Debate as a Final Examination in a Computer Ethics Course

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Abstract

The goals of our senior-level course, *Social, Ethical and Professional Issues in Computing*, include preparing students to think critically and to argue effectively about ethical issues that surround the field of computing. The course text, classroom activities, and assignments are geared toward developing those thinking, analysis, and discussion skills, while learning to work cooperatively with their classmates in the formation of their own opinions about controversial topics. The "final examination" for this course is structured as a debate allowing students to analyze an issue and thoughtfully consider multiple perspectives of the issue. This paper describes the course, the structure of the final examination and the results of a study used to ascertain student perceptions about the effectiveness of this style of final examination for this course.

1 Introduction

Computer Science majors at our university are required to take the senior-level course *Social, Ethical and Professional Issues in Computing*. As the title suggests, the course brings to bear on the students the societal ramifications of the technology with which they so closely work. Further, it guides the students in developing a framework for consideration of the ethical ramifications of the decisions that they will make as computing professionals. The pedagogy for the course includes a wide variety of techniques including discussion, debate, group work, argument and lecture. These techniques are commonplace in courses that deal with these sorts of issues. The culminating experience (i.e., the final examination) for the class involves dividing the students into two teams. One team is assigned to prepare to support a selected issue and the other is assigned to prepare to argue against it. The teams engage in a structured debate in lieu of a traditional final examination.

The rest of this paper begins with a more thorough description of the course and its objectives and the structure of the final examination. The descriptions are followed by information from a student survey, taken during Fall Semester 2004, regarding their attitudes and perceptions surrounding the debate, whether they felt that they were learning and whether that learning was valuable to them. The paper concludes with some observations about using debate as a final examination and some suggestions for alternate implementations.

2 The course

Social, Ethical and Professional Issues in Computing is a course taken in the fall semester by senior computer science majors. It is an unusual computer science class for them in a number of respects. There is an expectation of lucid writing, clear argument, lively discussion and the integration of their computer science experience into the larger world. There is no expectation of developing software or proving theorems. In general, students do not have a preconceived notion of pedagogy for this course.

I make my goals clear to the class on the first day of the semester. I am interested in challenging the status quo, developing their analytical skills, raising their awareness of issues and empowering them to be professionals. I also make it clear that I am *not* interested in deciding what is right or wrong or in advocating doing "the right thing." This goal forces me to be constantly on the lookout for anyone trying to end a conversation about a topic. (E.g., some one says, "It's against my religion, so clearly doing this thing is wrong.") By being open to conversation, we raise awareness and become more critical of not only others' ideas, but our own as well. During the course of the semester students are assigned materials to read and questions to answer in preparation for the conversation that takes place in class. Grading, both throughout the semester and on the final, is done on the basis of each student's contribution of new insights and the integration of ideas. I look for insightful analysis, probing questions, thoughtful summaries of statements made by others as indications that students are aware of the issues, analyzing them and then thoughtfully incorporating insights into their thinking about the issues.

We cover a fairly standard range of topics found in any computer ethics text (e.g., [2, 4, 6, 7, 8]). While there is some lecturing on some topics (such as ethical theories) much of the conversation is driven by students. Typically, students are assigned some reading or Internet research and given a series of 3–4 questions that are the basis for discussion. During this discussion students are coached on listening to what others are saying, on analyzing arguments, on applying ethical theories and on developing consistent, cohesive positions. Toward the end of the semester, *Barstool Debate* is introduced [5]. This technique starts with two chairs in the front of the room. An issue is identified and two people are chosen: one to argue for the issue and another to argue against the issue. The only people allowed to talk are those in the two chairs. The two make their arguments. The remainder of the class (instructor included) is invited to replace either of the two people arguing the issue. A simple tap on the shoulder causes the change. Over the course of discussing a particular issue an individual often ends up presenting arguments on both sides. This technique is useful in developing a number of important skills. Students experience the process of listening to what others say, critiquing others ideas and offering counter-arguments in a lively exchange. They see how being open-minded about an issue leads to illumination of multiple perspectives and potentially clarifies their own thinking about an issue. This type of exercise provides excellent preparation of the final debate.

