Frequency, Intensity and Topicality in Online Learning: An Exploration of the Interaction Dimensions that Contribute to Student Satisfaction in Online Learning

Kathleen Burnett, Laurie J. Bonnici, Shawne D. Miksa and Joonmin Kim

This article analyzes dimensions of interaction that contribute to student satisfaction in Web-supported courses. Researchers examined chat logs and discussion board postings for eight graduate courses in fall 2000 at the Florida State University School of Information Studies, and conducted focus group interviews in spring 2001 with 14 online and local students. Interaction was examined along three dimensions: frequency, intensity and topicality (FIT). Of the eight courses, one received a FIT ranking of high, three received a FIT ranking of low, and four received a FIT ranking of medium. Dimensions of interaction contributing positively toward online learning in master's courses in library and information studies (LIS) were explored to help LIS educators design, develop, and implement online courses that are both more effective in their support of learning and more satisfying to students and instructors.

Introduction

This article identifies and analyzes the dimensions of interaction that contribute to student satisfaction in Web-supported courses. The study was conducted between 2000 and 2002 at the Florida State University (FSU) School of Information Studies (now College of Information). The researchers examined chat session logs and discussion board postings for eight master's courses taught online in fall 2000 utilizing a codebook and coding procedures developed in an earlier pilot study during the summer of 2000. Focus group interviews were conducted in spring 2001 with 14 online and local students in these and other online courses. Interaction was examined along three dimensions: frequency, intensity and topicality (FIT).

In this study, frequency was defined as the mean number of interactions per student enrolled occurring each weekday during an academic term. Intensity was defined as the total number of statements generated by students,
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compared to the total number of statements generated by the instructional staff. Topicality was defined as the total number of statements regarding the topic of the course each week, compared to the total number of statements about activities and assignments plus the total number of ancillary postings.

Content analysis of the chat logs and discussion boards indicated that online learning experiences are enhanced by high frequency, high intensity, and high topicality. Focus group interviews confirmed this, and indicated that all three contribute to student satisfaction. Participants valued intensity more highly than topicality. In the eight courses studied, one course received a high FIT ranking, three received a low FIT ranking, and four received a medium FIT ranking. A course was ranked high FIT if it was above the mean in at least two dimensions, and was ranked low if it was below the mean in at least two dimensions. A course ranked medium if at least two dimensions fell within the mean or if it received one low, one medium and one high ranking. No effective relationship was found between FIT ranking and class size. Three courses were identified by focus group participants as positive models for course interaction. These included the course with a FIT ranking of high and two courses with a FIT ranking of medium.

Purpose and Significance of Study

The purpose of this research was to increase understanding and awareness of the dimensions of interaction that contribute positively to student satisfaction in Web-supported library and information studies (LIS) master’s courses. Identification of these dimensions may help LIS educators to design, develop, and implement online courses that are more effective in support of learning and satisfaction.

Background and Review of the Literature

In 2000, with few exceptions, research literature across disciplines paid little attention to the role of interaction in online learning, although its assumed lack was a frequent theme among distance education nay-sayers. Critics argued that successful learning could not occur online because me-
Mediation by a computer degraded the quality of interaction between instructor and student. Nonetheless, several ALA-accredited LIS programs claimed success in online degree programs, and by 2000 the University of Illinois at Urbana-Champaign (UIUC) and the Florida State University (FSU) had graduated significant numbers of students who rarely or never visited campus. Researchers at UIUC conducted social network analyses and other studies that indicated that regular face-to-face (F2F) meetings were important to the success of their program. FSU did not require F2F meetings, yet their online students successfully completed their coursework and reported satisfaction with the program. A research program was established to investigate the factors contributing to student satisfaction with online interaction in courses in the LIS master's degree program at FSU.

Using new technology in education has raised concerns about the quality of learner/instructor interaction. Must students and teachers be face-to-face to interact? What does interaction involve? Three types of interaction are generally considered appropriate for a learning environment:

- **Learner-content interaction**—interaction of the student with the subject matter and constructing knowledge through new understanding.
- **Learner-instructor interaction**—instruction, assistance, stimulation and support provided by the instructor to the learner. The learner can test the viability of new understanding with the instructor (who serves as a representation of expert knowledge).
- **Learner-learner interaction**—interaction between one learner and other learners, alone or in a group. It may or may not be in the presence of an instructor.

