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Jennifer R. Morrison
Old Dominion University

Ginger S. Watson
Old Dominion University

Gary R. Morrison
Old Dominion University

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COMPARISON OF RESTRICTED AND TRADITIONAL DISCUSSION BOARDS ON STUDENT CRITICAL THINKING

Jennifer R. Morrison, Ginger S. Watson, and Gary R. Morrison
Old Dominion University

Interaction is a critical component of distance education and involves the transfer of information between the learner and content, learner and learner, or learner and instructor (Moore, 1989). Current distance education literature has examined the role of interaction, specifically learner-learner interaction, in learning and discussion design to enhance achievement. The purpose of this study was to compare the effects of restricted and traditional discussion boards on critical thinking and learning in a graduate-level online distance education course. Findings indicated improved critical thinking in the quality and preparation strategies of initial discussion board postings when participants' views of peer responses to discussion board questions were restricted until a predetermined date. Although the overall quality of subsequent postings was not affected, content analysis revealed a significant increase in discourse and revised opinions in the restricted format.

INTRODUCTION

Whether completing a prompt in a programmed instruction unit (Markle, 1969), answering an inserted question (Rothkopf, 1970), or interacting with other students and the instructor in an online discussion (Garrison, Anderson, & Archer, 2000) interaction is considered a critical component of the learning process (Bernard et al., 2009). Moore (1989) identified three types of interactions in distance education: learner-content, learner-instructor, and learner-learner. Learner-content interaction is between the learner and the instructional materials. This form of interaction can occur as the learner reads a textbook, views a recorded lecture, or interacts with an instructional simulation. Holmberg (1989) and Keegan (1996) both proposed frameworks for structuring learner-content interactions that created a dialog between the learner and the subject-matter expert (i.e., the content) even though the materials were created by the instructor in one time frame and the student interacted in another time frame. Learner-instructor interactions occur between

• **Jennifer R. Morrison**, Department of STEM and Professional Studies, Education, Old Dominion University, Norfolk, VA 23529. E-mail: jmorr065@odu.edu

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the learner and the instructor during face-to-face meetings, telephone or Skype conversations, posting in a discussion forum, or through e-mail correspondence. Learner-learner interaction is the interaction between one learner and other learners occurring in a synchronous or asynchronous environment. This final form of interaction is typically facilitated through the use of discussion forums within an asynchronous distance education environment and is a key component of the community of inquiry (CoI) framework (Garrison et al., 2000). The equivalency theorem as proposed by Anderson (2003) suggests that deep and meaningful learning will occur as long as one of the three forms of interaction, learner-learner, learner-content, or learner-instructor, are present at a high level in distance education. Learner-learner interactions are critical for a constructivist learning environment (Anderson, 2003).

Discussion forums in an asynchronous learning environments have advantages over face-to-face class discussions, such as an extended time frame allowing for a deeper exploration of a topic (DeLoach & Greenlaw, 2007), the access to information to confirm or challenge ideas (Weiss & Morrison, 1998), and the written communication inherent in discussion forums aid in the development of students' critical thinking skills (DeLoach & Greenlaw, 2007).

The focus of this study is on the comparison of two discussion forum strategies to facilitate meaningful and thoughtful learner-learner interactions.

INTERACTION AND LEARNING IN DISTANCE EDUCATION

A recent trend in distance education is online learner-learner and learner-instructor interactions based on the CoI framework (Garrison et al., 2000). This social-constructivist approach proposes the use of online interactions to develop meaning and understanding. According to the framework, four stages must occur in a discussion to achieve critical thinking: a triggering event, exploration, integration, and resolution. The first, a triggering event, is the presentation of the problem. This stage follows with exploration, where learners search for information to make sense of and understand the problem. Integration occurs when learners organize and gain understanding of the information they discovered in the previous stage, resulting in the construction of a possible solution. In the final phase, resolution, learners apply their proposed solution to the problem. To accomplish the goal of critical thinking and enhanced learning outcomes, the instructor must create discussion questions that will promote the student's progression through these steps.

