AC 2007-1298: CLASSIFYING WEB-BASED DISCUSSION FORUM TASKS AND LEARNING OUTCOMES OF UNDERGRADUATE INFORMATION SCIENCE STUDENTS

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Classifying Web-Based Discussion Forum Tasks and Learning Outcomes in Undergraduate Information Science Courses

Abstract

The use of web-based discussion forums to enhance traditional classrooms and web-based distance learning environments are growing exponentially. Research on discussion forums have produced mixed results on learning outcomes. The purpose of this research was to classify the tasks that were assigned to undergraduate information sciences students using discussion forums and to examine the effects of these tasks on the learner's knowledge outcomes. Results showed that debates produced the most favorable learning outcomes while recall and simple posting of ideas resulted in the poorest learning outcomes. The results have implications for all instructors using web-based discussion forums in their classes.

Introduction

Web-based technologies are being introduced to traditional and on-line classrooms at an exponential rate with little thought being given to the quality of the tools or their effects on the learners. One area that is frequently touted as exceptional on-line activities is the use of discussion boards to supplement class activities or as a standalone learning activity[1,2,15]. Even though discussion boards can foster a sense of community and can help learners post their thoughts on discussion topic[12] they can only be successful in helping students learn complex thinking skills like problem solving, argumentation, and critical thinking if the instructor knows how to encourage thoughtful postings and discussions[3]. "Research has shown that good learning environments require active participation of the learner in the construction and use of knowledge; teachers who can provide learning opportunities, feedback, reflection, and scaffolding; and learning environments that can facilitate and motivate both the learner and teacher to do what they do best[6,,17].

Most of the current research on the use of discussion forums in learning environments has concentrated on the social aspects of these forums[5,12]. Some research that has reviewed discussions as phases have concentrated on tracking the students through different phases of interactions like comparing information, discovery, negotiation of meaning, to testing and co-construction of knowledge[11]. Other research has studied the personality types of learners and how each personality type interacts within discussion forums. Fahy & Ally[9] studied the Kolb learning style convergers resulted in better posting related to high level problem solving tasks. Finally, research has been conducted on the types of conferencing systems and their effects on learning outcomes[8], how discussions can be used in classrooms[10], fostering social collaboration[14], and knowledge creation[13].

None of the current research studies have focused on relating the assigned tasks and the discussion forum outcomes. For example, can a discussion forum task framed as shown in figure 1 differ in the posting quality compared to a discussion task framed as shown in figure 2? The example shown in Figure 1 sets the context for the problem followed by questions about advantages and disadvantages of the "networked" society. They are also instructed to plan for a

debate which focuses the student's attention on analyzing the situation, assessing the alternatives, taking a stand on which side of the issue they stand, justify the stand with citations and resources from their research. Figure 2 shows a sample of another problem that is described to the student but followed by questions to the students that requires them to focus on the outcomes but no justification for their conclusions. It is hypothesized that the framing of the debate shown in Figure 1 will result in more argumentation and justifications for solutions than the recall approach suggested in the question from Figure 2. Studying what types of tasks in the discussion forums result in what types of postings by learners can provide the most useful information to teachers using discussion forums in their classrooms.

This paper presents our research to address this research need. We begin with a description of our classification of discussion forum tasks synthesized from the current research. Then we follow with our qualitative approach to coding the postings in the discussion forums for these tasks and correlations between the tasks and the posting types. Finally we present our discussion and suggestions to instructors for applying our findings in their teaching.

Figure 1:

As networks move to the home, it is inevitable that all of the electronic devices will become network-able. These items will include your television, refrigerator, stove, and even your lights. For example, some networks will allow appliances to be switched on and off and monitored over the Web. Security systems will also be Internet enabled. Companies will be able to track and monitor your use of their products. Electric companies will be able to directly control your use of electricity to keep costs down. Can you imagine log file statistics on how frequently you use the microwave or open the refrigerator? What do you see as advantages and disadvantages of this type of "networked" society? Your team will debate these advantages and disadvantages on the forum.

Figure 2:

Most companies use electronic information extensively to support their daily business processes. Continuity of operations and correct functioning of information systems is vital to most businesses. Threats to computerized information and process are threats to business quality and effectiveness. Data is stored on customers, products, contracts, financial results, accounting, etc. The objective of IT security is to put measures in place that eliminate or reduce significant threats to an acceptable level. What needs to be protected, against whom, and how? If electronic information were to become available to competitors or to become corrupted, falsified, or disappear, what are the implications, what could happen? Outline the consequences as you see them.

