THREADED DISCUSSION AS A TOOL IN THE ASYNCHRONOUS TECHNOLOGY CLASSROOM

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Abstract -*Threaded discussion has the potential to be a very effective tool for learning online. However, it does not naturally fit well into engineering and science courses because of the factual nature of these domains. Our experience with this technique led us to be cautious in its use. Careful attention must be paid to topic selection and question design, instructor expectations of students, student personalities, and moderation of the actual discussion. This paper traces our experiences and concludes with recommendations for effective use of the technique.*

Index Terms – Online learning, threaded discussion.

BACKGROUND

Threaded discussion is the primary means of learner-learner interaction in web-based courses. Threaded discussion "refers to an asynchronous method of communicating in which comments to an original post are listed below, and indented under, the original post" [1, pg 212]. Figure 1 shows how a typical threaded discussion might appear. The instructor provides the first posting and students are expected to respond to the original posting as well as other students' responses. This paper looks at the evolution of an online course called "GUI Building"; a professional master's level course that deals with software architectures needed for creating Graphical User Interfaces (GUIs). The course was offered online in two succeeding years, 2000 and 2001, and students' interactions in the discussion area were part of the course requirements to encourage student participation and to elicit more interaction.

1.0 Posted question by Instrucrtor
 1.1 Response to 1.0 from student 1
 1.2 Response to 1.0 from student 2
  1.2.1 Response to 1.2 from student 3
   1.2.1.1 Response to 1.2.1 from student 4
 1.3 Response to 1.0 from student 5
 1.4 Response to 1.0 from student 6
  1.4.1 Response to 1.4 from student 7

FIGURE 1
THREADED DISCUSSION EXAMPLE

In the first version of the course (GUI'00), the syllabus stated that students were expected to participate in discussions and that 10% of their grade was based on this participation. The actual words used were

Most of the course content is delivered online. Students are expected to participate in discussions and activities, individually and in groups using WebCT.

The experience with discussion in this first attempt was mixed. Some postings seemed to generate a lot of activity, while others elicited little or none. We subsequently found research in online learning techniques [2, pg. 178] that suggest having very explicit instructions as to student expectations in threaded discussion. Unfortunately our inexperience hindered our discussion efforts.

Thinking that the clarity of instructions was the problem, we then used the following statement in GUI'01:

Asynchronous Sessions*---- Most of the course content is delivered on-line. Students are expected to participate in discussions and activities, individually and in groups using WebCT. When formal questions are posted on WebCT, the* **minimum** *expectation is that each student or student group (it will be specified) post one original response and also comment on one of the other student or group postings. The minimum postings earn 1 point of the 10 possible. Additional postings and all quality will be factored into the additional 9 points in the following manner:*

3 points -student consistently introduces and summarizes existing work related to the questions posed.

6 points - student consistently analyzes the questions, sees patterns and extends the summary.

9 points - student consistently synthesizes the literature; creates new ideas from old ones and generalizes.

As in all communications, a professional attitude is expected and a supportive atmosphere is encouraged.

Students responded to the use of clearer expectations. There was more student dis cussion in the GUI'01 responses, but many of the postings seemed superficial. We had the feeling that discussion was still not what it could or should be and this dissatisfaction led to the research described here.

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Data Analysis

Researchers claim that "asynchronous computer mediated communications has the potential to be a highly social, egalitarian, and deliberative medium" [3, pg. 208]. To achieve that potential, our research has led us to believe you must pay attention to four critical elements:

- Expectations of student
- Question design
- Personality of the students and instructor
- Facilitation

Success with these elements does not guarantee success with threaded discussion, but with our conditions it has proved to be an effective method.

Expectations

The statement on expectations of student participation used in GUI'01 was judged reasonable, based on literature recommendations. Since this is a different way of participating, students need a prescribed rubric indicating acceptable quality and quantity of postings. Without such details, too much is left to interpretation by both the student and the instructor. Having a detailed explicit expectations statement on discussion guides the student during the semester and gives the instructor a solid basis for grading that participation.

Question Design

In retrospect, by far the most difficult element of threaded discussion is question design. As stated above, some questions seemed to generate a lot of thought in the responses and others fell flat. To get a better feel for what constitutes a successful versus unsuccessful question, we invented a measure of "goodness" in the questions from the two GUI courses. The two extremes are illustrated in Figure 2.