Another important part of students' preparation for the final debate are the essays that students write as part of the course. The essays require students to research an issue, take a position on the issue and then justify the position that they have taken. Through the study of issues in class, students have been introduced to a variety of techniques for arguing for a position, including applying ethical theories, consideration of international perspectives, and the use of analogy. These assignments also provide students with meaningful preparation for the final examination. Students learn to evaluate important arguments from outside sources and put them together into a cohesive position paper. They also are expected to analyze counter-arguments and explain their value to understanding the issue. In order to guide students, they are given a rubric that lists these criteria and is used in evaluating the essays.

The pedagogy of the course is unusual for computer science students in a computer science course. However, my students have been been quick to adapt to this "softer" approach to learning. By the end of the term they have had the opportunity to practice using the intellectual skills that are necessary to make them successful in the final debate.

3 The Final Debate

While the entire class provides preparation for the final debate, the mechanical preparation begins at least four weeks before the final. The most challenging aspect of the process is to identify a topic. Topics that are current, only tangentially in the news, and at the cutting edge of computer ethics seem to work well. Something hypothetical, but believable, works well, too. It is essential to avoid topics about which students may have well-formed opinions or know a lot about. Yet there should be resources available for the students to

use.

Here are the last three topics I have used:

Software Copyright Protection This issue introduced a potential method for protecting software as intellectual property. Briefly, this proposed system included:

1. providing complete protection for the "look and feel" of the software;
2. providing complete protection for the parts of the code that are new;
3. providing protection for the underlying data structures and algorithms.

This protection gives the creator of the software exclusive rights, in exchange for agreeing to abide by the following conditions:

1. the actual code must be filed with the Copyright Office;
2. the protection extends only to "new" aspects of the software;
3. the protection lasts for five years;
4. one year after the protection begins, the Copyright Office will release the source code to the public.

Graded Software Liability This topic challenges the standard disclaimer on most software, both commercial and open source, and suggests a new standard from software liability. This standard has the following provisions:

1. a software provider that does not provide the end user access to the source code is liable for damages that occur as a result of the software;
2. a software provider that eventually releases the source code to the software is not liable for any punitive damages after the release date;
3. a software provider that releases the source code is not liable for any damages one year after the release date;
4. both the software companies and the individual software developers can be liable.

University Course on Writing Malware This topic challenges students to think about the ethics of universities offering senior-level computer science course that teach students how to write viruses, worms, Trojan horses and other forms of malware.

The Software Copyright Protection topic was used about the time that the Digital Millennium Copyright Act was being covered in the news. The Graded Software Liability topic was used about the time that Microsoft faced a class-action lawsuit in California regarding the fitness of its operating system. The Malware Course topic was used as the University of Calgary was being questioned about its decision to offer such a course. Students saw each of these topics as something that could have an impact on them, another salient feature of viable topics.

After selecting a topic, I use a "quiz" to help determine sides. The quiz is essentially a poll of the students to get their gut reactions to the higher-level issue in the topic. For example, in the Writing Malware topic, I judged a higher-level issue to be about getting security through secrecy versus getting security through openness. I asked students which way they thought security was generally better. I also gave two scenarios that challenged that notion (e.g., closed-source versus open-source cryptography software providing better security), to get a better sense of their position. Then, students with stronger secrecy leanings were placed on one team and the students with stronger openness leanings were placed on the other. Each team was assigned to argue the *opposite* point of view in the final debate.

Two weeks before the final debate, students are given the debate topic and their teams. They are given time to organize their team and identify initial research responsibilities. They are reminded that the entire purpose of the final debate is to demonstrate as many meaningful, unique aspects of the issue as possible through the use of the analytical techniques we had been developing for the entire semester.

Students are also told about the structure of the debate. The structure is used to fill most of the two-hour final examination time. The structure I have used begins with the FOR team making a five to ten minute opening statement and the AGAINST doing likewise. Students prepare these statements in advance and determine how the team will present them.

After the opening statements there are either two or three Question/Response/Followup rounds. A single round consists of two halves. The first half begins with the FOR team asking a probing question of the AGAINST team. They have two minutes to set up, ask and clarify their question. The AGAINST team then has five minutes to respond. The FOR team then has three minutes to make any follow up comments. The second half of a round is just like the first half, with the roles reversed.

After the Question/Response/Followup rounds, teams have 15 minutes to prepare a closing statement. The closing statement can be up to five minutes long. The FOR team makes their closing statement first.

Student preparation for the debate involves background research, preparing an opening statement and a list of potential questions to use in the Question/Response/Followup rounds. They are turned in at the beginning of the debate. They are not required to use them.

