Exploring the Relationships between Facilitation Methods, Students' Sense of Community, and Their Online Behaviors

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Abstract

The popularity of online learning has boomed over the last few years, pushing instructors to consider the best ways to design their courses to support student learning needs and participation. Prior research suggests the need for instructor facilitation to provide this guidance and support, whereas other studies have suggested peer facilitation would be better because students might feel more comfortable learning and challenging each other. Our research compared these two facilitation methods and discovered that students participated more in instructor-facilitated online courses where they wrote more notes, edited and reread notes more, and created more connections to other notes than students in peer-facilitated online courses. We identified student activity patterns and described differences in how those patterns manifest themselves based on the facilitation method that was used. Our findings also show that instructor-facilitated online courses had a stronger sense of community than peer-facilitated online courses.

Introduction

Online enrollment has risen at the postsecondary level (Allen & Seaman, 2013; Gray, 2013) with courses being offered through a variety of online learning environments (OLE). These OLEs have been praised because they allow learners to work at a pace that is comfortable for them and supportive to their individual learning (Brooks, Demmans Epp, Logan, & Greer, 2011; Bolliger & Inan, 2012). Some learners also seem to favor online courses because they provide discussion forums where students can share resources, engage in discourse, and reflect on their ideas (Hewitt, 2005). These discussion forums allow students to have greater access to others' ideas as well as provide a space for all students to participate and share simultaneously in many discussions at their own pace, which gives shy or quiet students more time to think before contributing to discussions (Hewitt, 2005; Dzubinski, 2014). These advantages have contributed to the recent growth in distance education.

This rapid growth and the varied manner in which OLEs and their associated discussion forums can be used to support student learning means that we do not fully understand how student activities and discussion forum design influence one another. Moreover, the historical absence of analytics that describe student activities within OLEs or their relationship to theoretically relevant constructs, such as the learner's sense of community, limits our understanding of the learning processes and experiences of those who have enrolled in online courses. This limited understanding only serves to make the problems that are associated with OLEs increasingly pressing. These problems include high dropout rates (Carr, 2000; Kizilcec, Piech, & Schneider, 2013) that have been attributed to feelings of isolation and alienation among students due to their physical separation (Rovai, 2002a), a lack of interaction between students (Carr, 2000), miscommunication between students (Rovai & Wighting, 2005; Zembylas, 2008), and the clash of societal beliefs with students' personal and cultural beliefs (Rovai & Wighting, 2005). There is also a "need for an education system that helps people to help each other" (Ferguson & Bukingham Shum, 2012, p.8), since the isolation and disconnectedness of students in an OLE is the main reason for student attrition in online courses (Angelino, Williams, & Natvig, 2007).

To provide a more comfortable, safe, and positive online learning experience, instructors are encouraged to focus on the "the social nature of learning," which emphasizes the need for interactions and discussions between students (Hew, 2015, p.2). This fits with a social constructivist perspective, where learning is a process in which learners are able to construct new meanings through interaction and active involvement (Vygotsky, 1980). It emphasizes that collaboration and interaction with others produces deep and meaningful learning. This framework also emphasizes that students need to be a part of their own learning by recognizing that new knowledge and understandings are created when their own beliefs interact with those of others (Richardson, 2003), making the purpose of education enabling learners to work together to construct knowledge (Shackelford & Maxwell, 2012). Doing so allows learners to value their own learning and their peers' learning because interacting with various knowledge sets leads to new understandings. These types of student interactions can be supported through online discussion forums, which can be facilitated by the instructor or students. In these spaces, novices and experts work together, and everyone mentors and is mentored because everyone is a learner no matter their experience or expertise (Ferguson & Bukingham Shum, 2012).

Some scholars identify discussion forums as the place where a class-wide learning community develops (Arend, 2009), because it is here that students interact with the content, the instructor, and their peers to reshape and develop their knowledge (Song & McNary, 2011; Swan, 2009). Discussion forum interaction is "a necessary and fundamental process for knowledge acquisition and cognitive development" (Barker as cited in Song & McNary, 2011, p. 1). Students have also stressed that using discussion forums benefits their learning (Ertmer et al., 2007). Given this landscape, instructors are trying to foster a *sense of community* in their online courses, which refers to a feeling of belonging and interactivity among learners in an OLE (Rovai, 2002a; Liu et al., 2007; Ouzts, 2006). Fostering community can reduce feelings of disconnection and isolation, because being part of a community allows students to build camaraderie and engage in social reinforcement (Conrad, 2005; Gallagher-LePak, Reilly, & Killion, 2009), with interaction being critical to building a class-wide learning community online (Arend, 2009; Song & McNary, 2011; Swan, 2009) because it is thought to lead to deeper thinking (Hulon 2013; Larson & Kieper, 2002) and better student outcomes (Liu et al., 2007). Rovai (2002a) suggests that fostering community in an online course has the potential to minimize feelings of isolation, alienation, and disconnection online learners may experience.

