Computing and Society:
An Innovative Teaching Approach

ABSTRACT: It is becoming increasingly important that students of all majors become aware of the impact of computing on society. This paper presents a different approach to teaching an introductory class on computing and society. There were
no textbook, no lectures, and no tests in the class. Instead, students read interesting stories on computing and took turns guiding discussions. They wrote papers and completed a substantial project on a topic of their choice. Students communicated with one another and the teacher through e-mail and bulletin boards. The details of the course and the teaching techniques, a student's reaction, and the instructors assessment are discussed in the paper.

There has never been anything in the history of technology that can match
the growth of computers. Some form of computer and computer technology exists in almost every facet of today's society. As technology becomes more complex and as we become more aware of its effect on our world, it becomes increasingly important for students of all disciplines to become educated in the social issues related to computing technology.

The importance that students of all majors become educated on the social issues related to computing is illustrated by the sheer number of textbooks that introduce computing and society-type issues (for example 1-4) These text- books and the corresponding courses typically introduce issues in sequential chapters--each identifying an impor- tant aspect of society that has been impacted by computing.

The course described in this paper also had the goal of introducing stu- dents to the variety of social issues involved with computing technology; however, the approach used was quite different. Instead of using a textbook, the students read interesting stories
such as *Cybe7punk* (5) and the *Cuckoo's Egg* (6) .Instead of lectures, the students took turns leading discussions. Instead of tests, student wrote reports. Instead of labs on word processing and spread-

sheets, the students completed labs on various aspects of the Internet.

Several articles have been published which describe activities in computing and society type courses. Miller (7) begins by explaining that the comput- ing and society course has undergone a "major metamorphosis" in the last few years. During the 1980s most college and university courses for non- majors were focused on "computer literacy" or "computer skills. " More recently, such courses now include at least a compo- nent which focuses on evaluating the impact of computer science on society. Miller outlined several projects to enhance the curriculum of such a course. For example, students were required to visit a store (such as Arby's) which had recently installed a computer system and were asked to think about that system from a variety of perspec- tives-as a customer, as a manager, and as an employee. Students were also asked to collect articles in periodicals or newspapers that discussed the impact of some computer technology. Such an experience helps students begin to understand how often computer tech- nology is integral to the world they cur- rently live. Bellin (8) provides some additional techniques which he finds quite successful including the "devil's advocate" position and the structured debate. For the devil's advocate posi-

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tion, the teacher plays the minority position, regardless of their true beliefs. For the structured debate each student must formally sign up for a pro or con position and debate the computing and society topic in a formal, timed session. Such an approach helps assure a discus- sion of multiple perspectives.

Different versions of computing and society courses are documented in the literature. Fendrich (9) discusses his experiences in teaching computers and society courses over the last 15 years. He discusses procedures for determining the requirements and goals of comput- ing and society courses. His experiences led to the development of two distinct computing and society courses: a gener- al education course for baccalaureate degree students and another for stu- dents with more advance preparation and experience in mathematics, sci- ence, and philosophy. A third version of such a course

is documented by Hiltz and Turoff (10). They discuss teaching computers and society using a virtual classroom. Such an approach allows stu- dents to send and receive messages to other students or professors, to read

and comment on lecture material, and to take tests on-line. This technique in and of itself is exceptional, and combin- ing it with the topic of computers and society provides some unique and excit- ing opportunities.

This paper presents a different ver- sion of the computing and society class with particular emphasis on pedagogy. The paper begins by describing the objectives of the course, course assign- ments and grading. Several innovative teaching strategies are discussed as they relate to this class. Last, a summary of the students' and instructor's assess- ment is included as well as ideas for implementation in larger classrooms. Although this paper outlines an entire course, aspects of the course can and have been used and modified in various other computing courses.

COURSE OBJECTIVES

The primary goal of the course was to develop an understanding of the social, psychological, ethical, philosophical, legal and political implications of tech- nology-particularly computing tech- nology. More specifically, students were introduced to a variety of social issues relating to the computer, computer- related crimes, computer subcultures, psychological and socio-economic

effects of computing technology, protec- tive security measures, and applicable laws. Questions such as "Is computeriza- tion likely to reduce privacy and person- al freedom?", "How does the computer transform work?", and "What are the risks raised by computerized system in health care and other industries?" are illustrative of the kinds of issues dis- cussed in the class.

