

The Effectiveness of On-Line Discussions

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Abstract:

This paper describes the results of a one year experiment in which in-class discussions were substituted with discussions exchanging electronic mail messages. This experiment was conducted as part of a two semester software engineering course. The subject matter was computer ethics. The experiment was motivated by the question of whether class discussion could be effectively moved to an on-line format and how the dynamics would change with such a move. It was hoped that the on-line format could alleviate some of the problems of open-ended in-class discussions, such as domination by a few members and too many silent class members. It was found that there are several advantages to on-line discussions making email a useful tool for enhancing class material. Furthermore, the experiment showed that in-class discussions can be moved to the on-line format for small classes (ten students or less) of motivated students. The evidence did not support moving large classes to the on-line format. It also did not support moving classes of any size to the on-line format if the students are not highly motivated. In-class discussions provide more opportunities for facilitators to engage students than on-line discussions do. For many of our classes, motivating the students to get involved with the material is a major activity. For classes where students require motivation, the on-line format is not appropriate.

Introduction

Last year, as part of a two-semester software engineering course, I facilitated six email discussions on computer ethics. This experiment was motivated in part by the popularity of email, list-servers, bulletin boards, and on-line chat groups. More importantly, this experiment was driven by a general interest in the broad topic of distance education. There is no doubt that the distance education revolution has arrived, but it is far from certain whether this arrival will result in a better educated populace. In this paper I am not as much concerned with final judgments on the merits of the distance education revolution as I am with a narrow focus on whether electronic mail can alleviate some of the problems of open-ended class discussions. Can the dominance of a few class members in a discussion be controlled and can the many silent students be motivated to participate through the use of email? Can this technology guide students toward desired educational outcomes? It was found that there are several advantages to on-line discussions making email a useful tool for enhancing class material. Furthermore, the experiment showed that in-class discussions can be moved to the on-line format for small classes (ten students or less) of motivated students. The evidence did not support moving large classes to the on-line format. It also did not support moving classes of any size to the on-line format if the students are not highly motivated. In-class discussions provide more opportunities for facilitators to

engage students than on-line discussions do. For many of our classes, motivating the students to get involved with the material, is a major activity. For classes where students require motivation, the on-line format is not appropriate.

Distance Education Revolution

Robert Moskowitz, president of the *American Telecommuting Association*, wrote:

“There’s a revolution happening in education. It’s called *distance learning*, ... with uncounted thousands of courses offered by hundreds of institutions worldwide, no one has yet compiled accurate statistics on the number of students, teachers, and educational facilities participating in this fast-growing phenomenon.” [1].

This *distance learning revolution* is founded on telecommunications technology. As expected, there is a spectrum of opinions as to whether this technology will enhance educational quality. Judith Boettcher, executive director of the Corporation for Educational Networking (CREN) states that part of the power of this technology is that “students and faculty can become a true learning community... community dialogue and communication flows in all directions.” [2] Along these lines Norman Wagner, dean of distance learning and extended academic services at Troy State University states that “the content and format of

the resulting new instruction will be more individualized... where ... decreased amounts of time will be spent with learners together in classrooms, but significant portions of the class time will involve greater interaction.” [3] At a recent academic forum held on distance education on the Montana Tech campus faculty claimed: “The communication environment will be impoverished;” “Distance delivery will never allow students to learn to work as a team;” “Nothing can replace group discussions. The ‘live’ classroom is needed for this.” The claim that the ‘live’ classroom is needed for group discussions is debatable given the advent of chat-rooms, bulletin boards, list-servers and email. My experiment with email discussion focuses on the question of whether class discussions can be effectively held via email.

Experiment

Class room discussions are a vehicle to help students think critically and develop their conceptual frameworks. “The give and take of technical discussion ... sharpens critical and quantitative thinking skills. Classes in which students must participate in discussion force them to go beyond merely plugging numbers into formulas or memorizing terms. They must learn to explain in their own words what they are thinking and doing.” [4]

It has been claimed that “the use of e-mail messages seems to encourage dialog with students, much of this in the form of e-mail initiated by the student.” [5] Feeling frustrated with the quality of the traditional class discussions which I facilitated, I decided to try slower paced, email discussions. My in-class discussions were frequently dominated by a few outspoken class members, and sometimes these dominant contributors were poorly versed in the material. I felt that female and minority students contributed less to the class discussions. In addition, I wanted students to spend more time thinking about their contributions before exposing them to the class. The slow pace of on-line discussions allows this. Students can crystallize their ideas, expressing them in writing where they can inspect and evaluate them before submitting them to group scrutiny. Being a shy person myself, who rarely contributed to class discussions as a student, I thought that I may be able to facilitate on-line discussions better than in-class discussions.

