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A Path Analysis of Online Discussion Behaviors and Their Impact on Quality of Posting in Online Debates

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Abstract

This study conducted a path analysis to test a model that describes how five types of behaviors exhibited by each student in online discussions influence one another and how each of these types of behaviors directly and indirectly affect the quality of the messages posted by a student. The findings suggest that: a) setting minimum requirements on number of posted replies could have an adverse effect on the quality of students' postings; and b) instructors can set requirements on number of opening arguments/threads posted and number of different posting days to *directly* increase the number of responses elicited by each student's messages and number of reciprocal replies in order to increase the quality of students' postings.

Introduction

One of the challenges of online teaching is the search for effective yet practical methods that can be used to encourage students to engage in exchanges that foster critical and deeper inquiry in online courses. Some of the common but not yet fully tested methods used to promote discourse and student interaction are to set minimum participation requirements on the number of postings, posting days, replies, reciprocating replies, and number of words per posting (Jeong & Frazier, 2008; Swan et al., 2007; Sparatiu et al., 2007). These particular types of criteria are frequently used because they are to a certain extent easier for instructors to track and monitor. The alternative but more time demanding approaches for example is the use of discussion rubrics to evaluate student performance based on qualitative criteria like relevance, originality, and quality of writing (Gilbert & Dabbagh, 2005; Kay, 2006; McAlister, 2003; Swan et al., 2007).

The findings from previous studies show how structural criteria (e.g., requiring minimum number of postings, replies, and posting days) can make a significant impact on level of interaction and discourse when measured simply in terms of the number of responses students post in reply to other students' messages. Two studies revealed that responses posted with short response times (which consequently, provides more remaining time for other students to read and reply back to the response) are much more likely to elicit subsequent responses (Hewitt, 2003; Jeong, 2004). A similar study found that the day in which a message is posted (early, midweek, weekend) can significantly affect how many replies are elicited by messages (Jeong and Frazier, 2008). These findings suggest that sustained discourse can be promoted by requiring (posting days) students to post messages on multiple days (and by necessity, posting messages at least two or more days before the end of the discussion period) in order to provide sufficient time for other students to read and response back to some if not all postings. In addition, previous studies show that the number of responses posted in reply to other students' messages can be increased by simply requiring postings across multiple days and/or to post a minimum number of postings

without necessarily stipulating how many of the required postings must be replies to other students' messages (Gilbert & Dabbagh, 2005; Swan et al, 2007; Sparatiu et al, 2007).

However, studies have yet to be conducted that adequately addresses altogether the following questions: What is the impact of each type of posting requirement (or posting behavior) on the quality of students' postings? How might each type of behavior affect other behaviors when multiple types of behaviors are performed and observed in discussions? Which type of behaviors directly versus indirectly affects quality? Which one behavior exerts the greatest influence on both message quality and other behaviors directly affecting quality? To simultaneously address these questions, this study proposes a path diagram and model of the causal relationships between five behaviors and message quality and tests this model using path analysis. The five behaviors measured in this study were the total number:

1. messages posted to initiate a new discussion thread
2. different days in which the student made one or more postings
3. messages posted in reply to another students' posting
4. replies elicited from each student's posting
5. reciprocated replies (or uptakes) posted by each student

Model of Online Behaviors & Quality of Postings

We believe that each time a student posts an argument (and initiate a new discussion thread), the student opens the door for other students to post a large range of possible responses (challenges, supporting evidence, explanations). Therefore, we believe that **total arguments** posted by a student contribute to an increase in the number of **replies elicited** by postings made by the student. We also hypothesized that each elicited reply generates for the student an opportunity to post a follow-up or **reciprocal reply** that moves the discussion forward (justify/defend his/own claims) in a way that produces new ideas or meaning. As a result, our model hypothesizes that the number of reciprocal replies posted by a student increases the **quality** of the postings made by the student. This hypothesis is based on Bakhtin's dialogic theory (1981) which purports that (a) meaning is constructed not from a single message alone but by the juxtaposition of two messages of differing viewpoints and (b) this juxtaposition of ideas triggers further discourse and deeper inquiry. We also hypothesize that when a student contributes **postings across more days** of the week, they are more likely to find and read messages posted in reply to their postings. This in turn creates more opportunities for the student to post a reciprocating reply. At this time, we do not have any underlying theory as to how **number of total replies** posted by a student is causally related to the other posting behaviors. As a result, our model simply tests the direct relationship between total replies and message quality.

Method

Over the course of two semesters, a total of 32 subjects participated in online debates (using Blackboard discussion forums) in an online introductory graduate-level course on distance education. Students were required to make a minimum of 4 messages per week in each debate (four total debates in the course) over an issue presented in the form of a controversial claim/statement. In each debate, students were assigned to a supporting or opposing team. Each team was given one discussion thread to post, tag, and number (e.g. +ARG1) each presented arguments used to support the team's position. Opposing team members were instructed to post

replies to presented arguments to test/challenge their merit. Students were also instructed to post rebuttals to challenges to justify and verify their arguments.