Our research focused on learner-instructor and learner-learner interaction. Learner-content interaction was integrated into the study to the extent that it may be reflected in the measurement of topicality. Today learner-instructor and learner-learner interaction is usually mediated by a computer, occurs across a network or the Internet, and may be synchronous or asynchronous communication.

Today’s students demand high levels of interaction between students and instructor and immediate access to information from around the globe. The demand for interactivity places a new focus on instructional design and the technologies that provide two-way delivery. Current technologies encourage students to be self-reflective as the flow of instruction may not be sequential and non-interactive. Network technologies add a social component to the construction of new knowledge, supporting learning communities where individuals can overcome isolation and benefit from group interaction. Learners are encouraged to take an active part in setting objectives, defining class content and capitalizing on life experiences; this requires strong interaction between all participants.

Lacking in the literature regarding online education are elements that
build interaction into learning. During the data analysis, the categories of frequency, intensity, and topicality emerged as dimensions of interaction requiring research that will contribute to our understanding of interaction. Interactive and collaborative learning is a natural outcome of online education because technology provides many avenues for interactions between students, instructors and information. Students are encouraged to participate in learning activities and group projects reflecting the complex organizations that may employ them later. In online classes employing collaborative learning, students work together at a distance, benefiting them in various ways.  

While the benefits of collaborative learning seem positive and easily accomplished with online learning, every student may not be an expert user of the technology supporting the online class. Students must become acquainted with the technology before starting online education. Some students may be slow to open up to the group and participate, choosing to lurk in the background, while others may be bolder online.

As each student is unique and has individual needs, there are many ways of implementing distance education. Innovative instructors use diverse methods to facilitate learning. The value of distance learning, and how it should be done, have spawned considerable literature, but there are still misconceptions regarding online education. Many who value seeing faces light up with “aha” expressions, or puzzled looks that indicate lack of understanding, fear decreased interaction and missing the dynamics of F2F communication.

Technology is just the medium. While research shows a slight learning advantage for newer media, it is the content carried through the technology that results in learning. Through interaction and collaboration, the curriculum assists students in constructing knowledge.

Participating in group discussion online contributes to community building by bringing people together through ideas, concepts or theories. Relationships can develop that will last long past the class meetings and even lurkers may find the environment safe enough to speak occasionally. Anecdotal evidence suggests that interaction may be positively correlated with retention and student satisfaction. At the FSU School of Information Studies, the retention rate among distance learners in the master’s program was over 98% in the first four years. In focus group and individual interviews, and unsolicited email and telephone comments, students repeatedly cited responsiveness of the faculty and technical staff, high interaction with instructors and classmates, and the well-formulated use of interactive chat technology to support real-time interaction as major factors in their decision to persist through the degree program.

Research Design

The study was conducted in three phases: two data collection phases and one data analysis and interpretation phase. The design integrated quantita-
Documentary Evidence

Online Web-supported courses at the School of Information Studies had, at the time of this study, asynchronous and synchronous components. Asynchronous components consisted of discussion boards, for students to use for learner-learner interaction and for students and instructors to use for learner-instructor interaction. Asynchronous discussion boards such as
the Faculty Office (FO) or Technical Office (TO) were available so students could post questions at any time of day. Instructors or Teaching Assistants answered FO questions. The TO was a cross-course discussion board centrally managed by the technical staff at the School of Information Studies. Synchronous components were mainly real time interactive chat sessions, which occurred weekly unless otherwise specified by the instructor. A log of each session was automatically recorded. Every action within the sessions was identified by the participant’s name and a date-time stamp. The researchers obtained electronic files for all asynchronous and synchronous components for each course and performed content analysis using an emergent coding procedure leading to the development of a codebook and coding procedure.

Focus Group Interviews

To develop the focus group interview questions, the research team analyzed the gaps and anomalies that emerged during the examination of the documentary evidence from the main study and the pilot study. Two focus group sessions were held, one F2F session and one chat session. The F2F session was tape recorded and transcribed. A log was obtained for the chat session. The focus group interviews were analyzed using the established content analysis technique of meaning condensation.