Students are evaluated two ways–team performance and individual performance, with team performance accounting for two-thirds of the final score. Teams are expected to be well organized, demonstrate a broad base of information, show deep understanding of pertinent issues from ethical, legal and social perspectives, and be cognizant of not repeating information. Individuals are expected to make a contribution to team preparation, make a contribution to the information presented and demonstrate the ability to listen and thoughtfully analyze statements made by the opposing side. As part of evaluating each student's contribution to the team preparation effort, each team member individually assigns a score to each teammate, along with a justification for that score. No team member does a self-evaluation. These evaluations are used as a basis in determining the individual part of the

score on the final.

To facilitate evaluation of both individuals and teams, my roll during the debate is limited to time keeper, note taker, and arbiter of questions regarding the rules. Throughout the debate, I write down statements made by individual students. I also evaluate the effectiveness of comments and note when a student demonstrates having listened, critiqued and analyzed something said as part of the debate. These written notes are used to support both the individual and team scoring.

4 Results of the Study

This section reviews the technique used to gather and analyze data and presents the results along with some analysis.

4.1 Methodology

In the Fall 2004 offering of *Social, Ethical and Professional Issues*, I had nine students in the class, eight male, one female, all traditional-age students. At the start of the final, students were given a questionnaire that consisted of both a quantitative part and a qualitative part. The students then participated in the final debate and afterward were given a second questionnaire, with the quantitative questions identical (except in tense) to the pre-exam questions and similar qualitative questions. Individual student's pre- and post-exam responses were tracked in order to ascertain any changes in attitude as a result of the experience of the debate.

4.2 Data Gathered

Each student was asked to select a response from *Strongly Agree*, *Agree*, *Neutral*, *Disagree*, *Strongly Disagree* for each of the following questions.

1. I am prepared for this final.
2. My group is prepared for this final.
3. This type of final is appropriate for this course.
4. My grade in this class will be brought down because of my group.
5. My grade in this class will be brought up because of my group.
6. The structure of the class meetings and assignments prepared me well for the structure of the final.
7. I learned a lot about the topic in preparing for the final.
8. I learned a lot about discussion techniques in preparing for the final.

9. This type of final should continue to be used in this course.

In addition, student responded to the following open-ended questions.

1. Explain what you think is expected from you on this final.
2. What are the strengths of this type of final?
3. What are the weaknesses of this type of final?
4. What additional guidance/support could have the instructor given to make this a better learning experience?

All of the above questions were included on both the pre- and post-exam survey. The following two questions appeared only on the pre-exam survey.

1. How much time did you spend in preparation for this final? Separate out the time you spent alone and the time you spent with your group.
2. How does this amount of time compare to other courses' finals?

4.3 Results

For the purposes of analysis all responses were given an integer equivalent with *Strongly Agree* given 5, and so on to *Strongly Disagree* given 1. Table 1 gives a numeric summary of their responses. In general students felt that both as individuals and as a group they were prepared for the final and that the style of final was appropriate for the course. Students did not express any concern about their group unduly influencing their grade. Students were uncertain about whether the activities in the course prepared them for the final (questions 6 and 8), yet they thought that they learned a lot about about the topic in preparing for the final.

Question	Pre-Debate	Post-Debate
1	4.22	4.22
2	4.33	4.11
3	4.00	4.11
4	2.56	2.44
5	3.22	3.22
6	3.78	3.67
7	4.33	4.11
8	3.00	3.22
9	3.67	3.89

Table 1: Average responses to survey questions.

There is a curious disconnect between questions 3 and 9. While there seems to be agreement that using debate is appropriate for the course, there is no enthusiasm for it to be

continued. One explanation might be that students felt a certain lack of control. Traditionally, if students know the material well and can demonstrate it, they end up with a good grade. In fact, most students have a good sense of their performance immediately after the exam. However, with the debate, their performance depends on a number of uncontrollable outside forces. Did the team perform well? Did the other team challenge them in a way they did not handle well? How, in practice, would the evaluation metric be applied? None the less, even in the presence of such uncertainties, they sensed that a traditional exam was not an appropriate evaluative tool, but did not have an alternative suggestion.

With the exception of one student, there was very little difference between the pre-debate and post-debate responses. In fact, there is no statistical difference in the averages at the 95% confidence interval, suggesting the experience of the debates did not change overall attitudes.