<input type="checkbox"/>	<input type="checkbox"/> SUPPORT statement because...	Student names	Sat Oct 2, 2004 11:18 am
<input type="checkbox"/>	<input type="checkbox"/> +ARG#1 MedialsButAMereVehicle	Student names	Mon Oct 4, 2004 8:47 pm
<input type="checkbox"/>	<input type="checkbox"/> -EVID MedialsButAMereVeh...	Student names	Tue Oct 5, 2004 7:09 pm
<input type="checkbox"/>	<input type="checkbox"/> +But RelativityTheory...	Student names	Tue Oct 5, 2004 9:43 pm
<input type="checkbox"/>	<input type="checkbox"/> -But RelativityThe...	Student names	Sat Oct 9, 2004 10:12 am
<input type="checkbox"/>	<input type="checkbox"/> -BUT Whataboutemotions?	Student names	Tue Oct 5, 2004 9:53 pm
<input type="checkbox"/>	<input type="checkbox"/> +EVID DistEdEffectiveAsF2F	Student names	Tue Oct 5, 2004 10:40 pm
<input type="checkbox"/>	<input type="checkbox"/> -BUTMediaamerevehicle	Student names	Wed Oct 6, 2004 8:19 pm
<input type="checkbox"/>	<input type="checkbox"/> +EVID MooreConcurs	Student names	Wed Oct 6, 2004 10:07 pm
<input type="checkbox"/>	<input type="checkbox"/> +EXPLMediaSelectionCo...	Student names	Sun Oct 10, 2004 12:35 am
<input type="checkbox"/>	<input type="checkbox"/> -BUT WellChosenEffect...	Student names	Sun Oct 10, 2004 4:31 pm
<input type="checkbox"/>	<input type="checkbox"/> +But SupportingRes...	Student names	Sun Oct 10, 2004 5:37 pm
<input type="checkbox"/>	<input type="checkbox"/> -BUTMediaismorethanamere...	Student names	Fri Oct 8, 2004 5:30 pm
<input type="checkbox"/>	<input type="checkbox"/> +BUT SupportingEviden...	Student names	Sat Oct 9, 2004 8:51 am
<input type="checkbox"/>	<input type="checkbox"/> -BUT LearningNotSimplyAP...	Student names	Mon Oct 11, 2004 9:54 am
<input type="checkbox"/>	<input type="checkbox"/> +ARG2 Standards for teaching	Student names	Wed Oct 6, 2004 1:48 pm
<input type="checkbox"/>	<input type="checkbox"/> +But Clarification?	Student names	Sun Oct 10, 2004 5:39 pm
<input type="checkbox"/>	<input type="checkbox"/> +ARG3 MediaUnrelatedtoLearn...	Student names	Wed Oct 6, 2004 3:12 pm
<input type="checkbox"/>	<input type="checkbox"/> -BUTMediaUnrelatedtoLearn...	Student names	Wed Oct 6, 2004 8:26 pm
<input type="checkbox"/>	<input type="checkbox"/> +BUT MediaSelection	Student names	Thu Oct 7, 2004 9:20 am
<input type="checkbox"/>	<input type="checkbox"/> -BUT MediaSelection	Student names	Sun Oct 10, 2004 11:21 am
<input type="checkbox"/>	<input type="checkbox"/> +EVID MethodNotMedia	Student names	Wed Oct 6, 2004 11:04 pm
<input type="checkbox"/>	<input type="checkbox"/> -BUT MediaUnrelatedtoLea...	Student names	Sat Oct 9, 2004 10:59 am

Figure 1. One debate in the Blackboard discussion forum

In each debate, scores were tallied for *each* student on the total number of messages posted to initiate a new discussion thread, different days in which the student made one or more postings, messages posted in reply to another students' posting, replies elicited from each student's posting, and reciprocated replies posted by each student. The quality of all the messages posted to the debate for a given student was evaluated using Cho and Jonassen (2003)'s rubrics for assessing quality of argumentation. Claims (ARG) were assessed if statements are clearly related to the proposition in the given debate topic. Rebuttals (BUT) were assessed if messages indentify constraints of solutions systematically. Warrants (EXPL) were assessed if students explain data and make the connection to the claim. Grounds (EVID) were assessed if students offer reliable data and relevant reference as evidences. Two raters evaluated the message with the scale from 0 to 6. Based on Pearson Correlation, the inter-rater reliabilities were $\gamma_{ARG}=.667$, $\gamma_{BUT}=.676$, $\gamma_{EXPL}=.737$, and $\gamma_{EVID}=.696$. The quality of each student's postings to the debate was scored by averaging the quality ratings assigned to all messages posted by the given student in the given debate.

Statistical Analysis & Results

To test our model, the Mplus5.1 software was used to test the fit of the model. Path analysis indicated that the model was good fit to the data (standardized root mean square residual = .095). The chi-square of model fit, whose result depends on the sample size (n=128), was significant. Table 1 shows direct, indirect and total effect for the path analysis. The direct effects were identical with standardized γ s in figure 2. Figure 2 presents the hypothesized path diagram with the relationships of most significance. The total number of arguments posted was found to be positively related with the number of replies elicited, while the number of replies elicited was found to be positively related to both number of reciprocated replies and message quality.

However, the number of reciprocated replies was not significantly correlated with message quality. The number of posting days was positively correlated to both the number of replies elicited and the number of reciprocal replies posted. Finally, the total number of replies was found to be negatively correlated with message quality.

Table1. Direct, indirect and total effects among variables

Exogenous variables	Endogenous Variables									
	Replies Elicited			Reciprocate Replies			Message Quality			
	direct	indirect	total	direct	indirect	total	direct	indirect	total	
Total ARGs	.362**			-.138	.209**	.071		.098*	.098*	
Posting days	.495**			.286*	.286**	.546**		.089	.089	
Replies								-.264*		
Replies Elicited				.578**				.289*	-.057	.232*
Reciprocate Replies								-.099		

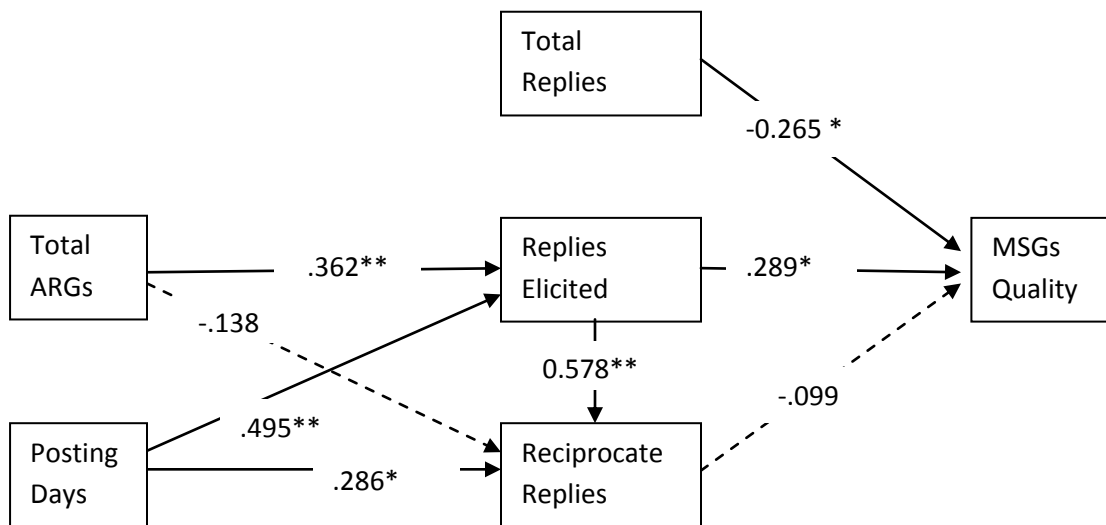


Figure 2. Path analysis of relationships message characteristics and condition to message quality

Discussion

The findings in this study (though not conclusive) to a certain extent support our model and theory as to how the five types of behaviors affect one another and how they directly and indirectly affect the quality of each students' postings to each weekly online debate. In terms of the instructional implications of our findings, the model suggests that instructors can implement requirements that establish a minimum number of posted arguments and minimum number of posting days to increase the quality of the discussions without having to add additional requirements (e.g., postings must elicit a certain number of replies from other students, minimum number of reciprocal replies, and minimum number of replies). Adding the other behavioral requirements may not be necessary given that increasing total posted arguments and increasing postings days in themselves may help to increase the frequency of these other behaviors. These findings are promising given that total posted arguments and total posting days are relatively easy for online instructors to tally (compared to tallying number of elicited replies and reciprocal replies) and use to hold students accountable for meeting the requirements.

Surprisingly, the findings from the path analysis revealed a significant and a negative correlation between the number of replies posted and the overall quality of a student's postings. Even though it is common for online instructors to require students to post replies to other students' postings, this finding in this study suggests that setting minimum requirements on number of posted replies could have an adverse effect on the quality of students' postings. One explanation for this finding is that the quality of a student's postings may depend on the type and number of posted replies (e.g., challenge, explanation, supporting evidence), not just on the total number of posted replies in general.

Directions for Future Research

Although this study provides insights into which behaviors to promote and insights into the potential effects of imposing requirements on certain behaviors to improve the quality of online discussions, the findings are not conclusive. Future studies will need to examine: a) the effects of these behaviors in controlled experiments where the minimum requirements are systematically varied to establish causality between the different behaviors; b) larger data sets so that the specific types of exchanges (e.g., argument-challenge, challenge-explain) identified with student-labeled messages can be analyzed in more detail; c) other student populations to determine the extent to which the findings reported here can be generalized to other populations; d) discussions implemented without the debate structures designed to promote interaction (controversial discussion topic, assigning student to opposing teams, message constraints and message labels, and after debate poll); e) the quality of discussions using rubrics with higher inter-rater reliability; f) the quality of discussions based on the analysis of behavioral patterns and quality observed within each discussion thread (rather than within each student); and g) how the combined changes in the structural and qualitative nature of the discourse ultimately affect learning outcomes, group decision-making, problem-solving.

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