However, there is a lack of consensus as to which strategies (such as instructor or peer facilitation) most effectively foster a sense of community in OLEs. This lack of consensus may be partly due to a lack of reliable analytics that detail how different strategies influence learner experiences. The development of these analytics could be used to address criticism about the lack of clear direction or empirically derived research that illustrates how to develop effective online communities (Liu et al.,

2007). One of the areas that could be better informed by the use of analytics is how different facilitation methods influence student activities and support the development of a sense of community in an OLE, since there seem to be conflicting recommendations. Some work urges instructors to adopt the role of online facilitator: This involves clarifying course topics, keeping the discussions on track, introducing opposing views to students, helping students navigate the online platform, and emphasizing good online behavior (Hew, 2015). Others question whether the instructor should facilitate online discussions, because they feel it may be too time-consuming to oversee discussions properly and may unintentionally develop discussions that center on the instructor's comments (Correia & Baran, 2010; Light, Nesbitt, Light, & White, 2000). As a result, peer facilitation—in which students collaboratively control the discussions in an OLE (Bull, Greer, McCalla, & Kettel, 2001; Hew, 2015)—was proposed because students may increase their cognitive engagement when they recognize that their instructor is less engaged (Belcher, Hall, Kelley, & Pressey, 2014), and they may feel more comfortable asking for help, discussing their experiences, challenging and negotiating ideas, and sharing their views in a peer-facilitated online discussion rather than an instructor-led one (Bull, Greer, McCalla, & Kettel, 2001). According to Clarke and Bartholomew (2014), research on the role of the instructor has been inconsistent; they argue that discussions should be moderated, but how much moderation is needed from the instructor and the extent to which the instructor's participation matters is unclear.

While both peer and instructor facilitation have been argued for (Rourke & Anderson, 2002; Correia & Davis, 2007; Mazzolini & Maddison 2007; Arend, 2009; Hew, 2015), it is important to understand how these methods influence the creation of a sense of community and support students' learning needs in OLEs, especially with peer facilitation being minimally explored despite its popularity and potential (Baran & Correia, 2009; Clarke & Bartholomew, 2014). Our research aimed to contribute to the discussion by exploring the impact of peer and instructor facilitation on students' online behavior through a variety of analytics that include students' discussion forum posting patterns. Specifically, the following research questions are explored: (1) Which facilitation method (i.e., instructor or peer) helps to develop a stronger sense of community online? (2) How are students' online activity patterns related to instructor and peer facilitation methods?

An awareness of students' online activity patterns in weak and strong online communities and the facilitation method related to these communities is important in identifying the method that best fosters an online sense of community and that method's influence on students' online behaviors. Having this understanding along with the development of analytics that describe students' online behaviors holds the potential of offering directions and strategies to design online courses with the aim of providing more positive online learning experiences for students.

Method

As recommended by several scholars (Gunawardena, Lowe, & Anderson, 1997; Hiltz & Arbaugh, 2003), this study adopted a mixed-methods sequential-explanatory design (Creswell & Plano Clark, 2011). For the quantitative phase, we observed students' online activity patterns and asked those students to complete a questionnaire. For the qualitative phase we conducted semistructured interviews with students from the online courses.

Participants and Data Collection
This research took place at a public research university in a large metropolitan city in Canada. The data was collected from graduate students in the field of education who have taken online courses through the Pepper OLE. Pepper is a web-based collaborative workspace used by approximately 2,000 postgraduate education students every academic year. We gathered data and recruited participants through Pepper because it offers a variety of specialized knowledge building features and social networking tools to support the sharing of information to develop ideas.

Rovai's (2002b) Classroom Community Scale (CCS) was randomly distributed to eight online graduate courses that used Pepper. These eight courses were then stratified by course format (i.e., seminar, independent study, and lecture) and instructor (i.e., different online instructors). Once stratified, the online courses with the same course format and different instructors were used in this study. Courses that did not meet this criterion were cut to ensure similar courses were being compared. For this study, six courses were selected for inclusion ($N = 110$), with each course having a different instructor; 47 students were spread across the three instructor-facilitated online courses, and 57 students were spread across the three peer-facilitated online courses. It is important to highlight that instructors from the instructor-facilitated online courses encouraged their students to be respectful to their peers and provide thoughtful online notes, but did not have any mandatory guidelines for their students with regard to participating in online discussions, whereas instructors from peer-facilitated courses had mandatory note guidelines for their students that included evaluation rubrics for note content, note length, and number of note contributions per week.