DESCRIPTION OF THE COURSE

The three credit hour course met one day a week. The course was offered as a Freshman honors course at a medium size midwestern universit}:. The class meetings generally began with the instructor discussing the days agenda and answering various administration questions about the current project.

The next hour and a half was followed bya student led discussion of the read- ings for the day. The final portion of

the class was in a laboratory where stu- dents either completed a lab the instructor had designed or shared their most recent findings on the Internet.

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The books used in the course were

not textbooks. Instead they were inter- esting stories each involving some

aspect of computing. The books were supplemented with readings prepared by the instructor-many of which were selected from the collection of papers edited by Dunlop and Kling (11). A top- ical outline of the Course is shown in Table I and the method used to deter- mine the final grade is shown in Table 2.

TEACHING STRATEGIES Student led discussions

Over the course of an entire semester (45 contact hours), there were approxi- mately 3 hours of lecture. The majority of the class was discussion led by stu- dents (note that almost all of the stu- dents were first semester freshman) . During second week of the term, stu- dents signed up for one week in which they were the discussion leader. During the week in which the student was

leader they interacted with the instruc- tor through e-mail. They also posted several discussion questions to an elec- tronic discussion board (which had

been previously set up for the class) at least three days prior to the class meet- ing. The instructor then selected (and occasionally modified) the discussion questions and created an agenda for the day. Students often created a one-page handout to help guide their discussion. As the semester progressed, students

became more creative in their approach to guiding discussions and the instruc- tor became less directly involved. Students sometimes decided to have small groups or pairs of students discuss issues. For example, one of the topics we discussed was gender issues related

to computing. We discussed the lack of female representation in computing, gender differences in using the Internet and other computer systems, and rea- sons for these differences. The student who led this discussion began the class by having students anonymously write their thoughts about gender equality in the workplace. She then collected the paper and read the responses to the class, thus providing a starting point for the discussion.

One of the problems with allowing students to play the role of discussion leader is that they are more likely to allow the conversation to move off task. In such instances the instructor had to decide whether to intervene and move the conversation back on task or let the conversation move in a different direc- tion. The best choice was not always clear. A second problem with discussion is that even with discussion guides, sometimes the conversation lacked organization and closure. To provide closure, the last 15 minutes of the class each student was asked to write a sum- mary of the most important points in the days discussion. Each student then

TABLE 1 Course Topics --- Week r 1(Topic

~ --Introduction to Course, Computing and Telecommunications Technological Utopianism & the Internet
Economic and Organization Dimensions of Computing Social Control & Privacy Security and Reliability Gender Issues
Transformation of Work
Psychological and Social Relationship Term Paper Presentation

2 3 **4-5 6-7** 8
9-1 11- 14-

○ 13 15

Cuckoo's **Egg** *Cuckoo's* **Egg**

Cyberpunk

TABLE 2 Grade Determination

20% Internet report
40% Term paper/proposal/presentation 10% Participation (electronic and in class

read their summary to the rest of the class.

Electronic Communications
An important component of this course was electronic communications. This communication took several forms. Students communicated through e-mail with the instructor and other students. Some of the students were quite active in their communication with the instructor and sent notes without request on a regular basis. Other stu- dents did not send the instructor e-mail messages unless they were prompted to do so. The majority of e-mail communi- cations regarded class requirements or questions about planning a discussion. One student was concerned that her discussion questions would not fill an entire class discussion. Through e-mail we discussed alternatives for her class session. Others commented to the instructor personally about their reac- tions to the readings. On average, each student communicated with the instruc- tor via e-mail once a week. Students also electronically communicated with oth- ers in the class.

Students used a bulletin board on a local community freenet run by the uni- versity. A local list serve could have
been set up to serve the same purpose. One board was set up specifically for
the class. The bulletin board system was menu-driven. As expected, the less experienced users enjoyed the system but the more experienced found it clumsy and slow. Students used the sys- tem primarily to post their weekly dis- cussion questions. Occasionally the stu- dents were required to post their reac- tions to a certain reading or their progress on various reports. Although the bulletin boards were intended to provide an outlet for students to initiate discussions, few students took advantage of the opportunity.