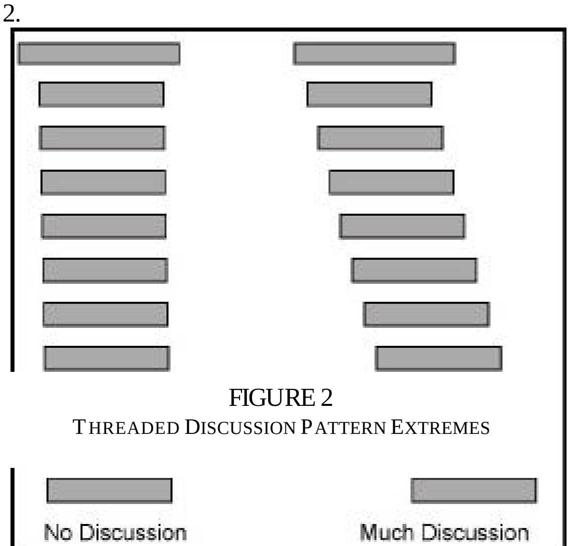

FIGURE 2
THREADED DISCUSSION PATTERN EXTREMES

In this Figure we use rectangles to represent the actual text string in order to better see the patterns described. On the left we have the worst case: a question is posted and all students respond to the question, but not to each other. This pattern of threads would be expected of a very factual question where there is one "right" answer and we assigned that pattern a value of zero. The thread pattern of the right of Figure 2 shows the opposite scenario: the first student responds to the question and other students continually build on previous postings. This pattern might be very desirable because it indicates interaction and critical thinking has taken place in the absence of consensus. Hence, this pattern was assigned a value of 1.

We also felt that the quantity of responses was less important than the quality, where quality was potentially reflected in the pattern on the right of Figure 2. To compare questions, we counted the number of "replies", i.e. the number of responses that replied to the previous posting, and divided by the total number of responses. Figure 3 is

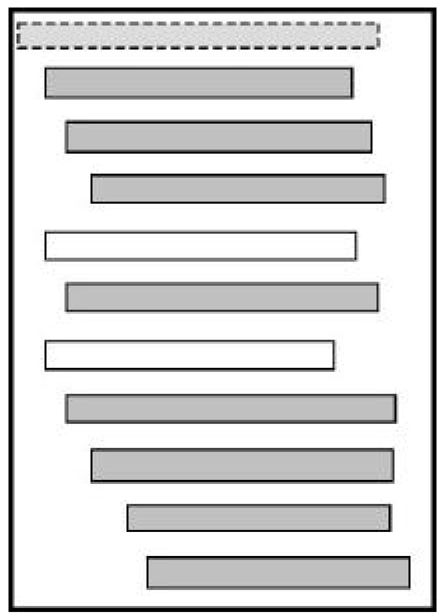

FIGURE 3
EXAMPLE QUALITY VALUE

an example of a quality value of 0.8. There were 10 responses to the original posting and 8 postings to the right of the previous level. This analysis was applied to the questions used in GUI'01 and is shown by the blue line in Figure_4.