The CCS was used to determine which courses had a high or low sense of community. Once the high and low scoring communities were identified, we explored students' online activity patterns by analyzing the logs that Pepper automatically collects. These logs store time-stamped records of online events (e.g., the creation of a note or when the Like button is pressed). Statistical data was pulled from the Pepper logs to understand students' online behaviors and activity patterns. For the qualitative phase, semistructured interviews were conducted with graduate students from the participating online courses. Interview data in the qualitative phase focused on students' views, experiences, and behavior in their online course.

Analysis and Validity

The CCS data was first cleaned to remove incomplete or duplicate responses. Then it was coded following the scale guidelines, and the highly reliable ($\alpha = .906$) CCS score was calculated. The average response rate ($M = 53.30\%$, $SD = 15.60$) was also calculated. Interestingly, the research community has yet to agree upon an acceptable minimum response rate, but it is not uncommon to see response rates below 20% (Fowler, 2009), with a response rate of 33% being typical (Nully, 2008). These statistics and the fact that nonresponse error does not have a strong relationship with survey error (Fowler, 2009) indicate that the response rate for the CCS was sufficient. Inferential statistics were then used to determine whether students' perceptions of the sense of community that they felt within their online course differed.

The Pepper log files were analyzed from two perspectives. The first considered students' activity levels (i.e., their raw activity counts for the term), and the second considered students' system usage patterns (i.e., the ebb and flow in their activity levels from week to week). The analysis of student activity levels used inferential statistics to determine differences in the levels of various student activities. Comparisons were made based on students' course membership and the facilitation method (i.e., instructor or peer) used within their course. Since Pepper tracks every button that is clicked and performs basic analyses on the text that students post (e.g., grade level or academic word use), inferential statistics were used to look for differences in students' activities and writing habits. We primarily report on the types of activities where differences were observed. These activity types include the following:

- **Note**: This refers to a single post within the discussion forum.
- **Private shared note**: This is a post that is shared only with a specific peer or group of peers selected by the creator of the note. The peer or peers also have the ability to edit the note.
- **Messages to instructors**: These are private Pepper messages that are similar to e-mail.

- **Editing**: This refers to the number of revisions made to notes by those notes' creator. Changes could be as simple as correcting the conjugation of a verb or could include substantive changes to the content or subject of the posting.
- **Liking**: This refers to the number of Likes that a note has received. Likes indicate an acknowledgement that is similar to the Like feature on Facebook.
- **Links created by note**: This refers to the number of links to other notes compared to the number of notes created. Linking within Pepper is similar to tagging in social media.
- **Note rereading**: This refers to the number of times a note is viewed following the reader's first reading of that note.
- **Replies**: These are responses to other notes. In Pepper, replies are indented in a similar manner to those in a threaded discussion forum.
- **Sentiment**: This is a measure of the amount of emotion that is present in the note. Sentiment values are calculated using natural language-processing techniques (Fakhraie, 2011).

The analysis of student activity levels informed which types of student activity we modelled. An initial list of activity types was created by selecting all of the event types in which students' usage levels differed significantly by course facilitation method. Other activities were added when they had prior empirical or theoretical support, as was the case with liking (Phirangee & Hewitt, 2016). The list of activities was then reduced based on a correlational analysis: Items from the initial list that were strongly correlated ($r > .90$, $p < .01$) were identified, and a single item from that group was chosen. For example, notes and replies had a strong relationship ($r = .976$, $p < .001$), so we analyzed students' note-writing activities because this was their primary course activity, which also meant that there was more data from which the models could be built. The list was further reduced to those activities where sufficient data was present. For example, the linking behaviors of students were not modelled, because there were fewer than 50 events across all courses, which would have led to overfit models that would not generalize. This left four activity types: note writing, revisions, rereading, and Liking.

To prepare the data for modelling, the number of times that a student performed a specific activity within Pepper was calculated for each week within the year. These activity counts were then used as the model features (the attributes that the algorithm reasons over to create models). We then labelled each week's activity count to communicate when the activities took place and enable our interpretation of the resulting models. Weeks during the regular term were assigned a label that began with a "W" and ended with that week's number within the term. For example, activities from the third week of the term were assigned a label of "W3." Since activity levels were lower during the exam period and each course had different deadlines for its term-end paper, all of the student activities that were recorded during the exam period were combined. The exam period activities were then labelled with an "E." All of the activities that occurred after the exam period had ended were aggregated for similar reasons. These activities were then labelled with an "A" standing for "after." Like the activities that were logged during the exam period ("E") or after the term had ended ("A"), those that were logged more than a week before the beginning of term were aggregated. These activities took place in mid-to-late December and early January as instructors were preparing their courses and notifying students that the course materials had been posted or that the course was about to start. These events were labelled with a "P+" to indicate that they occurred well in advance of the beginning of the term. The activities that were logged in the week immediately prior to the start of term were labelled "P1." These counts were then used as inputs to the model and appear in the charts that illustrate the identified models.