It became clear early in the class that students would not user the bulletin board without some motivation. Therefore, students were given assign- ments to post messages to the bulletin board by a certain date. For example, one week all student were required to

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post a one page summary of the
progress they had made on their term paper. Another week, the instructor posted a question relevant to the read- ings and asked each student to com- ment on the question and respond to another student's comment. Unfortunately (but expected) with
these assignments students did not post until the due date. Typically, the bul- letin board had very little activity through the week and then a burst of activity on the due date. Throughout
the semester a few discussions did begin without an explicit assignment but most did not.

In addition to electronic communica- tion within the cl.ass, students were required to participate in one listserv and one newsgroup related to comput- ing. One student from Russia found a newsgroup on computing in Russia. Many students received Comp-Risk-a listserv and newsgroup discussing com- puting security and privacy issues. With electronic communication playing such a vital role in the course, students were required to check the system at least three times a week. The student activity was monitored primarily via the written assignments discussed below.

Projects
Throughout the course students had a variety of written projects they were required to complete. These assign- ments were the primary means to assure the students were completing the read- ings and reflecting on the material. Students were required to complete two book reports, an Internet report and a term paper.
The book reports were to be 6-8
pages in length (double spaced). A
short portion of the report was a sum- mary of the reading but the majority
was a critique of various issues involved in the book. In the critique, the stu- dents used other outside readings and class discussions to support their main points. For instance in The Cuckoo's Egg, students discussed various privacy, security, legal and ethical issues involved in a networked society. The students were also required to

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write an Internet report. The report summarized their activities (e-mail, list- servs, newsgroups, and the local
freenet) and then identified some key social issues. Students discussed changes in communication patterns, changes in the perceived size of the world, the cre- ation of a two-tiered society, the addic- tiveness of the Internet, and anonymous communications. They incorporated outside readings (which had been assigned and discussed in class) to sup- port their discussion (for example see refs 12-14).
The primary assignment of the course was a term paper (approximately 20 pages). The term paper was an outside assignment for which the student did substantial research on a topic of their choice related to computing and social issues. Their research took the form of collecting journal and magazine arti- cles, interviewing appropriate people, and collecting information from various sources on the Internet. Examples of topics include: anonymous communica- tions on the Internet, computing in pol- itics, computing and the physically chal- lenged, and computing and gender. Students were evaluated on both a writ- ten project and a one-half hour presen- tation to the class. Prior to the project they were given a handout showing how the project would be evaluated. The project was evaluated on their in class presentation (effective use of handouts, visual aides, creativity in

presentation, fellow student evaluations) and their written project (quality and quantity of research, correct format of citations, effectiveness in incorporating the ideas of the class into the report, grammar, spelling, and punctuation) .

Laboratories

The last hour of most classes was a laboratory. The first several laboratories introduced students to e-mail, news- groups, listservs, and the local freenet. The later laboratories consisted of stu- dents demonstrating their particular Internet investigation. For instance, one student showed the others how to cre- ate a page using Mosaic. Anotherstu- dent demonstrated a system used to

check an airline reservation system. In the last few weeks of the term, several students used the laboratory for their term project presentation. A student whose term paper was on the physically challenged and computers had an on- line interview with such a person. A stu- dent whose topic was anonymous com- munication set up an experiment in which the class members were linked anonymously with other classmates to discuss a sensitive issue.

STUDENT REACTIONS Students completed midterm and

final course evaluations. The midterm evaluation consisted of an anonymous posting to one of the bulletin boards. The final evaluation consisted of a tradi- tional paper and pencil evaluation

form. Although a few likert-type ques- tions were included in the review, most of the questions were open-ended.

On a scale from O (unsatisfactory) to 4 (very good) students gave an average evaluation of 3.5 when asked for their overall evaluation of the course. Comments indicated that students enjoyed the course and learned a sub- stantial amount on the interaction of computing and society. A few students explained that prior to the class they had no idea that computing had such a powerful impact on society. Students also appreciated class discussion. Several students explained that discus- sion provided a means to understanding alternative views on the same topics. Some students commented that they enjoyed leading the class discussion. Almost all of the students commented positively on the value of in-class lab time. Several students especially enjoyed

and learned a substantial amount from the book reports.