Analysis of Findings

Frequency
The formula for frequency (F = (total # of statements ÷ (75 x # of students enrolled)) was applied to calculate frequency of interaction for each course where frequency of interaction was operationalized as the mean number of statements per weekday per student, and a table was developed. The results displayed in Figure 2 range from 0.78 to 5.24. The mean was 2.10 and the median 1.76. Two courses (LA, and ME) exhibited low frequency of interaction (<1.50); five courses (HH, MG, LB, LC, MD) exhibited medium frequency of interaction (>1.50<3); and one course (MF) exhibited high frequency of interaction (>3).

Intensity
The formula for intensity (I = total # of St statements ÷ (total # of In + Ta statements)) was applied to calculate intensity of interaction for each course, where intensity was operationalized as the number of learner interactions (St) as compared to instructor interactions (In, Ta), and a table was developed. The results displayed in Figure 3 range from 0.93 to 3.60. The mean was 2.24 and the median was 1.98. Three courses (LA, LB and LC) exhibited low intensity of interaction (<1.75); three courses (MD, ME and MF) exhibited medium intensity of interaction (>1.75<3.0); and the remaining two courses (MG and HH) exhibited high intensity of interaction (>3.0).
Figure 2
Frequency of Interaction.

Frequency = Total number of interactions
Total number of weeks for the course met(=15) * Total number of students

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>DM</th>
<th>Dmi</th>
</tr>
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<tbody>
<tr>
<td>LA</td>
<td>0.78</td>
<td>1.32</td>
<td>0.98</td>
</tr>
<tr>
<td>ME</td>
<td>1.05</td>
<td>1.05</td>
<td>0.71</td>
</tr>
<tr>
<td>HH</td>
<td>1.54</td>
<td>0.56</td>
<td>0.22</td>
</tr>
<tr>
<td>MG</td>
<td>1.70</td>
<td>0.40</td>
<td>0.06</td>
</tr>
<tr>
<td>LB</td>
<td>1.81</td>
<td>0.29</td>
<td>0.05</td>
</tr>
<tr>
<td>LC</td>
<td>2.28</td>
<td>0.18</td>
<td>0.52</td>
</tr>
<tr>
<td>MD</td>
<td>2.37</td>
<td>0.27</td>
<td>0.61</td>
</tr>
<tr>
<td>MF</td>
<td>5.24</td>
<td>3.14</td>
<td>3.48</td>
</tr>
</tbody>
</table>
Figure 3
Intensity of Interaction.

\[ \text{Intensity} = \frac{\text{Total number of interactions coded St}}{\text{Total number of interactions coded In or Ta}} \]

<table>
<thead>
<tr>
<th>Course</th>
<th>Intensity</th>
<th>DM</th>
<th>Dmi</th>
</tr>
</thead>
<tbody>
<tr>
<td>LA</td>
<td>0.93</td>
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<td>1.05</td>
</tr>
<tr>
<td>LB</td>
<td>1.54</td>
<td>0.70</td>
<td>0.44</td>
</tr>
<tr>
<td>LC</td>
<td>1.62</td>
<td>0.62</td>
<td>0.36</td>
</tr>
<tr>
<td>MD</td>
<td>1.94</td>
<td>0.30</td>
<td>0.04</td>
</tr>
<tr>
<td>ME</td>
<td>2.02</td>
<td>0.22</td>
<td>0.04</td>
</tr>
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<td>MF</td>
<td>2.85</td>
<td>0.61</td>
<td>0.87</td>
</tr>
<tr>
<td>HH</td>
<td>3.44</td>
<td>1.20</td>
<td>1.46</td>
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<tr>
<td>MG</td>
<td>3.60</td>
<td>1.36</td>
<td>1.62</td>
</tr>
</tbody>
</table>

Mean: 2.24
Median: 1.98
The formula for topicality \( T = \frac{\text{sum of } T + \text{AC statements}}{\text{sum of } AP \text{ and } Nr \text{ and } Nv \text{ statements}} \) was applied to calculate the topicality of interaction for each course, where topicality was operationalized as statements about the topic of discussion during the week or content of assignments as compared to the total number of statements about activity processes and non-relevant and non-verbal statements, and a table was developed. The results displayed in Figure 4 range from 1.26 to 27.63. The mean was 6.76 and the median 4.56. Four courses (LA, LB, MF and LC) exhibited low topicality (<4.5); three courses (MD, ME and MG) exhibited medium topicality (>4.5<8.0), and one course (HH) exhibited high topicality (>8.0).
Table 1
FIT Rankings.