Although few studies have examined the progression through the four stages leading to critical thinking in an online environment, current research reveals that learners typically contribute at the first two stages, the triggering event and exploration. For example, Kanuka, Rourke, and Laflamme (2007) found that 10.84% of messages were at the triggering stage, 53.32% at the exploration phase, 26.05% at the integration phase, and only 9.79% at the resolution phase. The highest frequency of messages at the second stage and lowest frequency at the fourth stage was also found by Garrison, Anderson, and Archer (2001). Similarly, Gunawardena, Lowe, and Anderson (1997) found an overwhelming amount of messages by participants that consisted of sharing and comparing of information. Van Aalst (2006) characterizes online discussions as focusing on facts rather than causal explanations, with few students following up on postings once read

Additionally, an analysis of the research on CoI did not find any support for the learner-learner interactions leading to deep and meaningful learning (Rourke & Kanuka, 2009). The majority of studies cited also failed to incorporate an objective assessment of learning for learner-learner interactions. Rourke and Kanuka (2009) reported that only 5 of the 248 reports on CoI included assessment of learning

and the measure was typically a single item on a closed-form survey. Rourke and Kanuka concluded that deep and meaningful learning occurred as a result of the didactic interactions with the instructional materials, learner-content interactions, as proposed by Holmberg (1989) and Keegan (1996) rather than from learner-learner interactions.

Interactions in Distance Education

A recent meta-analysis of the three types of interactions in distance education produced interesting results to support Anderson's (2003) equivalency theorem (Bernard et al., 2009). An examination on the effect of achievement of the three types of interaction in 74 studies concluded that learner-learner and learner-content had a stronger effect than learner-instructor, but no difference was found between learner-learner and learner-content interactions. Furthermore, learner-content was the common variable found in combinations of interactions that most strongly affected achievement. Finally, the authors found that providing learners with a stronger course design and learner-content interactions was the only interaction that made a substantial difference in achievement.

The lack of depth found in learner-learner interactions has been attributed to three factors. First, poor quality in discussions is due to the delayed time component between initial and subsequent postings (Kay, 2006). Second, lower quality levels of initial postings affect subsequent postings (Meyer, 2005). Third, when learners do not know how to make a relevant contribution to a discussion, perhaps due to a lack of deeper understanding of the content, they will reword a previous post or contribute a superficial comment (DeLoach & Greenlaw, 2007).

The existing studies on discussion forums have attempted to develop strategies for generating learner-learner interactions including setting clear guidelines, expectations, and deadlines for participation (DeLoach & Greenlaw, 2007; Kay, 2006). Additionally, instructor feedback to participants that is both timely and substantive allows for a higher level of student participation (Kay, 2006).

Instructor Presence. Research has explored strategies instructors may employ as moderators to sustain learner-learner interaction in online discussions (Eastmond, 1992; Feenberg, 1989; Lai, 1997). Strategies include keeping discussions on track, providing summaries that synthesize ideas of different learners, and encouraging student participation. Additional studies have examined whether the instructor should take an active role or remain absent, but fail to provide consistent evidence for the instructor's role (Blignaut & Trollip, 2003; Dennen, 2005; Greenlaw & DeLoach, 2003; Kay, 2006; Li, 2003; Poole, 2001; Rourke & Anderson, 2002). Several studies suggested instructors take an active role to help guide students through more a critical examination of content and increase dialogue (Blignaut & Trollip, 2003; Dennen, 2005; Greenlaw & DeLoach, 2003). Occasional steering and refocusing of discussion was found to be useful (De Schutter, Fahrni, & Rudolph, 2004), while other studies found dialogue and participation superior between participants when the instructor took a more passive role (Li, 2003; Poole, 2001; Rourke & Anderson, 2002).

Initial Question. The quality of the initial question posed to participants in discussion boards may determine the participation and quality of dialogue that follows. Discussion questions should allow for multiple perspectives rather than leading to a single, expected response (Dennen, 2005; Greenlaw & DeLoach, 2003). Presenting questions that lead to participants creating arguments and substantiating perspectives allows for more critical thinking and more robust dialogue (Greenlaw & DeLoach, 2003). Lower-level questions resulted in lower level responses, while higher level questions generated more frequent higher level responses when examined by Ertmer, Sadaf, and Ertmer (2011). Student higher level responses were still fairly low and the authors concluded that students often need prompting

to think at higher levels (Ertmer et al., 2011). The question then becomes one of how do we prepare the learner to think critically?