On the negative side many students complained about the workload throughout the course. However, one student commented that "the course was challenging to the point where I seemed to complain much of the time. In retrospect, I found this course to be a very successful learning experience." Several students commented that the two required book reports were not use-

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fullearning experiences. Specifically "book reports created too much work- overkill. "

Table 3 outlines one student's final evaluation of the course.

CONCLUSIONS

Many aspects of this course were quite challenging for the instructor. Allowing students to define the issues and lead the discussion was extremely difficult- especially for instructors who are accus- tomed to having control of the agenda. In fact, in the first few weeks of the class the instructor actually gave suggested discussion questions to the discussion leader. As the semester progressed, the instructor provided less direction, and the students became more creative. A second concern throughout the class was that there was no method (other than class participation) to insure class readings were complete. It appeared that the majority of students completed their readings; however, at least a few students did not consistently complete their work.

Although this was an ideal teaching environment-a small honors class-the techniques used in this class have been successfully adapted and used in several other freshman computing courses. Many of the ideas presented in this

paper can also be used in larger class- rooms with some slight modifications. The idea of using interesting stories rather than textbooks to introduce fun- damental issues is well received by the students. Students enjoyed the reading and many requested additional books to read. Electronic communication in the form of newsgroups and e-mail with both the instructor and among students can be a very successful outlet for the student who is very quiet in class but

has interesting ideas. The use of news- groups and listservs are perhaps even more successful with larger size classes where it is more intimidating for the student to participate. Instructors may use a single newsgroup in which stu- dents of multiple sections of the same course discuss course-related issues.

This has the added benefit of allowing students to discuss issues with others who are studying the same topics but

are not in the same classroom. In fact, in very large sections, the instructor

may consider creating "pen pals" among students in different sections of the same class. A larger sized classroom would also allow for more teamwork in all of the projects assigned in the

course. For instance, instead of assign- ing a one 20-page individual project, a team could be assigned an even more substantial project which requires work-

TABLE 3 A **Student Reaction**

This class was definitely an original experience for me. I took her course the first semester of my freshman year, and I had absolutely no idea what to expect of an Honors seminar. ..All of our class discussions were led by one or two students each time, who were determined beforehand. I enjoyed this technique, from the standpoint of both the leader and participant. I found it interesting to experience to some extent the professor's viewpoint, and enjoyed being "in charge" of the direction of the discussion. I did feel, at

Itimes, that our discussions were steered away from interesting side issues and back to
the main topic by the professor's intervention. Along with this, some students came to class as discussion leaders who were unprepared to lead the group. At these times, the dialogue was definitely not as interesting as it had the potential to be. ..By far the best

Ifacet of the class, in my opinion, was the electronic communication and use of the Internet I did not truly realize the quantity of information I had gleaned from the computer lab sessions until the following semester. ..

Overall, the class, although providing me with by far the most work of the semester, definitely taught me skills that I will use for the rest of my life. There is also a strong probability that I will use my term paper topic from her course for my senior honors thesis, which is an added bonus. The class was a wonderful opportunity for me, and a great experience.

ing with other members in their group. The most distinguishing feature of this course was allowing Freshman students to lead class sessions. This forces stu- dents to take ownership of the class and responsibility for learning. In larger classrooms, rather than a single student leading the discussion, a team of stu- dents could be responsible for posting the discussion questions to the news- groups and running a portion of the class session. Rather than having one large group discussion, the team leaders could each facilitate a small group dis- cussion and share the key points of

their discussion with the larger group. In summary, the class was quite suc- cessful and many of the techniques used can be adapted for different sized or different topic classrooms. The students handled the challenge of leading discus- sions very well and seemed to learn a tremendous amount. Students were excited to discuss the issues, which is quite motivating for an instructor. Over a period of 16 weeks, not a single stu- dent missed a class. Perhaps this was because the course met only once a

week and perhaps it was because of the 10% class participation grade. I suspect however, it was because the students

took ownership of the class. It was not my class, it was their class.

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