Enhancing Student –Teacher Interactions in Internet-based Courses

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Abstract

In face-to-face courses, instructors usually have a number of opportunities to interact with students, engage them in active learning, stimulate their critical thinking through discussions, and monitor their progress. These essential components of student – teacher interactions should also be incorporated in internet-based (online) courses to enhance student learning and capture the positive aspects of face to face courses. Enhancing student – teacher interactions in an online course requires addressing a variety of issues that impact such interactions and the pedagogical techniques available for integrating those interactions effectively. In this paper, a number of issues and techniques related to enhancing student – teacher interactions online are discussed. The issues include types of interactions, number of people involved, modes of interaction, communication tools used and training needed on those tools, language used for and tone of interactions, roles assumed by students or assigned by instructor for interaction, interaction facilitation techniques, timing, and volume and frequency of interactions, etc. The techniques address enhancing interactions during asynchronous and synchronous discussions, collaborative and individual interactions, and evaluating online discussions. The issues and techniques are illustrated with examples from the information systems course taught fully online by the author.

1. Introduction

Several universities in U.S. already offer engineering courses through the World Wide Web and satellite broadcasts. These courses are beginning to replace or supplement traditional classroom instruction with convenient, self-paced distance education, and reach a larger student body across U.S. Courses offered through satellite broadcasts are not very much different from classroom instruction, and therefore, require instructors to make minor changes in their course design to suit this mode of distance learning. However, courses offered through the internet require considerable instructional design and delivery due to the absence of frequent face-to-face interactions between students and teachers.

Numerous products have been introduced commercially during the past few years for online instruction and many of these products contain state-of-the-art course delivery features, such as audio, video, chat, etc. However, these products require instructors to design their courses using sound pedagogical techniques that allow students and teachers to interact effectively similar to a face-to-face course. In face-to-face delivery, instructors have the opportunity to interact with students, engage them in active learning, stimulate their critical thinking through discussions, and monitor their progress. These essential components of student – teacher interactions should also be incorporated in internet-based courses.

2. Issues to Consider in Enhancing Student – Teacher Interactions Online

Ottenhoff and Lawrence[7] mention that online discussion forums and conferencing tools have enabled new forms of interactions between faculty and students and introduce new factors into the teaching process that need to be examined. The scope of interactions in an online course depends on the level of integration of the course online and the dimensions of interactions. These interactions can run the gamut as shown in Figure 1 below from simple to complex, one-way to multi-way interactions. Online courses can be partially online to fully online, thus requiring a range of interactions.

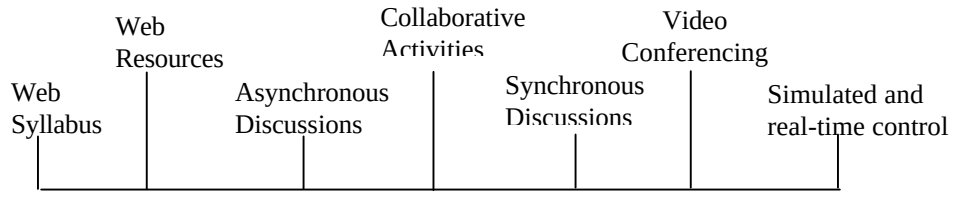

Figure 1. Range of possible interactions in an online course

The dimensions of interactions may include students, instructors, practitioners, and technical support staff. These may take the form of: (1) student to student, (2) students to instructor, (3) students to practitioner, (4) instructor to instructor, and (5) everyone to technical support staff and vice versa. One of the advantages of online courses is the possibility of interactions with practitioners in the field to give students real life perspectives on what is learned in a course. Even though interactions with technical staff may not be part of an online course content, provisions should be made for such interactions so that students and instructors can get the necessary technical support they need. The focus of this paper will be primarily on student – teacher interactions.