Discussion Tasks

Wijekumar & Spielvogel[17] report on a review of 100 on-line courses and compiled a list of tasks that were assigned when instructors used discussion forums in their classes. They include simple questions that students responded to individually, student posed question, help forums, debates, social conversations, and problem solving activities. The research from which these tasks were compiled included a study by Weisskirch et al.,[16] that showed discussion forums used as social support, to answer questions, and content area messages. The following tasks were found to be the most frequently used in discussion forums and therefore used in this study:

1. Instructor posed question (similar to one shown in Figure 2)
2. Student posed question

3. Help forums where students can receive assistance on the course
4. Discussion on instructor provided topic
5. Debate on instructor provided topic (similar to one shown in Figure 1)
6. Problem solving in discussion forum (collaboration among students in solving problem)

This research has concentrated on higher order learning outcomes as proposed by Bloom and Krathwohl [4] in their taxonomy of educational objectives. Therefore we studied the correlations between tasks related to debates, discussion questions with prompts for deep thinking (e.g, can you identify the reasons for using WANS instead of other software and provide justification for your responses), and questions with simple prompts (e.g., Why are WANS used in companies).

Review and Coding of Discussion Forums

The research team trained two independent rators to review discussion forum content from 18 undergraduate classes in information sciences. The discussion forums reviewed included face-to-face classes that were enhanced with supplementary on-line discussion forums and on-line distance education courses that were taught by six difference instructors. The discussion forum content was coded by independent raters using an extensive coding scheme of learning outcomes, communication types, and posting quality presented in Table 1.

Table 1: Codes for Classifying Discussion Forum Posting Segments

Code	Example
Subject Matter Related	
SP	Statement of Problem
ES	Identifying External Sources
J – EC	Justification with External Citations
J – WC	Justification without citations
OP	Personal Experience/Opinion
PP	Paraphrasing previous posting
Socialization	
IN	Introduction
RS	Relevant stories
SC	Unrelated social conversations
PE	Private personal experience not related to subject

The identifying information on the posting students were replaced with student numbers before each forum was coded. The following steps synthesized from Chi[7] were followed by the rators in reviewing and coding the forum postings:

1. Type of task/question posted by moderator (e.g., note the task, deadlines, and instructions)
2. Student group, description of course, objectives, and flavor of learning – (e.g., problem based learning, discovery learning, and case studies)
3. Code discussion content
    a. Identify segments within the posting that would be the shorted unit that would consist of a unit of thought
    b. Classify the segment as one of the pre-defined set of codes provided to them and shown in Table 1.

c. If there was no existing classification for the posting the rators were asked to create what they thought was an appropriate code and make special note of this. There were no additional codes suggested by the rators.
d. Once each segment was coded by two rators the researchers reviewed the codes and their placement on the postings.
e. Any disparity in the codes was resolved by the researcher.

After the discussion tasks were classified, the types of activities defined, and the discussion forum content was segmented and coded a frequency table was created. Each frequency table contained information on the type of activity, and the numbers of postings on each code. These frequency tables were then used to conduct statistical correlations on the type of postings with the types of discussion activity presented by the instructor. Additionally, we analyzed within and between subjects differences in frequencies of postings for the students to see if there was any differences in posting quality based on the type discussion forum activity created by the instructors.

Results

The results presented here used discussions from 34 discussions conducted in 18 courses taught by six different instructors. We present Pearson Correlations in Table 2 and highlight those correlations that were statistically significant. Specifically, arguments, justifications, and external sources were significantly correlated with the type of assigned discussion task. The argumentation postings were correlated to the discussion type (-.771, $p < .01$). The mean for the postings related to argumentation on the debate assignments were 39.25 (SD=9.414), whereas, the argumentation related postings for the simple question assignments was 4.4 (SD=9.6). Where discussion type = 1 (debate) resulted in more postings related to argumentation, justification with external citations, and whether it was on-line vs. regular class supplement. The on-line classes showed significantly higher social postings than classes that held discussions as supplement to their regular course work ($p < .05$). We also included an instructor variable in the analysis (Inst) and found that the instructor's approach to constructing the tasks and their responses correlated with the numbers of quality postings in justifications and opinions stated.