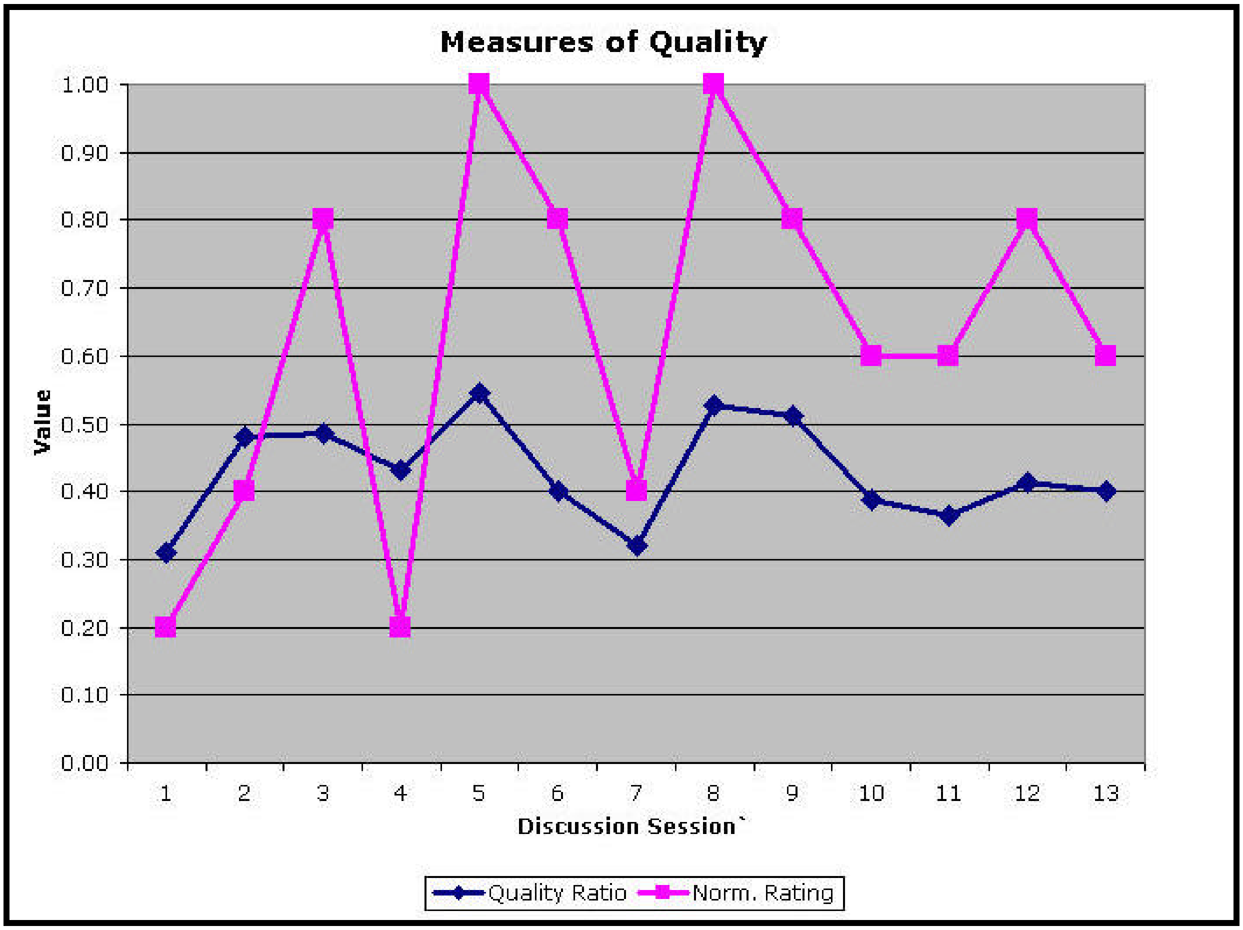

FIGURE 4
INTERACTIONS AND JUDGMENTS OF QUESTION QUALITY

The peaks represent successful questions, whereas the valleys represent questions that are not successful according to this rubric. For instance, Discussion Question 7 was:

We've discussed using pointing versus keyboard selection of menu items. Under what circumstances is keyboard input a better technique than pointing? Please give examples.

Obviously this question is very factual in nature. In contrast, Discussion Question 5 was:

We spent a lot of time talking about making our applications usable in other countries. At the same time, piracy of software is becoming outrageous! According to the Business Software Alliance (published in the October 2001 issues of CACM) estimates that 97% of the software units in Vietnam are counterfeit. China, Indonesia, Ukraine, and Russia have numbers of 94%, 89%, 89%, and 88% respectively. Assuming that these estimates are even partially true, does it really make sense to put in the time and effort for I18N when the software will be counterfeited?

Although this question is much longer, the real difference is that this question has more "opinion" or "value" associated with it – there is no one right answer.

We then asked three instructional designers to rate each of the questions used in GUI'01 according to a five point Likert scale with "Very Factual" as the left extreme and "Very Value Oriented" as the right extreme. The results are shown in pink on Figure 4, where the ratings were normalized so as to plot on the same scale. There is an obvious correlation (Pearson = 0.66) between the type of question and the responses elicited. Questions with a strong "value" dimension resulted in much more interesting threaded discussions.

This leads to the issue of types of questions used online and in face-to-face classes. Most of the interaction we have in the engineering or science classroom tends to be recitation, what is often called IRE for teacher *initiation* (question), student *response*, and teacher *evaluation* [4, pg.12]. Since the content that engineers and scientists deal with falls into the factual category, this is a natural phenomenon. Discussion is defined as "the free exchange of information among students and/or between at least three students and the teacher that lasted at least over a half minute" [4, pg. 36]. The discussion is not usually a debate, but a group dialogue that leads to some consensus. A better way to look at these questions is from the purpose perspective. A "test question" is one in which the answer is already known by the asker and is used to measure mastery. Whereas, an "authentic question" is one in which the asker has no pre-specified answer in mind and is trying to achieve understanding. Most of our engineering and science questions are test questions that lead to recitation instead of authentic questions that lead to discussion.