Computer ethics is part of the two semester software engineering course which I have taught for four years. This is a required, junior level course in the computer science curricula, with enrollments between fifteen and twenty. The majority of the students are traditional. By this time in the computer science program most are employed in computer-related jobs. These students have typically not experienced large amounts of classroom discussions and are frequently focused, technology-oriented individuals with little patience for open-ended questions. These students are working hard

to become competent computer scientists, and unfortunately, they do not see typically computer ethics as on their critical path to achieving their goals. Most of these students are highly motivated to succeed in the class. They are not highly motivated in the subject of computer ethics.

In the past, readings concerning computer ethics were assigned and/or a case study was shown on film. During a class period, questions were posed and discussed. Approximately one week per semester, broken up into a day here and a day there, was devoted to computer ethics. In 1997/1998, I changed the pattern of holding traditional in-class discussions on computer ethics. Instead I facilitated six email discussions, lasting from two to three weeks each. There were eighteen students in the first semester and sixteen students in the second semester. These students were broken into three groups. On the days when we would have held in-class discussions, the students did not attend class. Instead, they sent responses to questions which I posed via email with members of their group. The students continued exchanging email message within their groups discussing the readings and my questions for another week to ten days. During the final week of the discussion each group developed a group answer to each of my questions. Each group had a discussion editor (this job was rotated through the group) who composed and edited the group answer based on member input. By requiring a single group answer, and giving a single group grade, I hoped to increase interaction amongst group members. The groups were to work towards consensus, but could also report conflicting opinions. I was included on each group mailing list, so I was able to contribute to the discussion when I chose.

During the first two on-line discussions I established a precise set of rules telling the students approximately when each of their contributions should be made. This forced a degree of synchronicity to the class discussion, that is, students made their contributions within a day or two of each other. I found this format too restrictive. Some students stated their opinion initially. When the time came for a second contribution, they had nothing more to add, so simply restated their opinion. They continued to restate their opinion until they had satisfied my submission criteria. In order to avoid a lot of repetitive contributions, I relaxed the submission criteria for the next two discussions. Students were told to contribute, but they were not given a minimum number of required contributions and they were not given dates by which the contributions had to be made. While this reduced the number of repetitive contributions, there was still little interaction between the students. I realized that the students needed to be taught how to discuss before they engage in it. Each of the groups needed a facilitator. I considered facilitating six discussion groups simultaneously, trying to keep their threads distinct, but realized that the time required to do a good job would be prohibitive. Instead, I had the class form one large group (this was during the second semester when there were sixteen students in the

class). During these discussions the students complained about the number of ethics related messages that they were receiving. However these discussions involved greater student interaction, and increased critical thinking. I read each days' contributions and responded on most days, encouraging the students to elaborate their ideas and relate their ideas to those of other class members.

Following are the topics and goals of the six discussions:

1. Jonathan Jacky's report on the *Therac-25* incident [6] describes a sophisticated software controlled radiation machine malfunction, causing the death of two patients and permanent paralysis to others. The malfunctions were primarily due to a small programming error. Looking at the large picture, however, many things could have been done to avoid the tragedies. This goal of this discussion is to increase student appreciation of the larger issues of programming, such as user interface design, system operation, testing and safety. Computer science students spend so much time learning to write well-structured and efficient code that they sometimes lose sight of the larger issues which come to play in developing and putting into operation large, complex software systems.
2. The engineering ethics movie, [The Truesteel Affair](#), together with readings from [Ethics in Engineering](#) [7] demonstrate moral development. [The Truesteel Affair](#) presents a fictional case study where engineer Robert William's boss influences him to act unethically. I have found that many students feel that a person's ethics are static. I have heard students claim that children develop their ethics at a young age and these ethics serve them for the rest of their lives. The goal of this discussion is for students to realize that personal ethics change; to expose students to some theories of moral development; and to caution them that ones behavior is influenced by others.
3. Robert Collins article "How Good Is Good Enough" [8] applies three basic principles to a hypothetical case study. The three principles: don't increase harm to the least advantaged; don't risk increasing harm in already risky environments; and use the publicity test for difficult cost-benefit trade-offs, were derived from John Rawl's [A Theory of Justice](#) [9]. The case study involved suspicions that a hospital's prescription software system was flawed. After discussing this case student we applied the three principles to an actual free speech case. In the free speech case pornography was displayed on an academic computer, causing the administration to restrict use of the web on that campus. The goal of this discussion is to give students examples to help them evolve their own ethical reasoning.
4. In the engineering ethics movie "Gilbane Gold," an engineer struggles with whether he should "blow the whistle" about wrong doings of his company. It is likely

that students will experience a similar, hopefully less dramatic, situation during the course of their careers. Students are given the chance to explore alternatives with other students, and to discuss the boundaries of when to "blow the whistle."