Discussion

Based on the correlations and the analysis of variance presented in the results we can begin to provide some guidance to instructors of on-line discussion tasks about the types of activities that generate higher level thinking and postings on discussion forums. *We may suggest that debates and argumentation related discussion forum activities result in student postings that have higher order thinking skills like argumentation and justifications with citations*. We can also recommend that instructors use debates more often in their on-line discussion forum activities instead of recall types of questions that only require less complex cognitive skills.

However, correlations do not suggest causality. Since causality requires a controlled experiment we used two indirect methods to further study whether these discussion types really improved learning. The first was the outcomes in tests. Essay and short answer style tests revealed that debates on the discussion forum was highly correlated with good performance on the tests. A second approach was to study whether there was any carry over effect from one discussion

forum assignment to another. So we carefully tracked students who participated in a debate first and reviewed there subsequent postings on other types of discussion forum activities like a simple question with no prompts. This review showed that there was no students appeared to adapt to the types of discussions and did not use many of the skills they learned in one activity with the next unless they were reminded by the instructor. *These findings suggest that the role of the discussion activity as well as the feedback of the instructor is a critical component in the discussion forum learning activities.*

Table 2: Correlations between type of discussion task and the coded posting frequencies*

		Type	ARG	J - WC	J - EC	ES	OP	Inst.	SO
Type	Pearson Correlation	1	**-.771(**)**	**-.435(*)**	**.333**	**.359(*)**	.221	-.293	.310
	Sig. (2-tailed)		.000	.010	.054	.037	.209	.093	.075
	N	34	34	34	34	34	34	34	34
ARG	Pearson Correlation	-.771(**)	1	.240	-.054	-.024	.218	-.129	.104
	Sig. (2-tailed)	.000		.171	.763	.892	.215	.468	.560
	N	34	34	34	34	34	34	34	34
J - WC	Pearson Correlation	-.435(*)	.240	1	-.429(*)	-.366(*)	-.347(*)	.754(**)	-.735(**)
	Sig. (2-tailed)	.010	.171		.011	.033	.044	.000	.000
	N	34	34	34	34	34	34	34	34
J - EC	Pearson Correlation	.333	-.054	-.429(*)	1	.936(**)	.577(**)	-.505(**)	.452(**)
	Sig. (2-tailed)	.054	.763	.011		.000	.000	.002	.007
	N	34	34	34	34	34	34	34	34
ES	Pearson Correlation	.359(*)	-.024	-.366(*)	.936(**)	1	.613(**)	-.543(**)	.500(**)
	Sig. (2-tailed)	.037	.892	.033	.000		.000	.001	.003
	N	34	34	34	34	34	34	34	34
OP	Pearson Correlation	.221	.218	-.347(*)	.577(**)	.613(**)	1	-.699(**)	.738(**)
	Sig. (2-tailed)	.209	.215	.044	.000	.000		.000	.000
	N	34	34	34	34	34	34	34	34
Inst.	Pearson Correlation	-.293	-.129	.754(**)	-.505(**)	-.543(**)	-.699(**)	1	-.980(**)
	Sig. (2-tailed)	.093	.468	.000	.002	.001	.000		.000
	N	34	34	34	34	34	34	34	34
SO	Pearson Correlation	.310	.104	-.735(**)	.452(**)	.500(**)	.738(**)	-.980(**)	1
	Sig. (2-tailed)	.075	.560	.000	.007	.003	.000	.000	
	N	34	34	34	34	34	34	34	34

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

One area that we have not pursued in this study is the interactions that take place between the instructor and students, and students and their peers. Future research plans call for reviewing the coding schemes and creating tallies of communications between these groups to see if that is a mediating variable to the posting quality.

This research can provide answers to instructors in three practical areas in using discussion forums in learning environments. The first, instructors can construct debates and learn how to manage the debates to foster deeper thinking and improve posting quality in learners. Second, the construction of the tasks can be greatly improved with the samples provided here. Third, the continued differences in postings between on-line vs. traditional classrooms students' needs to be given careful thought. This factor of on-line learners posting significantly higher social posting maybe a necessary function of the students' disconnect with their counterparts in the classroom and the instructor. However, research needs to be conducted on whether their postings can be also focused to the content equally or more than the social conversations as seen in this research study.

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