One of the most difficult aspects of teaching online is integrating student – teacher interactions similar to a face-to-face course in an online course. The multisensory, multimodal, mulitasking interactions that are common place in a face-to-face course are difficult to capture or emulate in an online course. Some of the issues to consider in enhancing student – teacher interactions online are: (1) type of interaction (course activity), (2) number of people involved, (3) modes of interaction, (4) communication tools used and training needed on those tools, (5) incentives offered to students for engaging in interactions, (6) language used for and tone of interactions, (7) roles assumed by students or assigned by instructor for interaction, (8) interaction facilitation techniques, (9) timing (live or offline), and (10) volume and frequency of interactions.

In a face-to-face course, students and teachers can interact: (1) one-on-one (individual student interacting with an instructor or two students interacting with one another), (2) as a small group (with their instructor or working on a course activity), and (3) as a large group (the whole class interacting with their instructor). Students and instructors can also interact inside or outside the class. The mode of interactions between students and teachers in a face-to-face can take the form of (1) oral (questions and answers, presentations, debates, etc), (2) written, (3) graphical (drawing on the board), or (4) hands-on or performance-oriented (building, demonstrating, or performing an activity) interactions. Many of these interactions may have to be emulated in an internet-based course to fulfill the course objectives similar to a face-to-face course.

The quantity and frequency of interactions coupled with the timing of interactions can be major factors in handling student – teacher interactions effectively in an online course. The volume and frequency of email, newsgroup or listserv postings in asynchronous mode and the interactions during a synchronous chat session can be overwhelming to both students and the instructor, if not managed carefully. The tools used for communication in an internet-based course can also encourage or impede interactions. Their cost, ease of installation, flexibility of use, speed, variety of features, and suitability for particular forms of interaction can certainly make a difference.

Regardless of the sophistication of the tools used and interactions designed for the course, students need to be motivated and offered incentives to interact online. Grades assigned for online interactions or fulfillment of course requirements through such interactions should be reasonable, motivate student to interact, and convey the value of those interactions. Interactions designed primarily for the purpose of learning to use another communication tool may not always motivate students to interact.

Students have to be made aware of the language and tone to use online due to the absence of face-to-face interactions in most online courses. Some students who are shy by nature or have poor language skills may have to be drawn into the interactions whereas students who are generally very talkative may have to be carefully restrained so that they do not dominate the interactions. To help students improve their communication skills and experience diverse communication styles, they could be assigned specific roles for their interactions by their instructor. Instructors can also monitor the progress and conclusion of interactions using discussion diagrams. These issues require instructors to be skilled in preparing and training students, moderating and facilitating their interactions, and monitor the progress of interactions.

2. Techniques for Enhancing Student – Teacher Interactions Online

Typical student – teacher interactions in an online course include (1) asynchronous or synchronous discussions between students and the instructor, (2) collaborative activities among students for completing course assignments, (3) students interacting one-on-one with the instructor on course materials such as course notes, homework assignments, announcements, etc. The key is designing these interactions effectively so that students are motivated to participate and learn the course materials, and the instructor has ample opportunities to interact with students, stimulate their critical thinking, facilitate their learning, and meet course objectives.

In the course Engineering Information Systems taught by the author on the Web all three types of interactions were included. Senior and graduate level students took the course through the Web from different geographical locations near Northern Illinois University. The course covered the life cycle of information systems including both theory (indexing, data modeling, process modeling, relational database design, validation, relational algebra, etc.) and application (application development and implementation, data manipulation, SQL, etc.). The class met online twice a week for two hours each time in a chatroom during the semester. Apart from synchronous discussions online, course activities included homework assignments submitted via email, asynchronous discussions through newsgroup and listserv, collaborative class projects, and laboratory exercises. The laboratory exercises required students to complete and submit by email several exercises on information system application design and development using MS-Access ™.

3.1 Discussions: Getting engineering students to discuss in a newsgroup, listserv, or a chat session on the concepts covered in the course, engage them in a constructive dialog, and help them reflect on the course material is generally a difficult task. Many of them would rather solve numerical problems than convey their thoughts in writing. But there are several ways to enhance student – teacher interactions in asynchronous or synchronous discussions.