5. Helen Nissenbaum discusses existing barriers to accountability in the computer industry, and the detrimental consequences of this lack of accountability, in her article "Computing And Accountability" [10]. Ms. Nissenbaum proposes imposing strict liability on the makers of software products. The goal of this discussion is for students to recognize problems in the software industry, to think about what it means to be a professional, and to suggest ways that the industry can increase accountability.
6. Students work towards developing a professional code of ethics. After students have had a chance to develop their own code of ethics, we look at the IEEE and ACM ethical codes. The goal is for students to be aware of the existing code of ethics, and to consider what role these codes should play.

Experiment Results

Advantages Of On-Line Discussions

Overall, I think that this years students learned more about computer ethics than students in my previous classes. 63% of the students agreed that the on-line format was effective in encouraging them to think about the material. The on-line format encourages students to be better prepared. Students seem less willing to commit their ideas to writing before reading the material, than they were to contribute unformed ideas to an in-class discussion. (One must give credit to the outspoken, yet unprepared, student who sacrifices himself/herself in an in-class discussion in order to get the conversation moving.) It appears that students consistently read the material and the contributions of the other group members before composing their own email messages. The ideas contributed to the on-line discussions were better formed than the ideas contributed to in-class discussions. In the final evaluation of the on-line discussions one student commented that "on-line discussions tend to be less of a discussion and more of a complete, well structured document." I give this as an advantage. Later in the paper I discuss the disadvantage of this phenomena.

The on-line format made it easy to respond directly to comments made by other class members. Students did not "cut and paste" as often as I expected, however, they frequently replied directly to the message which they wanted to refer to. I spent a lot of time extracting excerpts from the messages to create summaries of where we were at in the discussion. I found having the exact wording of a comment to be helpful. On another note, due to the lack of other visual

cues, I frequently had no idea who was contributing an idea. The last two discussions were between sixteen people. With so many messages being exchanged, one frequently read the ideas without even noting who contributed them. With the on-line format I suspect that students are more likely to respond directly to the stated ideas, than to the person and their knowledge of the person's outlook.

The slow pace of on-line discussions is an advantage. One student commented "it is easier to have a discussion on-line. It gives one time to think about their response." As the moderator of the final two discussions, I found that I could better lead the on-line discussion than I could the live in-class discussion. Relating to this slow pace, in class discussions are short-lived. I typically devote one hour to discussing a particular reading. I stated that I felt that the students learned computer ethics better this year. I suspect that this was partly due to the students simply being involved with the material over a longer period of time.

Expected Advantages Which On-Line Discussions Did Not Deliver

Students were divided into discussion groups for the first four discussions. My hopes were that the students would discuss the material and my questions, and thereby gain insights and accomplish the learning goals set out for the class discussion. I imagined that a large class might be able to gain some of the advantages of a small class by dividing the students into email discussion groups. Even with the relatively small class of eighteen students, this was not the case. The students did not discuss. Most students stated their opinion and were at a loss as to where to go from there. The students needed to be prodded to elaborate on their opinions, in order to find common ground or contradictions with other students. Many students saw things as black and white, either you agreed or didn't agree, and there was no use looking deeper into the matter. Only with facilitation, as in the last two discussions, were students able to truly discuss. One student noticed this phenomena when he wrote: "On-line discussions were too mechanical at first. You would answer the questions and then you were done. Boring - no interaction. But lately, the boat began to rock and liven up the discussion a little." Breaking a large class into small discussion groups is an excellent idea, however this experiment indicates that each group will need to be facilitated. This can be extremely time consuming. It would be difficult, for an instructor to keep the thread of multiple discussions on the same topic in order to facilitate those discussions. This means that the most appropriate format for email discussion is for the entire class to be involved in the same discussion group. The last two discussion of the experiment involved the whole class as one discussion group. These discussions occurred in the second semester when there were sixteen students in the class.) A discussion group of sixteen is too large. So many email messages were

being exchanged that the students found it difficult to keep up. Less than ten students would be doable. Over twenty would be fruitless.

I expected the number of contributions per student to be more uniform with the on-line discussions than they were with in-class discussions. This was based on the ease with which rules requiring students to make a minimum number of contributions to the discussion, could be established and checked. I outlined these rules for the students in the first two discussions. In these discussions the students did contribute equally. However, the quality of the contributions were not equal. Many students were repeating the same ideas over and over in order to produce a sufficient number of contributions. This hampered the discussion. For the remaining discussion I relaxed the minimum contribution requirement, thereby allowing uneven amounts of contributions as exist with in-class discussion. Uneven contribution is preferable to poor contributions which are made only to fulfill a requirement.