Perhaps the lack of deeper understanding found in learner-learner interactions (Kanuka, 2005; Kanuka & Anderson, 1998; Kanuka et al., 2007; Meyer, 2003) can be attributed to a lack of initial understanding of the content prior to engaging in online discussions. Distance education courses must first focus on developing the learners' content knowledge before they can benefit from interactions with other learners. Learner-content interactions have been found to be highly effective for helping students develop an understanding of new content (Bernard, 2009; Jonassen & Grabowski, 1993; Wittrock, 1974, 1989). Using generative strategies, the learner is prompted to process the new information and modify or form new schema. This process helps the learner develop an understanding of the information and to encode it into long-term memory for later retrieval.

Purpose of the Study

The purpose of this study was to compare the effects of restricted and traditional discussion forums on critical thinking and learning in a graduate-level online distance education course. That is, what if students had to make their first posting without the benefit of reviewing their peers' posting? We predicted that participants' initial postings in the restricted discussion would show more depth of understanding and critical examination of the content than participants in the traditional discussion as the restricted strategy would encourage the participants to engage in learner-content interactions prior to posting. The second hypothesis predicted that the restricted treatment would produce more postings and more critical follow up postings due to the depth of the initial postings. There were two additional research questions of interest. First, do participants prefer the restricted or traditional treatment? Second, do participants report a more thorough preparation for discussion board questions and open discussion in the restricted forum as compared with the traditional forum?

Method

Participants. Twenty-four instructional design and technology graduate students enrolled in one of two online summer courses, Class A (n = 18) and Class B (n = 6) were recruited on a voluntary basis. Class A was a hybrid course with weekly synchronous online meetings in conjunction with discussion board activities, whereas Class B was an asynchronous course, relying on the discussion forum for all communication between participants. The majority of participants had completed prior graduate level courses that incorporate traditional online discussions into the course.

Design. The study employed a mixed factor repeated measures design. The independent variable was the restricted and traditional discussion board treatments. The dependent variables were quality of initial posts, quality of subsequent posts, student participant, student preference, and student preparation. Both classes were exposed to the traditional discussion format and the restricted discussion format.

Materials. Course syllabi established expectations for participation in the weekly discussions, including individual responses to questions and substantive comments on the postings made by peers.

Required readings were assigned for each week of the course. Readings for Class A came from journal articles and study guides. Readings for Class B were textbook chapters.

Weekly discussion forum questions were posted by the instructors to stimulate discussion on the weekly readings. Questions were written at the application, analysis, synthesis, and evaluation levels. Class A had an average of 5.75 questions per week and Class B had an average of 5 questions per week.

Procedure. Class A participated in two weeks of traditional discussions followed by two weeks of restricted discussions. Class B

participated in two weeks of restricted discussions followed by two weeks of traditional discussions. During traditional discussion weeks, participants could read postings from other participant at any time before or after they made their initial posting. They were able to respond and comment on the postings made by peers for a 7-day period. During the restricted discussion treatment, discussion forum questions were posted on either Sunday or Monday and participants were instructed to respond to the questions by end of day Tuesday or Wednesday, respectively. Participants were unable to see the initial posts made by their peers during the restricted time (e.g., moderated) period. The morning after the established initial post deadline, a moderator released (made available to viewing) all initial posts and participants were informed that the discussion forum was open and discussion could commence for the remainder of the week.

Outcome measures. A rubric devised by Kanuka (2005) based on the Structure of the Observed Learning Outcome or SOLO taxonomy (Biggs & Collis, 1982) was used to analyze the quality of online postings. This rubric provides a basis for assessing the quality of the postings and independent of the discipline or specific content. Each response was evaluated as a whole and classified into one of the five categories (see Table 1). Two evaluators were trained on the use of the rubric and separately rated each discussion forum posting. Raters were blind to the instructional treatments and agreement between evaluators was 96.23%. Any rater discrepancies were resolved through discussion and a single rating was determined.

Student participation was calculated by determining the average number of subsequent posts per question for each week.

A three-item forced-choice survey was administered after each treatment to assess student preparation for the posting of the initial discussion forum questions, their strategies for subsequent discussion postings, and perceptions of the effectiveness of each discussion forum treatment. After the final treatment, one forced-choice item and two open-ended survey items were administered asking which strategy was preferred and soliciting comments on what participants liked and disliked about each discussion strategy.

RESULTS

This section reports the results related to the quality of postings between the treatments, followed by results related to the surveys.

Effectiveness of Treatments

Results of the statistical analysis of the quality of initial posts garnered support for the use of restricted discussion forums, $F(1, 79) = 26.1$, $p = .000$, $\eta^2 = .201$, observed power = .991. Post hoc comparison indicated that the ratings of initial posts were significantly

Table 1
SOLO Classifications for Online Postings[a]

Category	*Explanation*
Prestructural	Student does not understand the question or point, fails to provide an appropriate response
Unistructural	Understanding is nominal, student addresses one or a few of the aspects
Multistructural	Has some understanding, addresses several aspects but each is treated separately
Relational	Understands relationships, ideas are integrated into a coherent whole with each aspect contributing to the understanding
Extended abstract	Able to transfer ideas and evidence of metacognition, the integrated ideas are reconceptualized at a higher level of abstraction

Source: [a]Adapted from Kanuka (2005)

higher in quality in the restricted ($M = 3.27$, $SD = 0.43$) discussion forum format than in the traditional format ($M = 2.755$, $SD = 0.47$). The results supported the first hypothesis that a restricted discussion forum produced an improved quality in initial postings as compared with the traditional discussion forum.

Results of the statistical analysis of the quality of subsequent posts did not support a difference between the restricted treatment ($M = 3.21$, $SD = .37$) and the traditional treatment ($M = 2.88$, $SD = .50$), $F(1, 40) = .062$, $p = .804$.

Although results did not support the second hypothesis regarding improved quality in subsequent posts, evaluators observed a noticeable difference in the amount of subsequent posts criticizing arguments and opinions presented in initial posts between treatments. A Poisson regression model revealed a significantly higher occurrence of discourse in the restricted ($n = 27$) discussion forum format than the traditional format ($n = 8$). The restricted treatment affected the frequency of disagreements, $p = .001$.

Additionally, participants in the restricted treatment were observed to present a higher frequency of revised opinions in subsequent posts than presented in initial posts, based on communication with peers. A Poisson regression model revealed a significantly higher occurrence of revised opinions in the restricted ($n = 9$) discussion forum format than the traditional format ($n = 0$). The restricted treatment significantly affected the occurrence of subsequent posts presenting a participant's revised opinion, $p = .012$.

A very slight difference between the number of subsequent posts was observed between the restricted treatments ($M = 1.159$, $SD = 1.197$) and traditional treatment ($M = 1.051$, $SD = 1.204$); however, the difference was not statistically different, $F(1, 42) = .088$, $p = .768$. These findings did not support hypothesis two that the restricted treatment would increase the quantity of subsequent posts.

Analysis of Survey Data

Preference. A chi square was computed comparing the participants' preference for treatment. A significant difference was found for participants indicating preference for the restricted ($n = 14$) treatment over the traditional ($n = 2$) treatment, $p = .000$.

Analysis of themes of the open-ended survey items revealed that participants liked the restricted initial post over the traditional approach in regards to originality, lack of bias, critical thinking, and controlled time. Approximately 31% of participants reported that the restricted approach allowed for an original initial post. For example, participants stated that, "I could post my responses without feeling like I was just restating someone else's responses," and, "We later saw that many of us were thinking alike, but the way we worded it or ad lib to the discussion gave me more insight to the topics. I really enjoyed this approach."

A lack of bias in the restricted approach was reported by 31% of participants. One participant stated, "It is helpful to get thoughts out there for discussion because it gives your first impressions and allows for teachable moments later when your initial thoughts are reviewed by others and you have had the opportunity to reflect." Another participant commented that,

TABLE 2
Survey Questions

	Restricted *N*	*Traditional* *N*	*Chi Square*
Preference for treatment	14	2	$p = .000$
Reading all assigned materials	12	11	$p = .800$
Reading unassigned, relevant materials	4	3	$p = .834$

"My responses were not affected by the responses of the other participants."

Third, 25% of participants commented that they felt this approach led to increased critical thinking. For example, one participant stated, "I did have to get my thoughts to a more mature level before posting … I think this had a beneficial impact."

The controlled time frame was a benefit in the restricted initial response mentioned by 13% of the participants. Regarding the restricted approach, one participant commented that, "It seemed more controlled and less chaotic. Since I could not see others' posts until the specified day, it gave me a couple days to get my post done and work on the weekly papers before I had to start devoting daily time to reading and responding to what others wrote."