Recitation, itself, is not bad. There are many instances where test questions are the most appropriate form to use. Online, however, we have to be careful because the discussion tools are intended for authentic questions. Using the bulletin board for test questions results in threaded patterns that are very linear. In the two sample questions above, you can see that Question 7 is definitely a "test" question and Question 5 has the important value dimension, the "*does it makes sense* …" part. Many topics in engineering and science could still lead to discussion if posed from a societal or future perspective. As one group of researchers concluded " in order for a knowledge community to be highly engaged it must include a high amount of affect including paralanguage, values, and acknowledgement from both the students and the instructor."[5, pg. 17]

Personality

Another element of discussion is the personality of the students and instructor. The Myers-Briggs Type Indicator (MBTI) continually confirms that most engineers and scientists are introverted rather than extroverted [6, pg.733]. Face-to-face interaction in engineering and science classrooms is mostly recitation. Why should we think that this would change online? Discussion has the potential to be more egalitarian, but the participants need to want to participate. A dominant student can still be dominant in class or online! A passive student may be passive not because of the lack of the opportunity, but because they simply prefer to be passive.

Recent research has concluded that "direct interaction is not necessary for all students, and that those who observe and actively process interactions between others will benefit through the process of vicarious interaction." [7, pg. 223] The quiet student may be learning just as much as the vocal student but has a different learning or personality style. Forcing these students to interact may be counterproductive at best. Knowing this at the outset of course design is the important point. On the other hand, the workplace demands group interaction and these skills, if lacking, must be developed. Perhaps students are willing to interact with small groups but not large classes. Obviously, more research needs to be done on this issue.

A related issue is whether threaded discussion, by itself, really leads to better learning. A recent study reported that "threaded online environments support electronic conversations that expand and branch, but provide few facilities for drawing together discourse in meaningful ways."[3, pg. 207] The authors blame most of this on the fact that the tools require you to "reply" to a posting. Instead, convergence must be initiated by a moderator or by students serving in that role. Course tools need to be redesigned to allow for divergence followed by convergence, and students should understand that convergence is the ultimate goal. Another approach is to have the moderator *model* convergence to train students in what are appropriate responses.

Facilitation

Moderating or facilitating a discussion is the fourth element that needs to be addressed. Instructors are used to being the expert and it is difficult for them to adjust to the role of moderator. Collison, et al say that "if a moderator can successfully *guide* instead of giving *expert answers*, then learning is maximized as participants are pushed to learn by doing instead of rote copying". [1, pg 8] The simple fact is that engineering and science faculty may not have the requisite skills to be good facilitators! Yes, we are trainable, but that may not be the most effective use of our talents.

One guideline for online discussion is that there should be roughly one facilitator for every 20 students [1, pg. 42]. If instructors have facilitation skills, are there enough of them to staff larger courses? Often times the number of domain experts in engineering and science are limited. One alternative is to use teaching assistants in the facilitation role. However, TAs are usually engineering and science students that have domain knowledge rather than facilitation skills. They too are trainable, but is THAT the most effective solution? Another alternative is to hire or train a cadre of moderators who may not have domain knowledge, but do have the requisite skills. Not being able to chime in with a technical answer may be a distinct advantage at times. The instructor should still be part of the well-designed threaded discussion, but the trained moderator can ensure that students are discussing and ultimately converging.

During the GUI'01 offering, we did, in fact, try this approach. The instructional team consisted of the instructor, a TA who focused on grading and helped with technical questions, and a trained facilitator. Our experience with this arrangement was very satisfactory. We felt that the division of labor ensured that each aspect of the course had the appropriate expertise available. The facilitator took the lead in encouraging true discussion amongst the participants and provided a "good form" for the students to emulate. The instructor also added comments or asked for clarification throughout the discussions. Our findings related to poor question design pointed out that we need to reevaluate and redesign in order to make use of the simple measures we had hoped to use. We will incorporate these new findings and try again in the near future.

CONCLUSION

Recitation is still a useful method for testing students' knowledge of facts. However, threaded discussion is a potentially valuable learning technique that could greatly improve engineering and science higher thinking skills and lead to deeper understanding of subject matter. Just as any tool, to be effective it must be used correctly. Our experiences show that it should be used in circumstances where an *authentic* question can be posed. Given that, expectations of the quantity and quality of student responses must be provided and the role of the instructor or facilitator must be to encourage discussion, not to give answers. However, even if you satisfy all these elements, some students still may not feel comfortable interacting in this way. As instructors learn how to better use discussion, students will also learn how to appropriately respond and enhance their learning.

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