongly support	88 (26.1%)	58 (19.4%)	146 (23.0%)
Support	144 (42.7%)	114 (38.1%)	258 (40.6%)
Oppose	59 (17.5%)	62 (20.7%)	121 (19.0%)
Strongly oppose	46 (13.6%)	65 (21.7%)	111 (23.0%)
TOTAL	337 (100%)	299 (100%)	636 (100%)

$$X^2_{(df=3)} = 10.75, p=0.01$$

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Figure 1: Attitudes of teachers towards various alternatives to dissection, by teacher gender in relation to the use of a) computer simulation ($t[613] = 2.67, p < 0.01$), b) slides ($t[619] = -0.48, p = 0.63$), c) video ($t[620] = 0.71, p = 0.48$), and d) models ($t[624] = 1.79, p = 0.86$).

Figure 2: Number of students objecting to dissection by gender of student and teacher

Figure 1a:

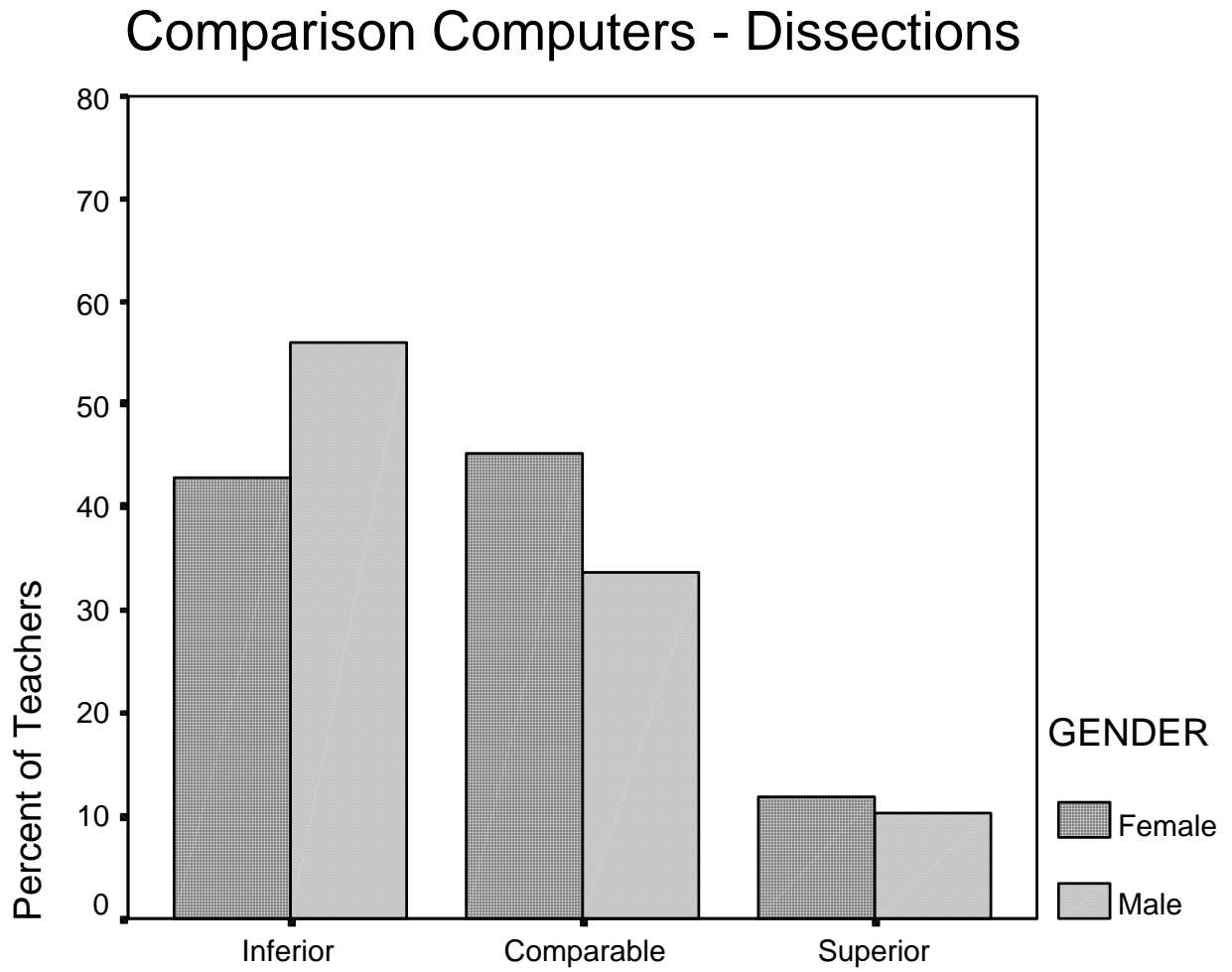


Figure 1b:

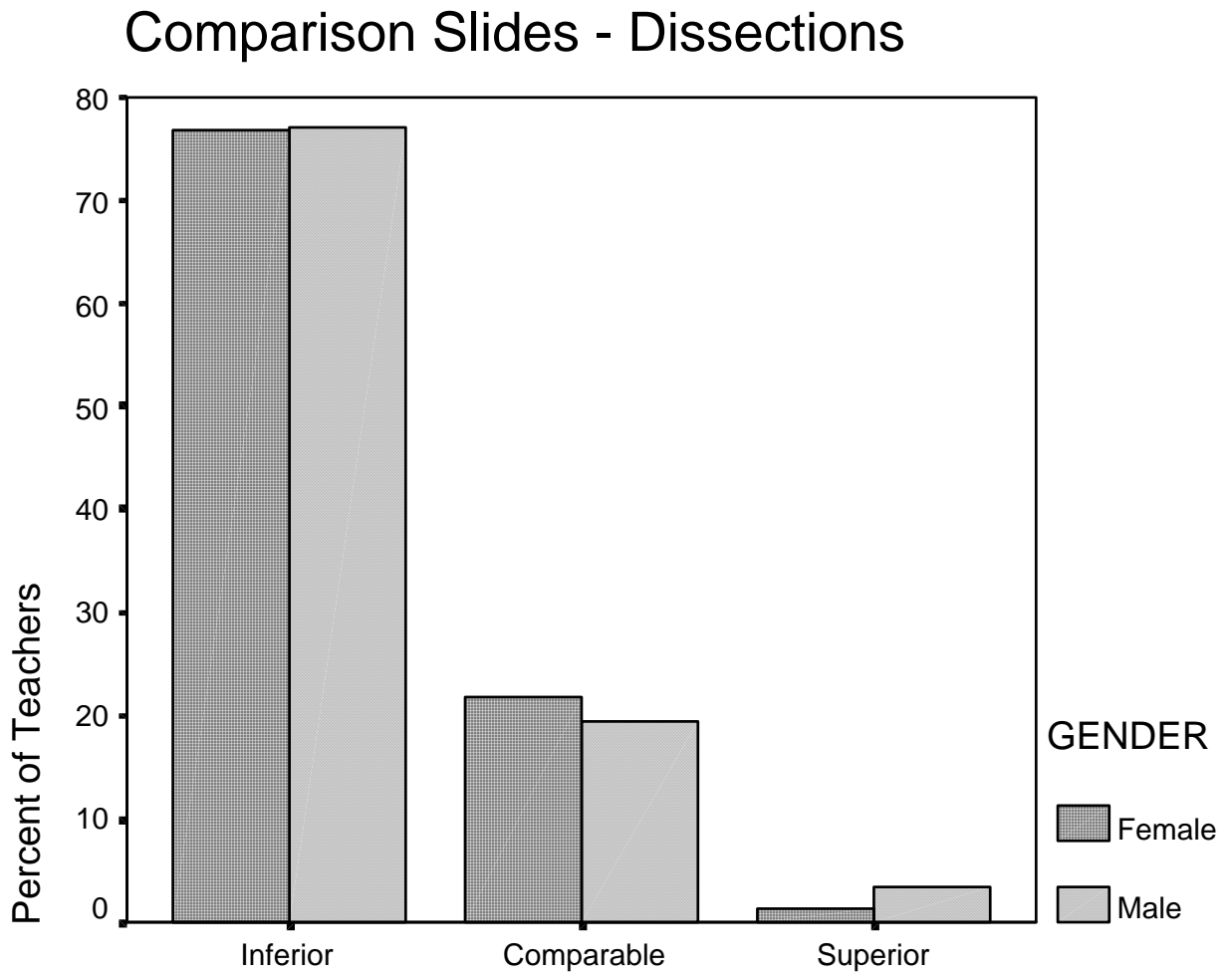


Figure 1c:

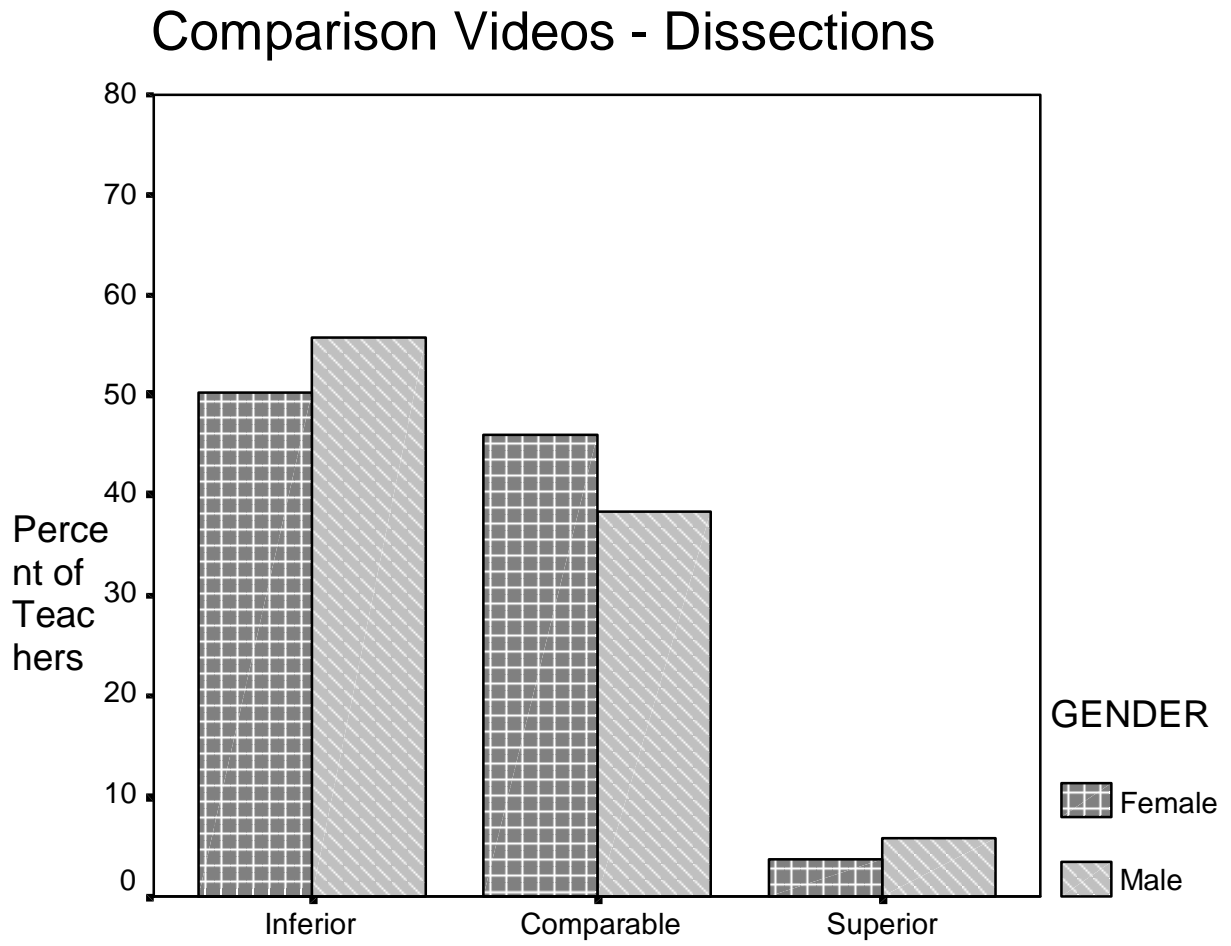


Figure 1d:

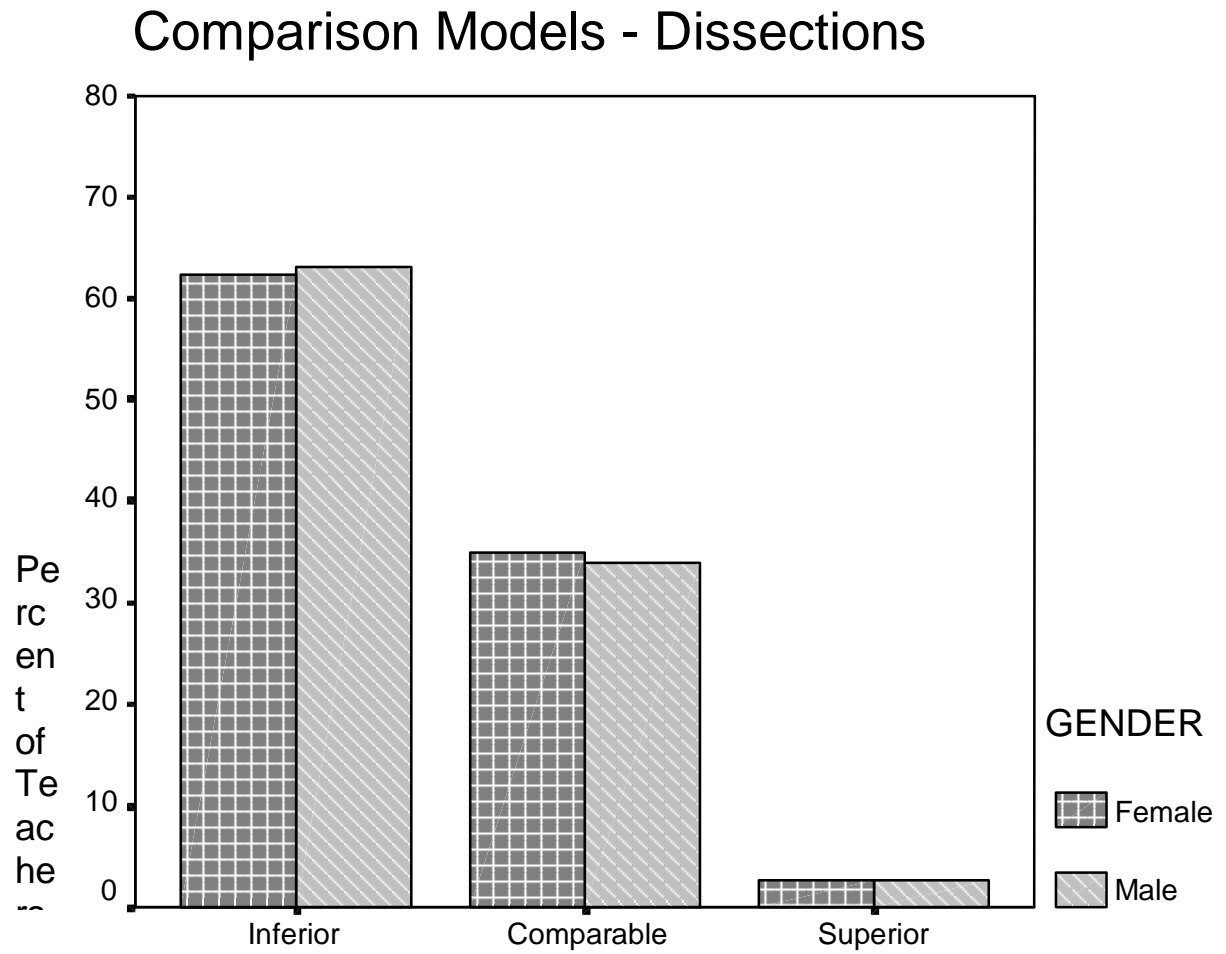


Figure 2:

