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Broadening the notion of participation in online discussions: examining patterns in learners' online listening behaviors

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Abstract While a great deal of research has studied the messages students contribute to electronic discussion forums, productive participation in online learning conversations requires more than just making posts. One important pre-condition for productive interactivity and knowledge construction is engagement with the posts contributed by others. In this study, these actions (how learners interact with the existing discussion; which posts they attend to, when, and how) are conceptualized as “online listening behaviors” and are studied in the context of a large undergraduate business course taught in a blended format. Clickstream data was collected for 96 participants from 3 week-long online discussions to solve organizational behavior challenges in groups of 10–13. Listening behaviors accounted for almost three-quarters of the time learners spent in the discussions, and cluster analysis identified three distinct patterns of behavior: (1) Superficial Listeners, Intermittent Talkers; (2) Concentrated Listeners, Integrated Talkers; and (3) Broad Listeners, Reflective Talkers. The clusters differed in the depth, breadth, temporal contiguity, and reflectivity of their listening as well as in their patterns of speaking. An illustrative case study of how the listening behaviors were enacted by one student from each cluster over time was used to deepen the characterization and interpretation of each cluster. The results indicate that online listening is a complex phenomenon and a substantial component of students' participation in online discussions. Findings are compared to the previous work on student learning approaches and implications for practice and future research are discussed.

Keywords Online learning · Computer mediated communication · Asynchronous discussion groups · Learning strategies · Student participation · Mixed methods

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Introduction

Productive participation in online discussions requires more than making posts

Asynchronous online discussions are commonly used to support collaborative learning in both fully online and blended higher education classes (Allen et al. 2007; Luppicini 2007). Through conversation, students are given opportunities to compare their ideas with those of others, modify their individual views, and build knowledge as a group. Online discussion forums also provide some benefits compared to face-to-face conversations such as a reduced need for turn-taking that allows more voices to be heard (Shank and Cunningham 1996), the opportunity for less assertive students to compose and contribute their thoughts (Hewitt 2001), and more time for all students to respond reflectively to others' comments (Poole 2000).

Despite these potential benefits, in practice asynchronous online discussions often do not live up to their promise. Many students do not meet expectations for participation (Dennen 2008; Palmer et al. 2008) and discussions often suffer from low levels of student involvement (Hew et al. 2008). Equally importantly, the comments that are made frequently do not respond to or build on each other (Thomas 2002). Even those which do, often reply to a particular comment without considering the discussion as a whole (Hewitt 2001). This can result in discussions that are shallow (Webb et al. 2004) and incoherent (Herring 1999). The limited responsiveness and interactivity found in many online discussions suggests a lack of attention to the ideas of others and that at many students interpret discussion participation as being more about "making posts" than engaging in dialog.

A similar emphasis on making posts is seen in the literature. The preponderance of research on collaboration in online discussions focuses on the messages students compose and how they contribute to knowledge construction (for example see Hew et al. 2008 for a review of 50 such studies). However, beyond making posts, an important pre-condition for productive interactivity and meaningful discussion is engagement with the posts contributed by others. This is the vehicle through which learners become aware of and attend to each other's ideas. Engaging with other's posts can support productive discussion not only as part of a direct sequence of events leading up to making a post, but also through modeling (seeing how others make contributions) and as a vehicle for reflection (considering one's post in the context of the discussion) (Dennen 2008; Mayes 2001; Webb et al. 2004). Thus, a fuller conception of participation in online discussions requires attention not only to learners' overt activity in making posts, but also to the less public activity of interacting with the posts of others.

The need for more detailed research on how learners interact with the posts of others

While limited attention has been paid to how learners interact with the posts of others in online discussions, the work that has been done suggests that this is an important area for study. At a basic level, students who engage with other's posts more often report that discussions are more worthwhile (Dennen 2008). The frequency with which students access discussions (Webb et al. 2004), the number of posts they read (Hamann et al. 2009), and the time they spend viewing posts (Morris et al. 2005) have also been shown to predict a significant amount of variance in course achievement (cf. Palmer et al. 2008). Despite the apparent importance of these behaviors, there is evidence that students often engage with the posts of others in limited and shallow ways (Hewitt 2001, 2003, 2005; Thomas 2002).

In a typical undergraduate class setting, Thomas (2002) found that many messages contributed to discussions were never opened by other students. Additionally, the comments made did not refer to the existing conversation in a meaningful way. Even at the graduate level, Hewitt (2003, 2005) found that students tended to only look through the existing posts once before making their own and that they focused their attention mainly on the messages that had been posted most recently.

This past work gives a general sense of students' behaviors in online discussions; however, it does not provide a detailed picture about what particular students do. This is important because not all students engage with discussions in the same way. For example, Palmer et al. (2008) calculated that on average students in an online engineering management course read only 22 % of the discussion posts available, but also reported that "a significant proportion of students read every single discussion posting" (p. 854). By focusing on aggregate data, the opportunity to identify and study such differences between students is lost. In addition, a finer level of granularity in data collection is needed to meaningfully examine student behaviors in online discussions. In the past, interactions with others' messages have often been examined using broad indicators such as the number of times online discussions are accessed (Webb et al. 2004) or the number of posts students open (Hamann et al. 2009; Palmer et al. 2008). But these measures overlook critical details about *which* posts are opened, *when*, in what *order*, and for *how long*.

While individually each of these variables could provide useful information about how students interact with existing messages in online discussions, examining them together gives us the power to identify more holistic patterns in how students participate. This was not possible in prior work due to the broad variables and aggregate analyses employed. To collectively conceptualize the various actions students take as they interact with the posts of others, we introduce the concept of online "listening" behaviors. The notion of online listening provides a unifying metaphor for thinking coherently about the different kinds of decisions and actions that learners take in relation to other's posts and how they are important to the process of learning in an online discussion. In the following section we present the concept of online listening behaviors, differentiate it from prior ideas about accessing others' contributions online, and describe several dimensions of online listening behaviors we suggest are important to consider as part of the process of learning through discussions.

Introducing the concept of online listening behaviors

Invisible online activity has been extensively studied outside of education in the context of "lurker" research (e.g., Muller et al. 2010; Nonnecke et al. 2004; Rafaeli et al. 2004). In this work, lurkers are defined as those who access an online space, but do not make contributions to it. Within education, less derogatory terms such as "vicarious learner" (Mayes 2001; Sutton 2001) or "read-only participants" (Nagel et al. 2009) have been used to characterize non-contributors. Regardless of the language used, all of these terms set up a dichotomy between those who "produce" and those who "consume" ideas in an online space (Muller et al. 2010). This is problematic for thinking about online discussions because it segregates the complementary actions of making and accessing messages across different categories of people, ignoring how contributors interact with prior contributions.

Using the analogy of a face-to-face discussion, we conceptualize the processes of making and accessing contributions in an online discussion as *speaking* (externalizing one's ideas) and *listening* (taking in the externalizations of others) (Wise et al. 2011).

Specifically, speaking involves making original posts and responses, while listening involves accessing the posts of others. We distinguish our notion of listening from previous lurker research in three important ways. First, while lurker research sets up a dichotomy between producing and consuming behaviors, we conceptualize listening as informative of, and inherently related to speaking. Thus listening is considered as a *behavior* that one engages in, rather than a fixed characteristic of a person. Following this notion, while lurkers are identified as non-contributors, we examine listening as a behavior that is often exhibited by the *same individuals* who speak in an online space. Finally, while there are often negative connotations associated with lurking, listening is conceived as a *productive* behavior in a discussion. Our work focuses on online listening in formal education contexts where students are usually required to contribute; however, the notion of listening behaviors as distinct from lurking can also be useful in informal learning contexts. For example, Muller et al. (2010) found that the users who accessed the most content in a voluntary file-sharing service were also active contributors. This suggests that in general there are useful ways to think about invisible online activity beyond the notion of “lurking.”

It is also important to note that online listening differs in several specific ways from listening in face-to-face conversations. In general, in online discussions students have active control over which comments they attend to, as well as when and for how long they do so. Comments are not necessarily received in the order they were made and learners may decide to focus their attention on a specific part of the discussion rather than listening to all parts indiscriminately. There are also opportunities not available in face-to-face situations such as taking time to reflect before responding and revisiting comments from earlier parts of the conversation. Put together, there is a greater degree of control and decision-making involved in online listening that makes it important to consider as an active form of participation in online discussions.

Thinking about online listening as described above, several important dimensions of behavior and related variables can be proposed. First, similar to face-to-face discussions, the *depth* with which students attend to comments is an indication of the degree to which they are considering others' ideas. This can be examined by variables which measure how long students spend in discussions and on each post they read. Hewitt et al. (2007) make the important point that this time also needs to be considered in relation to the length of the posts being read, and that there is a qualitative difference between reading posts at a speed that allows for comprehension and simply scanning them quickly. Second, in an online space where students control which posts they view, there can be variations in the *breadth* with which they attend to others' comments. This is important in terms of the diversity of ideas that they are exposed to and their ability to respond to the discussion as a whole. Breadth can be examined by variables which measure the number of different posts that students view, and their proportion of the total number available. Third, since students decide when they participate in the discussion, it is important to consider the *temporal contiguity* of their listening. Variables to measure this include the frequency and length of students' sessions (whether they concentrate or distribute their participation) and the degree to which their listening and speaking actions are integrated. Along this dimension there may be a trade-off between the benefits of continuity of participation (considering different ideas together) and multiplicity of participation (interacting with ideas on repeated occasions). Finally, online discussions allow students to revisit their own and other's comments multiple times, permitting *reflective* activity. This can be examined through variables that measure the number of times students review their own posts and the posts of others that they have read previously.

Examining patterns of student behavior and approaches to learning

As mentioned earlier, examination of student behavior along multiple listening variables together can identify patterns that may indicate qualitatively different approaches to their participation in online discussions. One statistical technique for detecting such patterns is cluster analysis, an approach that has been useful in building an understanding of learners' behaviors in many digital environments (e.g., Barab et al. 1997; Bliuc et al. 2010; del Valle and Duffy 2007; Liu and Bera 2005). In cluster analysis, learners are progressively grouped together based on their similarities across a set of variables. The technique helps to determine the best number (if any) of sub-groups within the larger group that share a similar set of characteristics. For example, in a learner-centered online environment del Valle and Duffy (2007) identified three types of interaction patterns that represented qualitatively different approaches to learning: mastery-oriented (high amount of work-time, sessions, activities and resource use), task-focused (shorter, more concentrated work-time, similar amount of activities and resource use), and minimalist (few sessions, activities, and resources; work spread over a long time). Focusing specifically on online learning discussions, Bliuc et al. (2010) analyzed survey data and found two distinct groups of learners: those who had a cohesive conception of learning and took a deep approach to online discussions and those who had fragmented conceptions and took a surface approach.

Conceptually, online interactions patterns can articulate with more general student orientations and approaches to learning. The goal-orientation literature distinguishes between students with goals oriented toward “mastery” (focusing on one’s own learning), “performance-approach” (wanting to receive a positive evaluation), “performance-avoidance” (trying to avoid a negative evaluation), and “work avoidance” (exerting minimal effort to complete the task) (Dweck 1986; Elliot and Harackiewicz 1996; Meece et al. 1988). Research on student studying contrasts the deep- and surface-approaches of students who try to understand ideas or memorize information respectively (Entwistle 2009). Conceptual models and growing empirical evidence relate mastery goals with a deep learning approach and performance and work-avoidance goals with a surface approach (Phan 2008). This previous work on student interaction and learning approaches can provide useful contextualization to support the interpretation of listening patterns and consideration of their role in student learning processes.

The current study

This study expands the existing research base on student participation in online discussions by using the above conceptualization of online listening behaviors to examine individual learners' actions. Specifically, the work adds to the understanding of students' approaches to online learning by identifying collections of behaviors that constitute distinct listening patterns. In addition, the study explores how these sets of behaviors manifest when enacted in a discussion over time.

Research questions

1. What patterns of listening behaviors do learners engage in as they interact with existing comments in asynchronous online discussions?
2. How do these listening behaviors appear when enacted in an actual discussion over time?

Methods

Participants

All 113 students in an undergraduate business course on organizational behavior were invited to participate in the study; 96 agreed. The course is required for all students majoring or minoring in business and thus has a class composition typical of business students at the university. Based on a subsample of 41 students who provided demographic data, participants were evenly divided on gender (51 % female) with the majority in the first 2 years of study (85 %) and 22 years old or younger (94 %). Final grade distribution for the class was typical for the university (mean in the B range). Less than a third of the responding subsample reported that English was their first language (28 %). While this is an extreme figure, it may reflect the high degree of multilingualism in this Canadian province (Statistics Canada 2007) and/or self-selection in those who chose to provide demographic data. All students had fulfilled the university language admission requirements demonstrating English proficiency.

Learning environment and discussion assignments

The course was taught in a blended (face-to-face and online) format. For the face-to-face session, the class met on Fridays in a 2 h whole-class lecture and 1 h small group (20–24 student) tutorial sessions. For the online discussions, each of the five tutorials was split into two sub-groups of 10–12 students. Each sub-group was required to participate in several week-long (Saturday to Friday) asynchronous discussions contributing 9 % to their course grade. In the first week, all sub-groups took part in an ungraded “Introductions” discussion. For the next 6 weeks, the two sub-groups in each tutorial alternated discussion weeks (one sub-group participated in discussions one, three, and five; the other in discussions two, four, and six). Discussions took place in a standard asynchronous threaded discussion forum where both sub-groups’ discussions were always available to all students in each tutorial.

Each discussion presented students with an organizational behavior challenge drawn from a set of real, anonymized situations submitted by students at the start of the term. The particular challenges given to each group were unique, but always related to the theme of the associated week’s course material (e.g., Leadership). Students were encouraged to be active in the discussions, post more than once, and make comments that drew on relevant theories from class to move their group’s discussion forward. At the end of each discussion, one student was asked to summarize the challenge and solution orally in tutorial.

Data extraction and processing

Participants’ click stream data was collected based on their activity in the organizational behavior discussions. Each time a student read, created, or edited a post in the discussion forum, the system logged the action taken, the identity and length of the post made or read, and a time-date stamp.

Extracted data was separated by participant. Actions were coded as either “views” (opening others’ posts), “posts” (creating a post), “reviews” (revisiting one’s own posts later), or “edits” (making changes to one’s previously submitted posts). Action durations were calculated by subtracting the time stamps of sequential actions by each user. Views

were then further categorized as either reads or scans using a maximum reading speed of 6.5 words per second as a threshold (based on scanning rates reported by Hewitt et al. 2007).

The data stream of actions generated by the system was continuous (e.g., if a learner read one post at night and then one the next morning, the length of the first read action would be calculated as over 10 h). It thus needed to be divided into meaningful series of actions (sessions of student use), with the duration of the final action in each session adjusted accordingly. Frequency tables showed that 89 % of all actions and 97 % of post actions (typically longer and less likely to be abandoned in progress) took 60 min or less, with a sharp drop in frequency after this point. Thus a maximum action length was set at 60 min (for details of this procedure see del Valle and Duffy 2007). Actions with longer calculated durations were taken as indicators of a session's end and their duration was re-calculated as an estimate based on the relevant post's length and the average speed of the student conducting the indicated action (i.e. read, scan, post or edit). Aggregate scores for each individual were then calculated for 13 variables described below.

Variables

Seven variables were judged as the most economical set to represent the different facets of students' listening and speaking in the discussion forum in the cluster analysis.

Average length of session served as a measure of the degree to which a student's participation in the discussions was temporally contiguous. This was calculated as the total time a student spent in the discussions in minutes divided by his or her number of sessions.

Percent of sessions with posting actions served as a measure of the degree to which a student integrated their listening and speaking behaviors in the discussions. This was calculated as the number of sessions in which a student made a post, divided by their total number of sessions.

Percent of posts viewed at least once served as a measure of the breadth of a student's listening to others in the discussions. This was calculated as the number of unique posts (made by others) that a student opened divided by the total number of posts made by their classmates to the discussions.

Percent of total views that were reads (not scans) served as an initial measure of the depth of a student's listening to others in the discussions. This was calculated as the number of times a student viewed other's posts that were slower than 6.5 words per second, divided by the total number of views.

Average length of time reading a post served as a further measure of the depth of a student's listening to others in the discussions. This was calculated as the total time a student spent reading posts, divided by the number of reads.

Average number of posts contributed per discussion served as a measure of the quantity of speaking a student did in the discussions. This was calculated as the total number of posts a student made, divided by the number of discussions.

Average number of reviews per discussion served as a measure of the degree to which a student listened to their own voice in the discussions. This was calculated as the total number of times a student opened their own posts, divided by the number of discussions.

The six remaining variables were used for additional comparisons to further characterize the differences between the clusters.

Average number of sessions per discussion served as a measure of the degree to which a student concentrated or distributed their visits to the discussion. This was calculated as the total number of sessions a student had, divided by the number of discussions.

Average number of reads before contributing a post served as an additional measure of the integration of listening and speaking behaviors. This was calculated as the total number of others' posts a student read before making their last post in a session, divided by the total number of posts made in the session.

Average number of views per discussion served as an additional measure of the breadth with which a student listened to others in the discussions. This was calculated as total number of posts (written by others) a student viewed, divided by the number of discussions.

Average number of words per post served as a measure of the quantity of speaking a student did in the discussions. This was calculated as the total number of words contributed divided by the total number of posts created.

Average length of time creating a post served as a measure of the care students put into their speaking in the discussions. This was calculated as the total time of posting actions in minutes, divided by total number of posts made.

Final grade served as a measure of the overall level of performance of a student in the course. This was determined by the course instructor based on the discussion assignments, in-class quizzes, a midterm and final exam.

Cluster analysis

The sample size needed for cluster analysis is not strictly defined since it depends on the distribution of participants across the variables. Guidelines for linear regression suggest having at least 10–20 cases for each variable, though successful clustering has been achieved with less (see del Valle and Duffy 2007). After removing one outlier, this study examined the clustering of 95 participants across seven variables. The resulting ratio of 13.6 cases per variable falls comfortably within the acceptable range described above.

Ward's (1963) hierarchical clustering technique and the squared Euclidean distance metric were used to determine the distances between clusters for possible solutions. All scores were standardized to account for different scales of measurement. Examination of a scree plot was used to determine the leveling-off point for clustering solutions after which additional groups would not have meaningful differences between them. ANOVAs and post hoc analysis using Tukey's HSD criterion with a Bonferroni alpha level correction were used to confirm a quality solution and characterize the clusters.

Case studies

While cluster analysis is a useful tool to identify patterns in how students interact in discussion forums, it does not provide a sense of how these behaviors play out in action. To address this gap, an illustrative case study of listening behaviors in a discussion was conducted for one participant from each cluster whose data aligned well with the cluster profile. The analytic method used to construct the case studies from click-stream data was piloted in an earlier study of a small subset of the data (Wise et al. 2012b). As the discussions in the course followed a 1-week-on, 1-week-off pattern, a 2-week period in the middle of the term was chosen for analysis to capture student interactions in both on- and off-weeks. For consistency, case studies were selected such that the third discussion ("Leadership") was an assigned discussion week for all students. The fourth discussion ("Power and Politics") was not an assigned discussion week for these students; however, the discussion being held by their classmates was open for them to view.

Results

Descriptive statistics

The 95 participants registered a total of 17,695 actions in the discussions. On average, each student logged-in 22 times ($SD = 16$) over the course of their three discussions. The average time spent in a week's discussion was 171 min ($SD = 136$) broken down as follows: 73 % listening actions; 18 % making posts; 6 % reviewing one's own posts; 3 % system-generated actions. A negligible time editing posts was recorded by the system.

Cluster analysis

Examination of the scree plot (see Fig. 1) revealed flattening between three and four clusters, indicating a three-cluster solution best captured meaningful similarities and differences between students. Solution quality was confirmed by repeating the analysis with resorted data (cluster membership did not change) and conducting ANOVAs for the clustering variables (significant differences between groups were found for six of the seven).

The distribution of cluster members on two of the grouping variables is shown in Fig. 2 as an illustration of the segregation between clusters; additional dimensions for the other variables would reveal further separation. No clear pattern of alignment between clusters and discussion groups was observed; all discussion groups had members from at least two of the three clusters and eight of the ten discussion groups had members from all three. In addition, a lack of significant difference between the clusters on the final course grade indicates that no cluster contained a disproportionate number of students from any level of class performance.

Values for each cluster on both the grouping and additional variables are summarized in Table 1. Clusters whose levels of a variable could not be distinguished from each other in the post hoc analysis share one or more subsets in common; clusters which had significantly different levels for a variable have no subsets in common. The following sections characterize each cluster in turn; Table 2 presents characterization summaries based on the cluster analysis.

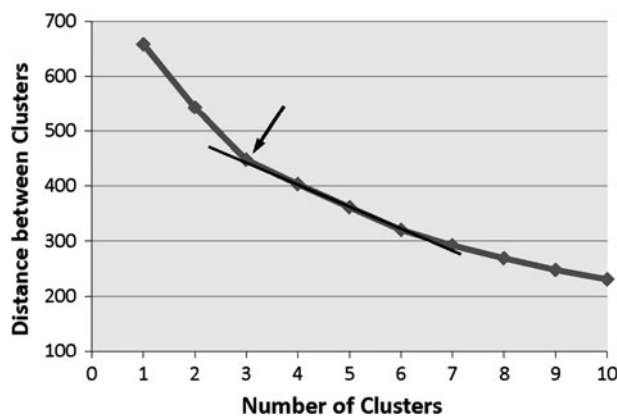


Fig. 1 Scree plot for the cluster analysis

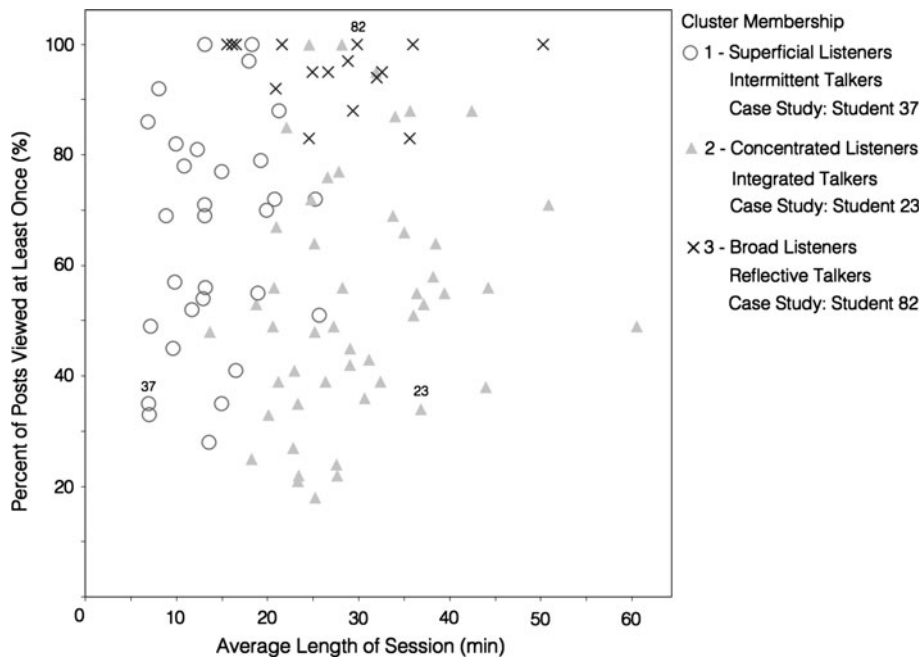


Fig. 2 Comparison of average session length and percent of available posts viewed by cluster

Cluster 1: Superficial listeners, intermittent talkers

Thirty-one percent of students were grouped into the first cluster. A distinctive characteristic of these learners was the brevity of their sessions (just 14 min on average). Their number of sessions was more moderate (seven to eight per discussion), though posts were only made in a few of these (23 %). Over the course of their sessions in a discussion they showed a modest breadth of listening, opening classmates' posts a total of 44 times and viewing 65 % of the posts at least once. However, their depth was relatively shallow as they read only 45 % of the posts they opened and spent just 3 min on each one. In terms of speaking, students in this cluster only posted an average of 1.69 times per discussion, but they did spend a similar amount of time making these posts and created posts of similar length as students in the other clusters. Cluster 1 students did not exhibit a great deal of reflectivity on their postings, reviewing them just twice per discussion.

Cluster 2: Concentrated listeners, integrated talkers

The second cluster accounted for the largest amount of students (49 %). While the number of sessions they engaged in per discussion (five on average) did not differ significantly from Cluster 1, the sessions were significantly longer (30 min). In addition, members of Cluster 2 are distinguished from both other clusters by the high proportion of sessions in which they made a contribution (40 %). Opening classmates' posts only 35 times per discussion and viewing only 52 % of classmates' posts at least once, their breadth of listening did not differ significantly from Cluster 1; however, they spent significantly longer (over 5 min) on each post they read, suggesting greater depth. The amount of speaking was also similar to Cluster 1 with just over two posts made per discussion;

Table 1 Comparison of clusters across variables

Dimension	Variable	$F_{(2,92)}$	Subset	Cluster 1 ($n = 29$) Superficial listeners, intermittent talkers	Cluster 2 ($n = 47$) Concentrated listeners, integrated talkers	Cluster 3 ($n = 19$) Broad listeners, reflective talkers
Temporality	Average length of session (C)	37.15*	1		30.02 (9.13)	26.94 (8.48)
			2	13.92 (5.37)		
	Percent of sessions with posting actions (C)	25.84*	1		0.40 (0.16)	
			2	0.23 (0.11)		0.18 (0.06)
	Average number of sessions per discussion (A)	27.55*	1			13.56 (5.48)
			2	7.49 (3.42)	4.77 (4.37)	
	Average number of reads before contributing a post (A)	5.17		3.60 (2.38)	5.16 (4.48)	7.03 (2.61)
Breadth	Percent of posts viewed at least once (C)	39.82*	1			0.96 (0.06)
			2	0.65 (0.20)	0.52 (0.20)	
	Average number of views per discussion (A)	70.15*	1			109.19 (29.44)
			2	44.10 (20.53)	35.44 (22.34)	
Depth	Percent of total views that were reads (not scans) (C)	4.67		0.45 (0.14)	0.54 (0.13)	0.51 (0.08)
	Average length of time reading a post (C)	9.98*	1		5.18 (2.26)	4.63 (1.77)
			2	3.15 (1.38)		4.63 (1.77)
Speaking	Average number of posts contributed per discussion (C)	14.88*	1			3.04 (0.68)
			2	1.69 (0.65)	2.18 (0.98)	
	Average number of words per post (A)	1.07		207.91 (72.00)	186.99 (83.61)	178.79 (47.66)
	Average length of time creating a post (A)	0.97		12.61 (8.23)	13.16 (7.33)	15.50 (5.60)
Reflectivity	Average number of reviews per discussion (C)	38.29*	1			10.16 (7.22)
			2	2.09 (1.64)	2.09 (1.95)	
	Final grade (A)	3.38		75.77 (6.95)	72.81 (10.97)	78.96 (5.12)

C clustering variable, A additional variable

All times given are in minutes

* $p < .0038$ (.05/13)

Table 2 Summary of characterizations based on cluster analysis

Label	Characterization
Cluster 1: Superficial listeners, intermittent talkers	Staccato temporality (several short sessions); limited depth and reflectivity of listening; moderate breadth; infrequent speaking.
Cluster 2: Concentrated listeners, integrated talkers	Limited number of extended sessions; moderate breadth but extended depth of listening; listening and speaking actions often integrated in the same session.
Cluster 3: Broad listeners, reflective talkers	Many sessions, often extended; comprehensive breadth but only moderate depth; frequent speaking and reflectivity on own posts.

however, as noted above, they showed greater integration of listening and speaking within sessions. Nonetheless, reflexivity was limited as indicated by just two reviews of previously made posts per discussion.

Cluster 3: Broad listeners, reflective talkers

The final cluster described the remaining 20 % of students. These students engaged in approximately twice as many sessions as students in the other clusters (between 13 and 14 per discussion), with sessions of a similar length as those in Cluster 2 (27 min). Many of the additional sessions were dedicated only to listening, as indicated by the relatively low proportion of sessions in which posts were made (18 %). One of the most notable differences between students in this cluster and the other two is the greater breadth of listening in which students engaged: they attended to almost all of their classmates' posts at least once (96 %) and viewed classmates' posts an average of 109 times per discussion. The depth of listening was not noticeably different, as indicated by a similar percentage of posts scanned (51 %) and time spent reading each post (four and a half minutes). In terms of speaking, members of Cluster 3 were more frequent talkers, making an average of three posts per discussion, though their posts were of a similar length and time-to-create as those made by the other clusters. The number of posts read before making a post also did not differ significantly from the other clusters, suggesting that the Cluster 3 students' listening breadth was not due to extended sequences of listening prior to each speaking event. Instead, their breadth can be attributed partially to listening before the additional speaking events, and predominantly to their large proportion (82 %) of listening-only sessions. Finally, students in this cluster displayed extensive reflectivity, reviewing their own posts an average of ten times per discussion. This is greater than the other clusters both in absolute numbers and relative terms (three versus one review of each post made).

Case studies

Cluster 1 (superficial listeners, intermittent talkers): Student 37

Student 37 listened very briefly and superficially to the discussions and did not consistently meet the assignment requirements. On average, he engaged in just four sessions per discussion, (each lasting less than 10 min), viewed only 35 % of his classmates' posts, scanned 75 % of the posts he viewed and spent less than two minutes on the posts he read. He contributed 1.3 posts per discussion on average and had only two reviews overall. These figures represent an extreme example of the superficial listening pattern seen for Cluster 1.

During the Leadership discussion week, Student 37 engaged in five sessions on three different days (Saturday, Monday, and Friday). He spent 38 min in the discussion, the majority of which (26 min) was spent in his first session reading the discussion prompt and composing a response. In this session, he logged in Saturday afternoon just after the discussion had opened and created the first reply for his group. While he offered several recommendations to address the business challenge, a key sentence in his post was left unfinished. He then returned to the discussion prompt and left the system. Later that night, he made a quick visit to the forum in which he likely saw that nothing else had been contributed and immediately left the system.

The remainder of his sessions were very brief. On Monday, he visited the forum for 2 min, quickly reading or scanning all three posts available, and briefly revisiting the discussion prompt between views. He then reopened his own post, and shortly after, left the system.

Student 37 did not return to the discussion until Friday (the final day of the assignment). On this morning, he entered the discussion forum, re-read the discussion prompt, and then quickly viewed five of his classmate's 16 available posts. These were scattered throughout the discussion and he spent less than 24 s on each. He then spent 4 min replying to a post from the middle of a thread (though his comments did not refer to this post), quickly viewed a newly contributed post and left. He returned an hour later to briefly re-visit a previously viewed post and then immediately left the system.

Cluster 2 (concentrated listeners, integrated talkers): Student 23

Student 23 is a mostly typical member of Cluster 2. She had an overall average session length of 44 min, with 43 % of sessions including posting actions. On average, she viewed only 38 % of available posts, but she spent almost 6 min on each one. She contributed about one post per week and reviewed it once; these figures are below average for this cluster.

During the Leadership discussion week, Student 23 had a single 2.5 h session on Wednesday. In this session, she viewed all 11 of her available classmates' posts. An additional 13 posts (which she never viewed) were made to the discussion after her single session of participation. She began her session by surveying all available posts in the discussion. She seemed to prioritize the posts that started and ended the two threads, opening these four posts first; she then viewed the intermediate posts in each thread. Her duration of post viewing varied, ranging from 7 s to 17 min. After her initial pass, Student 23 revisited several posts. Some of these she revisited more than once and there was one post in particular that she revisited four times. Throughout this process, she also revisited the discussion prompt five times. Near the end of her session, she spent 46 min composing her reply. While she chose to situate her contribution as a direct reply to the discussion prompt (starting a new thread), the content of her post referred back to several of the posts she had viewed; in particular she referred to the one she had viewed four times. After posting, she quickly scanned a previously viewed post and then spent 8 min reviewing the post which she had read multiple times and referred to in her own post. Finally, she scanned the discussion prompt and a new post that appeared while she was posting, then reviewed her own post and left.

Cluster 3 (broad listeners, reflective talkers): Student 82

Student 82 is a typical member of cluster 3. Each discussion week, he viewed all the posts made by his classmates, contributed two or three of his own, and revisited his posts

multiple times. His average session length was just under 30 min, 14 % of his sessions included posting actions, and his average time spent reading a post was just over 5 min.

During the Leadership discussion, Student 82 engaged in 12 sessions over 6 days. While he spent a total of almost 5 h in the discussion, the majority of activity took place on the final day of the assignment and half of his total participation occurred in one long session on this day. This was unexpected for a learner in a cluster characterized by broad listening, thus a follow-up examination of the other students in this cluster was conducted to determine if this was a typical behavior. A similar pattern of conducting the bulk of activity right before the discussion ended was found for all other 18 students in the cluster. Thus, this case study of listening behavior over time adds considerably to the picture painted by the aggregate statistics used in the cluster analysis.

Student 82's early participation during the Leadership discussion week was brief and scattered. In his several sessions, he focused on listening to past discussions and reviewing his own posts. On Tuesday, he moved his attention to the current discussion where he viewed all five posts available in a linear order. Late on Thursday night, he engaged in five sessions where he jumped around, visiting a previous forum, viewing this week's discussion prompt eight times, and viewing classmates' posts seven times. Several of the posts he viewed were contributed by the same author, one of which he viewed for 50 min. At the end of these sessions, there were other classmates' posts available that he did not view.

Student 82's major activity for the week began on Friday morning when he commenced a 2.5 h session of 64 actions. He began by spending 22 min viewing all the posts available in the forum from top to bottom, regardless if they had been previously read or not. After this, he re-opened several posts concentrating on those at the very top of the forum. He then took 45 min to compose his first reply to the post that he had viewed for 50 min in the previous session. After, he spent almost an hour on two reviews of his post, broken up by a quick scan of the discussion prompt. Student 82 then repeated his earlier pattern of viewing a segment of posts, this time focusing on a group near the middle of the forum for 10 min. After being idle in the forum for over an hour, he contributed a post in response to one of these. Three hours later, he returned to the forum to review his second post and spent 5 min editing his first post. There were no new posts at this time and he had already viewed all of the 26 existing posts.

The following week was not an assigned discussion week for Student 82. However, he still visited the discussions on 4 of the 7 days, for a total of almost 4 h. He visited the Leadership discussion shortly after it closed and read the one new post that had been contributed. Later visits to the Leadership discussion and his group's previous discussion focused on new posts contributed by the course instructor. He also visited the other subgroup's discussion for this week, opening seven (out of 23) posts; several of these posts were contributed by the same authors.

Discussion

This study aimed to develop a better understanding of different learners' patterns of listening in online discussions. Across all participants, almost three-quarters of their time in the discussions was attributed to listening behaviors. This indicates that similar to other online contexts (e.g., Nonnecke et al. 2004; Rafaeli et al. 2004), there is a lot of invisible activity going on under the surface. Online listening behaviors appear to make up a substantial component of students' participation in online discussions. In addition, over half of all sessions were listening-only (did not include posting actions) indicating that

listening behaviors are important to understand not only in the immediate context of preparing to post but also as activities unto themselves. The cluster analysis identified three distinct patterns of interaction that seem to indicate qualitatively different approaches to participating in online discussions. Interestingly, no patterns between clusters and group membership appeared, suggesting that at least in this situation, these approaches better reflect individuals' characteristics than group dynamics.

Cluster 1: Superficial listeners, intermittent talkers

Members of cluster 1 were minimally engaged in the online discussions; they spent a small amount of time listening to others and contributed on an infrequent basis. Both their breadth and depth of listening appeared to be quite shallow, as evidenced by their small number of short sessions, few viewed posts and little time spent on these. This was illustrated by the case study of student 37 who exhibited not only short and shallow reading behaviors, but also scattered post viewings, suggesting a lack of purpose and coherency in his interactions with the discussions.

The behavior pattern for members of cluster 1 is similar to del Valle and Duffy's (2007) minimalists who met their course obligations with the least amount of effort, and Bliuc et al.'s (2010) students who took a surface approach to participating in online discussions. Both this study's superficial listeners and del Valle and Duffy's (2007) minimalists had a relatively low numbers of sessions, low total time online, short session lengths, and accessed only a portion of the learning resources/posts available. This may present evidence for a blended context of what del Valle (2006) notes is well known to practitioners but not often discussed in the literature: learners who approach their online work "with a low commitment that results not in attrition, but in course completion with the minimum work possible" (p.116).

While a work-avoidance orientation has been related to a low level of cognitive engagement (Meece et al. 1988), members of cluster 1 did view over half the posts in their discussions and did not differ significantly from the other clusters on the final course grade. Thus it is possible that cluster 1 students' surface approach to fulfilling the discussion requirements originated instead from a desire to avoid a negative evaluation in the class (performance-avoidance orientation; Elliot and Harackiewicz 1996). If, like many students taking a surface approach, these students considered the course material simply as a set of facts to be memorized (Entwistle 2009), they would be unlikely to understand or engage with collaborative online discussions as a valued component of their learning. Further research is needed to examine the motivations for a superficial listening approach and its relationship with measures of student contribution quality and learning.

Cluster 2: Concentrated listeners, integrated talkers

Members of cluster 2 spent a similar amount of time in the discussions as the superficial listeners, but they did so through a small number of longer sessions. Their listening was also concentrated in that they only viewed a portion of their classmates' posts, though they spent more time on those they read than the superficial listeners. As the case study of student 23 showed, one reason they may not have viewed some posts was that they were contributed after the concentrated listeners had finished participating in a discussion.

This focus on efficient completion of requirements aligns with del Valle and Duffy's (2007) task-focused cluster whose members were strategic in their activity and concentrated their work on a small number of days. It is unclear if such a concentrated/task-focused pattern aligns with a particular learning goal-orientation. While the attention to

efficiency might suggest a focus on getting a good grade rather than learning deeply (performance-approach orientation; Elliot and Harackiewicz 1996), members of cluster 2 also spent extended time on each post they read, indicating some effort to understand their classmates' ideas. Thus cluster 2's concentrated listening may be more reflective of their efforts to manage time constraints than indicative of a mastery or performance orientation. Similarly, Entwistle (2009) notes that strategic behavior can be combined with both surface and deep approaches to learning. The case study of student 23 suggests that concentrated listeners may be quite thorough in their behaviors during their limited number of sessions: in her single session this learner viewed all posts available at the time, reread several posts more than once, and drew on these in her reply. Thus, while her participation was not comprehensive, for the interactions she did engage in she appeared to be taking a deep approach to her discussion participation (Bliuc et al. 2010).

Interestingly, a side effect of engaging in a limited number of sessions is that members of cluster 2 had greater integration of their listening and speaking actions than the other two clusters (listening and speaking frequently occurred in the same sessions). This seems inherently desirable in supporting interactivity and the contribution of comments which productively build on previous ones. It also highlights the large number of listening-only sessions by students in other clusters as an area for investigation. Future work is needed to examine student motivation for engaging in listening-only sessions and explore the ways in which they are beneficial or detrimental for learning.

Cluster 3: Broad listeners, reflective talkers

Members of cluster 3 spent the most time in the discussions and had high values on most variables. Notably, they attended to a very large percentage of the discussions, viewing almost all their classmate's posts at least once. Broad listeners share several characteristics with del Valle and Duffy's (2007) mastery-oriented group including a large number of sessions, an extended time devoted to the learning activity, and a high percentage of learning resources (posts) accessed. This aligns with a mastery goal-orientation focused on increasing one's competence (Dweck 1986). However, while a mastery orientation has been found to be predictive of a deep approach to learning (Phan 2008), the differences between our broad listeners and the other clusters were primarily in the breadth of their participation, not in its depth (they viewed and re-viewed posts more often, but spent a similar time to the other clusters engaging with the posts they viewed). While it is possible that that students in this cluster never engaged deeply with posts or that the time they spent was sufficient for deep engagement given the length of posts, the case study of student 82 suggests that the most likely explanation is that members of this cluster engaged deeply with a small subset of the posts they viewed, and that this behavior was not revealed by the average time.

The unexpected finding that members of this cluster conducted the majority of their activity in a small number of sessions toward the end of each discussion suggests that broad listeners may also have some similarities to concentrated listeners. Comparing the case studies for the two clusters, the final day of broad listener student 82's activity has many features in common with the activity for concentrated listener student 23. Both spent over two and a half hours viewing and revisiting all the posts available at the time, situated their responses as replies to posts they read many times, and contributed all of their posts for the discussion during their extended session. Thus, one factor contributing to the broad listeners' greater comprehensiveness may be that they conduct their extended sessions at a point in the discussion when they have the opportunity to view a larger proportion of the posts.

Other key differences between the broad and concentrated listeners are the numerous additional listening-only sessions the broad listeners engaged in and their persistent reviewing of their own posts. The purpose and role of the additional sessions is not yet clear, but the fact that student 82 devoted several sessions to reviewing the current, previous, and other group's discussions suggests that it may relate to a basic concern for keeping track of, or "covering" the conversation (see Wise et al. 2012a). This case also illustrates how listening in one session can be part of the preparation for posting in a future session. Whether motivations are the same for other broad listeners and if this is a productive activity for learning remain questions for future research. Attention is also needed to the role of reviewing one's own posts and if reflective activity is actually occurring in relation to review actions. Reflecting on one's contributions can support metacognition and synthesis of learning in online discussions and is an activity that many educators try to encourage in their students. Future work can investigate why and how students are revisiting their earlier posts and ways in which reflective behaviors can be encouraged in online discussions to support learning.

Implications for practice

Given the early phase of this line of research, implications for practice must be drawn carefully. While superficial listening does not seem to align with theoretical notions of meaningful participation in discussions, we cannot clearly say that concentrated or broad listening is preferable; there may also be other, more productive, ways to listen in an online discussion. Nonetheless, the results of this study do have several implications for how we think about supporting students' participation in online discussions. Importantly, the three distinct patterns of students' online listening found suggest qualitatively different approaches to discussion participation that may require different types of support. By utilizing click stream data collection early in the course, educators can recognize the approaches being taken and offer tailored feedback. In particular, the length and frequency of students' sessions are factors that differentiate across clusters and are relatively easy to examine without a full-blown analysis.

Looking at the specific clusters, similar to Hewitt's (2001, 2003) findings we identified students who attended to others' comments superficially. These students may not value their classmates' ideas, the discussions as a learning tool, or the course more generally; local instructional design factors designed to elicit richer listening behaviors are unlikely to affect these more global variables. Bliuc et al. (2010) found that students using surface approaches in online discussions reported fragmented conceptions about learning; more generally, a surface approach is associated with an understanding of knowledge as discrete pieces of information to be memorized (Entwistle 2009). This suggests that efforts to support these learners in deepening their listening need to be part of a more holistic development of their conceptions of and investment in learning. In a blended context, it is also important that the instructor places value on the online activities and integrates them with the face-to-face activities as two elements of the same learning experience (Dennen 2005). This was attempted in the course studied here by having a student summarize the contents of each online discussion during tutorials, but greater efforts in this direction may be needed.

Different from previous studies (e.g., Palmer et al. 2008; Webb et al. 2004), superficial listening was not the predominant approach found in this study. Concentrated and broad listeners exhibited two alternative approaches to interacting with others' messages that are important to consider. Notably, members of both clusters conducted a large portion of their

listening in a small number of extended sessions. For the broad listening case study, it was these sessions (rather than the many earlier short ones) that contained the deeper and more complex interactions. This raises the question of what are desirable and realistic expectations for discussion participation. While there is a presumed benefit to students engaging multiple times in an ongoing conversation, a limited number of extended sessions present a greater opportunity to consider multiple ideas together in depth than a large number of short sessions. Similarly, while there may be an idealistic goal of getting students to listen deeply to all the comments in discussions, in a large or lengthy discussion this may not be feasible. Thus deep listening to a portion of the comments may be preferable to shallow listening of all and instructors may want to encourage learners to engage in a handful of extended sessions rather than a large number of very brief ones. We are exploring this approach, while also attending to the dangers of students overly condensing their participation, by asking students to engage in both “early-week” and “late-week” integrated sessions of listening and speaking. More attention to students’ goals for participating in online discussions is also warranted. Students who are oriented toward mastery and see discussions as vehicles to support this goal are likely to participate in productive ways. In contrast, for students oriented toward performance goals, explicitly embedding desirable participation behaviors in the activity requirements and assessment scheme can help encourage more productive listening and speaking.

Limitations and future research

Limitations of these findings include generalizability of the results to other kinds of course content, structures, and settings. This study examined online listening behaviors in organizational behavior challenge discussions held as part of a blended undergraduate business course. Patterns of online listening behaviors may differ for other subject matter (e.g., literature), discussion tasks (e.g., open conversations about readings), course structures (e.g., online only), and settings (e.g., voluntary non-academic contexts). In separate work examining listening in a fully online undergraduate education course (Wise et al. 2012a), we found that three of five case studies conducted had profiles which fit well with the clusters identified here. This suggests that these clusters may be applicable beyond this specific context; the two additional cases studies which did not align suggest that other listening patterns may also exist. In future research, we will work to validate these clusters for different students in a variety of learning contexts. We will also expand this work by exploring student perspectives on their listening behaviors, the motivations, goal-orientations, and study approaches underlying them, and how listening behaviors may be affected by students’ reading (text-comprehension) skills and strategies.

The use of click-stream data in this study presented the opportunity to examine the timing and sequencing of behaviors in more detail than other data collection methods, such as think-alouds and stimulated recall (Barab et al. 1997). This was important as it allowed us to differentiate between different kinds of listening behaviors and to characterize them in detail. However, there are also limitations in using click-stream data. While we assume that students are attending to the discussion elements they view, we cannot confirm what a student is actually doing at each moment. At times they may be daydreaming or engaging in off-task behaviors in other browser windows. They may also spend time working on the task outside of the discussion system. This is especially relevant when there are large gaps in time in the click stream. For this reason, it is important to triangulate these results with studies that explore students’ reports and perceptions of their experiences. We have begun such work by conducting a study surveying students about factors they perceive as

influencing their listening behaviors; we also plan to include an interview protocol in future case study work. Research can additionally be conducted in more controlled environments; however this limits the authenticity of the context and thus the ecological validity of the results.

Several unexpected phenomena appeared in this study requiring further investigation. Students in all three clusters scanned around half of the posts they viewed. It is unclear if the function of the scanning is similar or different across clusters. Some possibilities include: ensuring “coverage” of the discussion; identifying specific messages to focus on in a large discussion; and relocating specific posts or content read previously. Future research is needed to determine the motivations behind these scanning behaviors, the different functions across clusters, and the relationship to learning in the discussions.

Another surprising finding was that despite very different behavior profiles, final grades did not differ significantly across clusters. This is similar to the findings of del Valle and Duffy (2007), but counter to other work showing a positive relationship between the degree of interaction with other’s posts and course performance (Hamann et al. 2009; Morris et al. 2005). It is important to note that the final grade for this course included assessment of a great deal of content beyond that covered in the discussions, and thus is a quite distal measure of learning outcomes from the discussions. More work is needed to examine direct learning outcomes from engaging in online discussions using specific listening patterns. Our goal for future work is to be able to classify these qualitatively different approaches to online listening as more or less productive for dialog and learning and to use this understanding to design interventions to support more effective discussion participation by all students.

Conclusions

Engagement with the ideas contributed by others is an important element of interactivity and productive participation in discussions. This paper presented the concept of online listening behaviors as distinct from prior notions of lurking, and outlined the dimensions of depth, breadth, temporal contiguity, and reflectivity over which it can be considered. The empirical data documented how online listening behaviors accounted for the vast majority of time students spent in the discussions, with many sessions devoted solely to this activity. Three distinct listening approaches were identified and characterized along the listening dimensions; case studies of how the behaviors were enacted over time deepened and, in some cases, substantially altered the interpretation of each cluster. These results indicate that listening is an important and differentiated component of online discussion participation, and raise important questions about desirable listening behaviors that require further research as we pursue a deeper understanding of and richer support for online learning discussions.

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