<table>
<thead>
<tr>
<th>Course</th>
<th>F</th>
<th>I</th>
<th>T</th>
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<tbody>
<tr>
<td>LA</td>
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<tr>
<td>LB</td>
<td>m</td>
<td>l</td>
<td>l</td>
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<tr>
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<td>l</td>
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<tr>
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<td>m</td>
<td>m</td>
<td>m</td>
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<tr>
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<td>l</td>
<td>m</td>
<td>m</td>
</tr>
<tr>
<td>MF</td>
<td>h</td>
<td>m</td>
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<tr>
<td>MG</td>
<td>m</td>
<td>h</td>
<td>m</td>
</tr>
<tr>
<td>HH</td>
<td>m</td>
<td>h</td>
<td>h</td>
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</table>

FIT Rankings

Table 1 displays the FIT rankings for each of the eight courses and Figure 5 displays each of the three dimensions for each course.

Three courses were ranked low FIT. Course LA exhibited low frequency, low intensity and low topicality; Courses LB and LC each exhibited medium frequency, low intensity and low topicality.

Four courses were ranked medium FIT. Course MD exhibited medium frequency, medium intensity and medium topicality. Course MG exhibited...
medium frequency, high intensity and medium topicality; Course ME exhibited low frequency, medium intensity and medium topicality; Course MF exhibited high frequency, medium intensity and low topicality. All courses that exhibited medium topicality were ranked medium in FIT. Course MF was the only course ranked medium in FIT that did not receive a medium topicality ranking. All courses that exhibited medium intensity were ranked medium in FIT; Course MG was also ranked medium in FIT.

One course, HH, received a FIT ranking of high; it exhibited medium frequency, high intensity, and high topicality of interaction.

Focus Group Interviews

Across both focus groups, students indicated they were satisfied to very satisfied with the learner-instructor interaction in their online courses. When asked how this compared to their expectations before they began online courses, most said they did not have any expectations, assumed that courses would involve only asynchronous message boards, or assumed courses would be “independent study” with virtually no interaction. Most students expressed positive feelings about their perception that courses were more interactive than expected. An exception to their positive feelings was expression of dissatisfaction with the level of detail in feedback on assignments.

Student expectations of learner-learner interaction followed a similar pattern. Student comments on the importance of learner-learner interaction included “very useful,” “helpful,” and “extremely important.”

In terms of the format of the interaction, most students reported preferring synchronous (interactive chat) to asynchronous (discussion boards) communication. Some students indicated both were necessary, and a few expressed a preference for asynchronous. When asked whether faculty preference or course content should determine format use, students in the online focus group responded overwhelmingly in favor of faculty preference. Approximately one third of the students indicated that the synchronous format had dominated in their courses the previous semester, while one third indicated asynchronous had dominated. The remaining one third indicated both formats had been used equally. The most-mentioned negative aspect of the asynchronous format was a design feature (threaded display) rather than lack of support for synchronous interaction.

The importance of rules and conventions to successful interaction in synchronous chat meetings was repeatedly raised. Participants indicated that while many rules and conventions were implemented across courses, some instructors were more successful in establishing and enforcing rules and conventions to support positive interactions online. Most students indicated it was important for the instructor to lay out rules and conventions in the course syllabus and to enforce them consistently.

Instructors implemented different teaching techniques to support learning. Among those commonly used during the time of this study were
asynchronously delivered pre-recorded audio lectures with slides, group discussions, question and answer, and synchronously delivered text lectures with slides. Over half the participants agreed that listening to pre-recorded lectures contributed positively to their learning, and indicated they preferred this to synchronous lectures during chat sessions. About one quarter indicated they preferred small group discussions to lectures, and two students indicated the question and answer format was most useful.

Conclusions

Frequency of interaction is a difficult concept to measure, since frequency may vary over time, and perceived detriments of short periods of infrequent learner-instructor interaction may outweigh perceived benefits of long periods of frequent interaction in students’ minds. Conversely, students may perceive detriments to long periods of learner-learner interaction if these are not balanced by learner-instructor interaction. In this study, we used mean values representative of the full duration of the course, which may underestimate the complexity of students’ perceptions of this dimension. Comparative sub-analyses by interactor type may clarify some complexities. As focus group participants indicated, frequent interaction does not make up for timely feedback, particularly for major and final assignments. This points to a new, fourth type of interaction: instructor-content interaction.