The same instructional design principles and learning models used in a face to face course are also applicable in an online course. But the major difference is that in an online course instructor's role should be one of facilitating students' learning instead of teaching them similar to a face-to-face course. The key is in planning ahead what is to be covered in each online session and designing the discussions using learning cycle principles, such as the Kolb Learning Cycle[6] shown in Figure 2. Online discussions can be designed to cover all the four quadrants of the learning cycle by addressing motivational issues, theory and facts, application, and synthesis. This helps to impose a structure on the discussions and make them more substantive than unfocused or loosely organized.

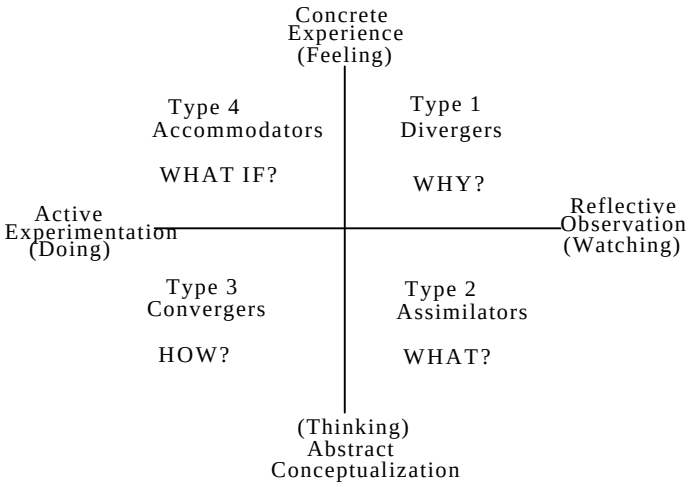

Figure 2. Four Quadrants of Learning and Learning Styles[6]

Akers[1] suggests that online discussions fit with *learning theory and teaching methods*. He mentions that the extensive student to student and teacher dialog, and the process of analyzing, interpreting, predicting, and synthesizing reflect the *constructivist approach*. The ability of students to participate in online discussions, reflect, explore, question, and seek out answers for themselves reflects Piaget's developmental theory of learning. The ability to contribute to the online community that creates the potential for learning reflects the *communities of practice approach*. Effective communication online, the ability to interact effectively, and think critically reflects *higher-order learning skills*.

The author had considerable success in synchronous discussions by applying the Kolb Learning Cycle online and engaging students' interest in the course material. One of the difficult topics to cover early on in the information systems course was indexes and indexing schemes. This topic was necessary to provide students with some basic knowledge and theory needed for information

system design, but the author discussed this material online according to the Kolb Learning Cycle such that students were presented with the reasons for learning this topic (Why?), the theory behind the indexes (What?), procedures for applying the indexing schemes (How?), and opportunities for synthesizing the concepts learned (What if?).

To participate in newsgroups or chat sessions and interact constructively, students need clear and specific instructions. They need to know why, how, and how often they should participate and what the incentives are. Without proper motivation and reasons for participation, students may not willingly participate in the discussions. At the beginning of the semester before the classes started, the author presented to students the protocol for interacting online, how often they should participate, what the incentives were for participation, etc. The presentation also included a demonstration and step-by-step instructions for using the online discussion software (WebBoard™) and the Web courseware (TopClass™) used in the course. These were well received by students and during the semester there were no questions or confusion regarding how to use the tools or what the protocols for interactions were. Figure 3 shows a sample screen from WebBoard (the chat software) the author used to interact with his students online.