When the students were asked to analyze the debate in the context of the course, there was a strong consensus that they were expected to learn something about the topic (5 of the 9 students made such a comment). Prior to the debate, 6 of the 9 students said a main strength of this type of final was the group nature of the debate, yet offered very little in the way of specifics. However, after the final, the specific group-oriented strengths of the debate were clearly articulated. Four students reported that the debate was successful in illuminating both sides of the issue. Another noted that it "allows students to develop a concise argument about a certain topic." One student did see the debate as an opportunity to use "techniques learned in class in a real-world situation."

Suggestions for improvement were largely requests for richer structure, again suggesting some uneasiness with unknowns. Three students asked for guidelines for the opening statements. Another asked for a set of sources to use in preparation, and another for an earlier deadline for turning the set of questions to be used in the final debate. Presumably this student believed that it would have helped their group prepare more effectively.

Students reported spending an average of 5 hours working with their groups and 3 hours working alone in preparation for the debate. About half of the students reported that this was comparable to other final exams they take and the rest reported that this was more time than usual.

5 The Road Ahead

My main objective in this project was to determine whether students perceived the debate to be a valuable learning tool. Their comments indicated that not only did they learn in preparation for the debate, but the learning continued through the debate as well. Furthermore, they did not find this type of final onerous. Finally, in addition to becoming well-versed in the topic of the final debate, students had the opportunity to enhance their group skills, their listening skills, and their speaking skills.

The three times I have used debate as a final examination, I have have had around ten

students in the class. This number works out quite well with teams with four or five. Teams have been effective in organizing themselves and assigning tasks to group members. At the debate there is ample opportunity for everyone to speak. Although, there is a chance that an individual student can "get lost" in a team that size. Students expressed concern for the "quiet student" who may not say much during the debate and that it "can be easy for individuals to slack."

A possible modification of this technique is to incorporate some of the aspects of structured controversy into the final examination. Structured controversy (described in [3]) differs from debate in a number of ways. The preparation is the same, but at the actual meeting teams begin by presenting their best case for their particular side and then switch rolls and argue the opposition's case as convincingly as possible. After argument, the teams work to develop a compromise position. This development is followed by a traditional written exam on the material in which individuals are given bonus points when everyone scores above a certain threshold. Finally, students present the compromise positions. Previous work by Bohy has found that students in his environment had a positive attitude toward structured controversy (as well as other cooperative learning methods) [1]. An aspect of structured controversy that might further the goal of having students understand both sides of an issue deeply is to have teams argue the opposite side in their closing statements. Such a change enforces the notion that there is value in understanding both sides of an issue. It lessens the value of listening to the other side and critically analyzing those statements. I have observed teams as they prepare their closing statements, and they intentionally weave their closing arguments around the statements the other team has made during the debate, effectively demonstrating that they listened to and heard the other team.

One aspect of this process that is challenging is the evaluation of both the team and individual efforts. The grading is much more subjective than in your typical computer science final. Questions about the quality of information, strength of arguments, accuracy of recall of the other side's statements are often a challenge to answer. However, by functioning as a time keeper and a note taker, it is fairly straightforward to record who made statements and the general theme and effectiveness of the statement. The record gives a document that can be used to back up the relative strengths of the teams, as well as the relative strengths of the individuals on the teams. An easy enhancement is to record the entire debate (either audio or video) and revisit the recording to document the team and individual scores.

The student responses to questions 6 and 8 in the scaled questions give the most concern. Their collective response seems to indicate a disconnect between their perception of what we did in class and how it was connected to the debate. There is underlying concern about not getting enough guidance in discussion techniques that must be addressed in future offerings of this course. One student suggested a practice debate earlier in the semester as a way to better prepare for the final. I had been hopeful that the Barstool Debate would serve as that preparation, but its less formal style may not provide appropriate structure.

An additional, related concern is the effectiveness of some groups in using their allotted time. Some groups willingly revisit topics they wished to clarify or make further argument

about. Others just give up the time.

A course in Computing Ethics is an environment unfamiliar to most traditional CS students It is an opportunity for professors to stretch the intellectual and group skills of students since they do not have strong preconceived notions about “appropriate” pedagogy for such a course and do not object to (and even embrace) nontraditional pedagogical styles.

References

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