When asked what participants disliked about the restricted approach, the most common theme cited by 13% of participants was the uncertainty they had when posting initial responses to questions. One participant stated, "I wasn't always sure that I was on the right track with the answer and would have liked to read other people's posts." Another participant stated, "I liked reading other people's ideas and the themes that they took off on. It made me feel grounded, like I was also on the right page with everyone else."

Preparation. A chi square was computed to determine the difference in reported preparation between treatments. Although more participants reported reading all materials for the restricted weeks (n = 12) than traditional weeks (n =11), the difference was not statistically significant, p=.800. Participants also reported reading additional materials not assigned for the weeks, but relevant to discussions more frequently on the restricted (n = 4) weeks than traditional (n = 3) weeks. A chi square analysis revealed that these differences were not statistically significant, p =.834.

DISCUSSION

In this study there was an overall significant difference between the two treatments for initial posts and an overall observed power of .991. The results related to the first hypothesis found that in a restricted discussion, participants' initial posts reflected a deeper understanding and more critical examination of the content than participants in the traditional treatment. The improved quality of initial posts in the restricted treatment coincides with prior research findings that when learners do not know how to make a relevant contribution to a discussion they will reword a previous post or contribute a superficial comment (DeLoach & Greenlaw, 2007). This response was not possible in the restricted treatment as learners were unable to view the posts made by peers and were required to compose an initial posting based on their understanding of the assigned readings. The encouraged learner-content interactions have been found to be highly effective for helping learners develop an understanding of the content (Wittrock, 1974, 1989).

There was, however, no significant difference in the overall quality of subsequent posts between the restricted and traditional treatment. This finding may be attributed to the more active role of the instructor in the discussion forum of Class B, as well as the difference in the format between the two classes. For example, Class A involved weekly synchronous online meetings, whereas Class B relied entirely on the discussion forum for communication and discussion of weekly topics. These factors may also have affected the number of subsequent posts. While the initial postings did promote critical thinking, a more critical discussion failed to develop as found in similar studies (Garrison et al., 2001; Gunawardena et al., 1997) and the review of CoI research by Rourke and Kanuka (2009).

Although the overall quality of subsequent posts was not affected by treatment, the frequency of discourse and revised opinions was strongly affected by the treatment. Participants in the restricted treatment produced significantly more alternate perspectives and criticisms of peers' initial posts, resulting in participants more frequently revising their responses to discussion forum questions pre-

sented in initial posts. This finding reflects the effectiveness of the restricted treatment in stimulating learner-content interactions, allowing learners to more critically examine the posts made by peers and negotiate an understanding through learner-learner interactions.

Survey responses collected at the end of each treatment found that participants preferred the restricted treatment over the traditional treatment. Participants appreciated that they did not need to struggle to produce an original post that did not repeat points made by peers since they were unaware of what others had posted. Without the affirmation from reading peer posts prior to making their own posts, participants had to think on their own and produce original, honest responses. Since participants were informed that their initial response must be made by a specific time and the open discussion would develop after the initial posting date, they may have felt less pressure and rush to respond. In the traditional approach, initial posts and subsequent posts would occur throughout the week, leaving little room for a participant to contribute to a discussion if their postings were delayed until later in the week.

There was little that participants did not like about the restricted approach, except for the uncertainty participants had when posting initial responses to questions. Without the confirmation of a "correct" answer by reading the responses of others, participants were unsure of their responses.

Finally, participants did report a more thorough preparation for the discussion questions in the restricted treatment as compared with the traditional treatment both in reading materials assigned for the week and researching additional materials.

FUTURE RESEARCH

The current study was restricted to a 4-week period involving two courses with differing instructional strategies and few participants. Future research should explore the effects of the restricted format over a full semester, as well as collecting data in different sections of the same course to control for course content. Further research should also examine the relationship between restricted discussion forums and achievement measures, as well as the type of discussion forum questions and subsequent board facilitation that produce the most effective learner-learner and learner-content interactions.

The restricted discussion forum strategy may prove beneficial as a mechanism for graduate students to critically examine assigned reading materials and develop responses to forum questions independently, rather than relying on a peer's interpretation of the materials, as may occur in an open, traditional format.

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