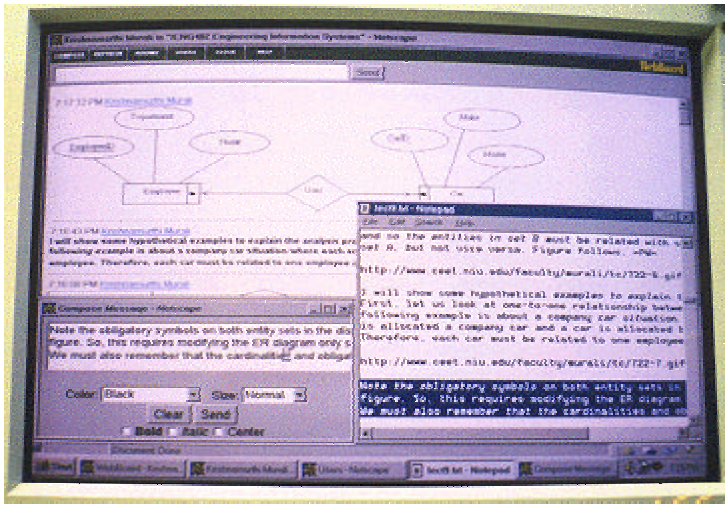

Figure 3. Sample screen from WebBoard used for online interactions in the course

It is very important to explain to students the need for proper use of the language and the tone of their interactions during online discussions. Some students may assume the appearance of informality of online discussions as an excuse to use inappropriate language and offend other students intentionally or unintentionally. This issue was stressed by the author to his students during the introductory presentation on online interaction protocol at the beginning of the semester. This helped to maintain a sense of formality during the semester and online interactions proceeded very smoothly. There were a number of international and minority students in the class who felt very comfortable to interact freely online throughout the semester and they participated much more than they usually would in face-to-face courses.

Providing students with a sublanguage that they can use during synchronous discussions to speed up the conversation and simplify typing is a good idea. It is already a common practice in email and chat for people to use abbreviations, such those indicated on the two left columns of Table 1.

For the online course taught by the author, the class used additional abbreviations for frequently used information systems terminology. A sample of such abbreviations used by the students and the author in his online course are indicated on the two right columns of Table 1.

Table 1. Sample abbreviations used in the online course

Chat Abbreviation	*Meaning*
TY	Thank you
L	Laughing
LOL	Laughing Out Loud
WB	Welcome Back
PRP	Please Re-Post
PW	Please Wait
BRB	Will "Be right Back"
**IHAQ*	I've a question

Chat Abbreviation	*Meaning*
LN	Leaf Node
*NLN	Non-Leaf Node
SI	Sparse Index
DI	Dense Index
ERD	E-R Diagram
DFD	Data Flow Diagram
RA	Relational Algebra
PK	Primary Key

Apart from the language used during online interactions, students' tone of interactions can have an impact on discussions. Depending on their personalities and tone of interactions, students can assume several roles when participating in online discussions. Some of these roles are starter-wrapper, wanderer/lurker, contributor/participant, mentor, expert, seeker/questioner, sage, warrior, planner, bloodletter, questioner, comic, slacker, mediator, pessimist, commentator, idea generator, optimist, devil's advocate, etc[3]. Effective communication is one of the critical skills most engineering instructors strive to impart on their students in face-to-face courses. This can also be accomplished in online courses using written interactions, if not verbal presentations. One of the advantages of online discussions is the opportunity to save transcripts of discussions and analyze them later to show students their communication styles. By recognizing the roles they portray online and the tone of their interactions, students may learn to communicate constructively. Instructors can also assign students specific roles to help them experience and express different viewpoints during online interactions and learn better interaction skills.

Stimulating critical thinking skills and motivating students to reflect on the topics require careful design of interactions in an online course due to lack of face-to-face interactions. When posting questions or items to stimulate discussions it may be better to post open-ended questions with several possible solutions instead of posting problems or questions with one particular solution. For example, it may be possible to post a question in a newsgroup asking students to analyze several ways data models can be designed for a problem and discuss their pros and cons.

3.2 Collaborative Interactions: Instructors can design collaborative activities in online courses to encourage teamwork and cooperative learning[4,5]. One simple strategy to enhance interactions among students in a team or a small group would be to set up hyperlinks on the course Website for email for all students in a project team. This requires only a line of HTML code to include the email addresses of all the students in a team in the "mailto:" tag in HTML. By clicking on the hyperlink, students in a small group will be able to send email easily to all the students in that group to share information on a team project or activity.

Collaborative writing or problem solving activities are beneficial for enhancing interactions in an online course. There are collaborative writing software, such as Collaborative Writing Engine and

Connect.net, that allow students to post their work online and let other students (or the instructor) modify it or comment on it to write or solve a problem collaboratively. Online whiteboards are useful for collaboratively solving a problem graphically. These types of collaborative techniques are very useful for enhancing student interactions and encourage even students with partial solutions to a problem to interact and participate in the course effectively.