Disadvantages Of On-Line Discussions

On-line discussions remove the visual cues present in the context of in-class discussions. When a student is not contributing to the discussion it is impossible to determine if that student is shy, confused, bored, unprepared, angry or simply not logging on. After I dropped the criteria requiring a minimal number of contributions, there were students who rarely contributed to the on-line discussion. These students need to be engaged. They need to be drawn into the discussion. A facilitator of an in-class discussions has several ways to bring a student into the discussion without actually calling on that student (pointedly look in that person's direction, catch their eye, physically move closer to that person). None of these techniques transfer to the on-line environment. A student commented on this. "I think classroom discussions are better. You can't judge emotions and reactions though on-line discussions." These considerations are less relevant with the student who is very interested in the topic. These highly motivated students generally contribute to the discussion and spend more time thinking about the issues. Visual cues are less critical for these students.

Recall the student comment that "on-line discussions tend to be less of a discussion and more of a complete, well structured document." While this tends to make students better prepared, it reduces the student's willingness to accept new ideas. Students carefully scrutinized their ideas before contributing them to the discussion. Once they have expended the effort of crystallizing their ideas and committing them to writing, they are less willing to listen openly to other ways of looking at the situation. One student spelled it out more bluntly than others: "I have seen nothing in the contributions the rest of you have lodged to sway my

opinion of what went on. Thus, I will simply reiterate my opinions...”

The lack of synchronization in the on-line discussion format causes some difficulties. Students are able to move back and forth from being active discussion participants, to being inactive participants. Students entering the discussion after an inactive period, frequently made contributions to old messages. This was disruptive to the discussion. One student commented that she liked the in-class discussion simply because a set time was allotted for the discussion. She had trouble finding the time to check her messages.

Another synchronization problem is that rude comments are not dealt with as quickly as they can be in the context of in-class discussions. During an in-class discussion, rude comments can be stopped as soon as they occur. With the on-line format, the facilitator must be vigilant to nip such problems before they get out of hand. One student commented on this: “I think the only thing in-class has over on-line is that in-class discussions are more structured, keeping loud mouths from getting off the subject.”

Evaluation Of These Results

The experiment brought to light several advantages to on-line discussions. The evidence shows that email can be used to enhance the classroom experience. Email encourages the students to be prepared, to think hard about their answers, and to crystallize those answers in writing. These results suggest using email to prepare students for class discussions. One way to gain the advantages of email is to require that one or two questions be answered via email before the class discussion begins. This serves to ensure that students have read and thought about the material, and provides some concrete take off points for the class discussion. This is similar to traditional classes which require mini-essays to be turned in at the beginning of each class discussion. Using email, the entire class, or a portion of the class (depending on how the email groups are set up) view the mini-essays and get an idea of the opinions of the other class members. The instructor also gets an initial view of student positions. Opening questions which will entrench the students in a position should be avoided. At the end of the discussion, new questions can be posed for the student to answer, again sharing their responses with other members of the class.

The experiment also indicated that there is no inherent reason that on-line discussions can not replace in-class discussions to promote critical thinking when the class size is small (ten students or less) and the students are highly motivated. This is evidenced by the popularity of list servers, bulletin boards and chat groups. Unfortunately, this situation does not exist in any of my classes. While some of my class sizes are sufficiently small for an in-class discussions (less than twenty students), the sixteen students which participated

in the final two discussions (recall that these were the only discussions which involved the entire class) complained about the number of ethics related email messages being exchanged. One student stated that “in-class they got immediate responses, on-line discussions require too much reading.” Overall 54% of the students responded false to the question “Classroom discussions can be effectively held in an on-line format.”

Class size plays such an important role in the success or failure of on-line discussions because the students appear unable to dissect ideas and delve into issues on their own. They did not search for areas of agreement and disagreement with other discussants. Students seem more inclined to state their opinions and consider the matter done. A colleague, responding to my statement in an earlier draft of this paper that students need to be taught how to discuss before they can engage in it, said “Absolutely. I frequently encounter all the problems you note above in argumentative/persuasive essays by composition students.” This pervasive problem is exacerbated when the discussion is moved to the on-line format. The discussions need to be facilitated. The instructor has the choice of facilitating one large on-line discussion, or dividing the class into groups and facilitating several small discussions. Facilitating several small groups discussing the same topic, is difficult and extremely time consuming. One large group discussion is preferred, but this limits the class size.

Student motivation also plays a major role in the success or failure of on-line discussions. Without visual cues the instructor has a hard time engaging non-participatory students. The instructor has fewer techniques available to draw a student into the discussion. Motivating students is a major part of some teaching situations. In these situations, even with a small class the on-line format is ineffective.

In conclusions, while there are several characteristics which make email a useful tool for enhancing class material, in most situations in-class discussions can not be substituted by email discussions. On-line discussions require too many resources and hamper addressing the problem of student motivation.

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