The data in this study indicate some support for the statement that the less frequent the interaction, the more likely it is that students will express dissatisfaction with the course. This theme emerged repeatedly in the focus group interviews concerning a course in which the frequency of interaction was particularly low because the instructor was not comfortable with the chat technology and did not adopt strategies to facilitate and increase learner-learner interaction. Usability of technology affects the frequency of interaction and can be addressed by providing tools that students and instructors find easy to adopt and providing extra training and support for those whose learning curves are longer.

The data in this study appear to support the statement that the higher the intensity of interaction, the more likely that students will express satisfaction with the course. Student satisfaction is tightly coupled with perception of the instructor’s engagement in course interactions. In the focus group interviews, students talked exclusively about learner-instructor interaction until asked about learner-learner interaction. Once the moderator introduced learner-learner interaction, students expressed strong positive feelings regarding the importance of interacting with their peers.

The data in this study appear to support the statement that the higher the topicality of interaction, the more likely that the course will exhibit high intensity of interaction. Focus group participants indicated that high topicality did not necessarily correspond with student satisfaction, especially when high topicality was perceived to interfere with development of com-
munity among the learners. The three courses with lowest topicality of interaction were also the three courses about which statements of dissatisfaction were made during focus group interviews. Online course instructors must balance the desire to keep interactions "on topic" with allowing opportunities for learner communities to develop.

The three dimensions of FIT are useful separate measures of online learning interaction. Together they can help develop a course profile useful for diagnosing problems, designing intervention strategies, and making administrative decisions to increase student satisfaction. For example, FIT analysis might be used to improve Course LC (low intensity and topicality of interaction, but medium frequency). The medium frequency indicates there was adequate interaction overall, while low intensity indicates the instructor was not as engaged as the students. The low topicality confirms this and suggests the instructor should guide course interactions more effectively. An intervention strategy for Course MG might target increasing the topicality from medium to high. This course emphasized small group discussions; integrating more lectures might effectively increase the topicality. An example of using FIT for administrative decision-making is Course LA. Statements of dissatisfaction with the interaction in this course by the focus group participants support the low FIT ranking, as did the course rating on the student survey administered at the end of each semester. Administrative action may be indicated to determine why the FIT is so low, and to remedy this with training or reassignment of course personnel.

**Recommendations for Future Research**

This study was conducted using courses taught at a single institution. It needs to be replicated at other institutions to determine whether FIT is influenced by differences in technology, pedagogy, or administrative structure. Further investigation is needed to establish whether instructor-content interaction should be studied and, if so, efforts must be made to establish a measure for this type of interaction. Finally, a longitudinal analysis of the student participants' perceptions of satisfaction and success is planned to determine whether these change over time and as graduates apply what they have learned in a professional context. Further discussion of the development of the data analysis techniques used in this research will appear in the *Journal of the American Society for Information Science*, 58:9 (July 2007).

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References and Notes


6. Sherry, Fulford & Zhang, “Assessing Distance Learners’ Satisfaction.”


9. Ibid.; also see Cj Baehr, “Interactivity in Distance Learning: Connecting Students, Instructors and Content,” paper presented at the Conference on Distance Teaching & Learning: Teaching Strategies for Distance Learning, (Madison, Wisconsin, August 9–11, 1995.)
10. Gilbert and Moore, "Building Interactivity into Web Courses"; also Kirby, "Building Interaction in Online and Distance Education Courses"; Baehr, "Interactivity in Distance Learning"; and Jerald G. Schutte, "Virtual Teaching in Higher Education: The New Intellectual Superhighway or Just Another Traffic Jam?", http://ddi.cs.uni-potsdam.de/HyFISCH/Teleteaching/VirtualTeachingSchutte.htm.


14. The researchers chose to use the mean as the indicator of central tendency in this study; the findings would likely have been different had the median or a trimmed mean been used.

15. This course exhibited the second highest topicality and so was the closest of the courses ranked medium FIT to a high FIT ranking.

16. The data for this course are not reported in this study because it was not taught during the fall 2000 semester. It was part of a pilot study and the data support the students' perceptions of low interaction.
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