3.3 Individual Student Contributions: Careful design of individual student contributions can enhance students' interactions in an online course. Students' learning styles vary and some prefer to work in teams and some prefer to reflect on their own and engage in self-paced learning. Interactions in an online course should be designed to accommodate different learning styles and encourage individual interactions as well as collaborative ones.

In an information systems course, for example, students can be assigned online activities to surf the Web and check out various data modeling packages available online, download and try them, and post a critique online on the packages they tried for other students and instructor to read. Students can be assigned to post online their learning portfolios and journals on what they learned and reflected in the course for the course instructor to read and respond to them, if necessary. Some online course packages have features in the course website where students can post their presentations. Students can be paired with practitioners in the field and encouraged to interact on issues related to the course and get a real-life perspective on course topics. Students can be required to generate links to Websites related to course topics and post them online. These individual contributions by students may motivate students to explore course topics on their own and generate opportunities for interacting with the instructor or other students in the class.

3.4 Evaluating Interactions: Both formative and summative evaluations of student – teacher interactions are important in an online course to assess the effectiveness of those interactions. Formative evaluations can be conducted using surveys and questionnaires to assess students' reactions to course activities designed to enhance online interactions. The author designed a special course evaluation survey to obtain students' feedback on a number of issues related to the course including online interactions. The issues related to online interactions dealt with activities designed for interactions, effectiveness of communication through those activities, students' learning as a result of the interactions, etc.

Student –teacher interactions can also be evaluated on a discussion thread-by-thread basis to understand the interactions better and refine them further. Discussion diagrams based on sociograms[8] used to study traditional classrooms can be applied to model online discussions, understand the interactions better, and improve on them. Since archives of asynchronous discussions and synchronous chat transcripts can be saved, it is much easier to do this for online courses than face to face courses.

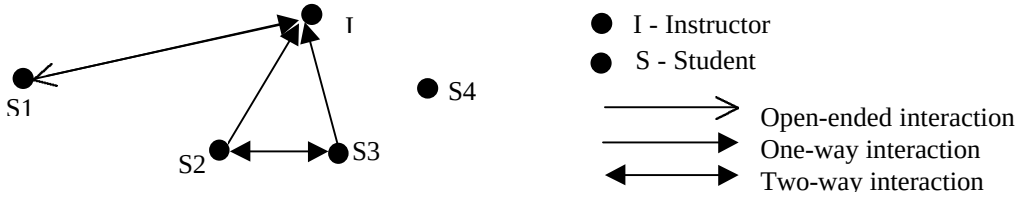

Figure 4. A sample discussion diagram

A sample discussion diagram for a single thread of discussion is shown in Figure 4 indicates the open-ended question asked of student 1 (S1) by the instructor (I) which results in a one-way response from student 1 (S1), unsolicited one-way responses from students 2 (S2) and 3 (S3), a two-way response between students 2 (S2) and 3 (S3), and no response from student 4 (S4).

Bickel[2] provides methods for calculating indices that quantitatively describing interactions, student contributions and instructor contributions to the interactions, instructor mediated and non-mediated interactions, and the extent to which the interactive potential of the discussion was achieved. Table 2 illustrates the computations of interaction indices for the sample discussion diagram shown in Figure 4. The values of the indices indicate that for the particular discussion thread student contribution was 75% of what was possible and the total interaction was only 40% for those in the discussion group. This type of quantitative analysis of online discussions can be beneficial for evaluating student interactions during online discussions and refining the questions posed by the instructor in the classroom to stimulate discussions.

Table 2. Sample computations of indices for the discussion diagram shown in Figure 2.

Index	Formula	Example	Values
Student contribution	No. of students contributing at least once/ total no. of students in discussion group	(3/4)*100	75%
Total interaction index	Actual no. of connections / total no. of one way connections	(4/10)*100	40%
Instructor-mediated interaction index	Actual no. of instructor-student connections/ total possible no. of one-way instructor-student connections	(3/4)*100	75%
Instructor-independent interaction index	Actual no. of student – student connections / total possible no. of student – student connections	(1/6)*100	17%

Note that the total possible number of one-way connections is $(n^2-n)/2$, where n is the number of nodes, the total possible number of one-way instructor-student connections is $n_i * n_s$, where n_i is the number of instructor nodes and n_s is the number of student nodes, and the total possible number of one-way student-student connections is $(n_s^2-n_s)/2$.

3. Lessons Learned

Teaching the Engineering Information Systems course online was a unique experience in many ways because of the type of interactions required to address course content and facilitate students' learning. The content required students and the instructor to convey text, graphical, and mathematical information and required careful design of content delivery through the course Website, asynchronous and synchronous interactions, and course activities. The author took considerable precautions to reduce the volume of email interactions with individual students and the need to repeat the same information with several students. He directed students to post their general questions about the course topics or course activities to the newsgroup, but he still had to respond to a large volume of email even for a small class.

Conveying graphical information during synchronous chat sessions was not an easy task. Even though tools, such as NetMeeting have whiteboards available for drawing simple graphics and interacting synchronously, the tools were not very flexible to draw freehand using a mouse similar to what one would do on the board in a face to face classroom. To enhance graphical interactions, the author and his students learned to create the drawings offline and then post them during online chat sessions to discuss related concepts. Conveying mathematical equations was also a difficult task during online chat sessions and all the equations needed for discussing Relational Algebra and Relational Calculus concepts had to be created offline, saved as graphic files, and displayed as images online. However, newer Web course teaching packages are beginning to provide better features for creating and displaying equations and graphics online.

Several synchronous chat tools currently have voice chat features. Tools such as Cheetachat™, Yahoo Voice Chat™, and mplayer™ allow groups of users to talk one at a time during a chat session. Some of these tools do not allow each user to talk for more than a predetermined amount of time (say 20 seconds) at a time. Some tools such as Microsoft Netmeeting™ allow users to talk synchronously but it degrades the quality of the audio. However, the author found these tools to be too cumbersome to engage in audio as well as in graphical communication with students online. Simplicity is the key in enhancing interactions online and too many modes of communication and features only serve to distract students and their concentration on course content. For addressing individual students concerns or problems, telephone was a better tool for communication for the author.

Effective moderation of online interactions is very important for enhancing online interactions and motivating students to participate in online discussions. If the instructor requires students to interact and does not participate in the discussions himself/herself, students will not be motivated to participate and will not have a sense of direction to discuss the course materials online. The author had to moderate asynchronous discussions on a daily basis, respond to students' posts, and direct the discussion. Similarly, he had to design the synchronous discussions by scripting them ahead of time and moderating them effectively online. One of the significant lessons learned by the author from teaching the information systems course online was the considerable amount of preparation time needed for designing the course materials and activities and delivering them online.

4. Conclusions

In this paper, a variety of issues and techniques for enhancing student – teacher interactions in internet-based courses were discussed. The issues ranged from the type of interactions to the volume of interactions. The techniques addressed enhancing interactions in asynchronous and synchronous discussions, collaborative activities, and individual student contributions. A technique for evaluating online discussions was also illustrated. The issues and techniques were discussed in relation to the Engineering Information Systems course taught fully over the Web by the author.

Enhancing student – teacher interactions in internet-based courses requires applying the same instructional design principles used in face-to-face courses in online courses and designing the

interactions effectively to facilitate student learning, accommodate different learning styles, and convey course materials effectively. The interactions should be accomplished through a variety of course activities, such as asynchronous and synchronous discussions, collaborative activities, and individual student activities. Conveying graphical concepts or mathematical equations during online interactions may require considerable preparation. Students should be provided with adequate introduction to the protocol for interacting online and the necessary training on the tools needed for those interactions. Students should also be informed on the roles they assume when interacting online and the need for improving their communication skills. The instructor should participate in the interactions on a frequent basis to motivate students, direct the discussions, and ensure that course objectives are being met. Online interactions can also be analyzed and refined using techniques, such as discussion diagrams. Finally, simplicity is the key to enhancing interactions online - few tools and few modes of interactions will better serve the purpose.

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