Models of students' activities within Pepper were then identified using RapidMiner 5.3.015 (2014). These models represent students' system usage patterns. The k-means clustering algorithm was then applied to the normalized weekly usage statistics of individual students. The purpose of using k-means clustering was to create tight clusters or groups of students and to have each of these groups be as different as possible from each other. The k-means clustering was used because it has a history of being

successfully employed to identify students' usage patterns within educational technology (Baker & Yacef, 2009; Brooks, Erickson, Greer, & Gutwin, 2014). Furthermore, it enabled us to explore which student groupings might be appropriate based on the similarities in their normalized weekly usage counts. Students' usage counts were normalized using z-transformation: This type of statistical normalization converts the data so that it fits a normal distribution that has a mean of 0. Students whose weekly activity counts match the mean are assigned a value of 0, those with activity counts above the mean are assigned an appropriate positive value, and those with activity counts below the mean are assigned a negative value. Performing this transformation helps ensure that extreme values do not unnecessarily influence the results of the modelling process. The results of clustering algorithms, including k-means, are also influenced by the data points that are selected as the cluster center points (Witten & Frank, 2005). To overcome this bias, precautions were taken: Each cluster's center point was randomly selected, and the process was repeated 1,000 times. Running the algorithm this many times with randomly selected center points reduces the likelihood that a poor initial choice will negatively affect the results.

While some clustering methods try to determine the appropriate number of clusters, k-means does not (Witten & Frank, 2005). As a result, we iteratively explored the number of clusters by changing the value of k (i.e., the number of clusters that the algorithm is expected to create). We started by setting k to 2, and increased k by 1 each time that we ran the analysis. We stopped adding more clusters once it became clear that we were creating groups whose activities were similar to one another. We used a combination of information to make this decision. We used the Davies-Bouldin Index (DBI), which measures the distance between individual clusters and the distance between each student who was assigned to a cluster. We also visually inspected the clusters and considered the number of students assigned to each cluster, the interview data, and educational theory to determine the appropriate value for k. We selected the value for k (i.e., the number of clusters) that minimized the DBI without creating unnecessarily small clusters. The k-values where a cluster contained only one or two students were kept only if there was strong theoretical support for their existence or the interview data confirmed the identified behavior pattern. The identified clusters were then assigned labels based on existing theory and the interview results.

The above analyses and modelling were considered in conjunction with interviews to further understand students' online experience and behavior. Semistructured interviews, an hour in length, were conducted with six students from the participating online courses. An e-mail inviting students to participate in an interview was sent to the six postgraduate courses, and those who expressed interest were selected to take part in the interview. Interviews were transcribed (please see Appendix A), and then thematic analysis was used to analyze each interview, which involved searching the data for patterns and themes to generate research insights about the phenomena (Glesne, 2011). After each student interview was analyzed, it was categorized by course facilitation method, which had been determined by the students themselves. This student-labeling method of course facilitation allowed us to compare both types of courses more accurately and generate themes that reflected students' online experience in each type of course.

Results

For this study, the quantitative data revealed only which activities students engaged in online, whereas the qualitative data provided students' understanding of their online behavior. Students from the instructor-facilitated ($M = 33.62$ hr, $SD = 21.95$) and peer-facilitated online courses ($M = 27.16$ hr, $SD = 21.01$) spent a comparable amount of time logged into the OLE ($p > .05$). Similarly, students' session counts from the peer-facilitated ($M = 104.23$, $SD = 77.79$) and instructor-facilitated online courses ($M = 100.38$, $SD = 62.65$) did not differ significantly ($p > .05$). The majority of the results focus on student activities; teacher activities are included only in the modelling of system activity patterns. These patterns, along with student interviews (i.e., their experiences, activities, and sense of community), are discussed below.

Students' Sense of Community and Usage

Table 1 (next page) shows the CCS scores for individual courses. It also details the facilitation method used within each course and the relationship between that facilitation method and the level (high or low) of community that was present within each online course. The tight relationship between the results of grouping the courses based on their CCS scores and the primary facilitation method that students identified as being used within their course led to our performing subsequent analyses from the perspective of the course's facilitation method. This small change in perspective allowed us to retain course C data for later analyses.

From Table 1, we can see that students' sense of community is higher ($F_{5,49}$ = 3.44, p = .010) in instructor-facilitated online courses (M = 55.75, SD = 10.60) than in peer-facilitated online courses (M = 45.67, SD = 9.07). This difference may be due to students' associating peer facilitation with a lack of instructor involvement. In particular, participants from both types of course expressed a preference for instructor facilitation but for different reasons. Students in peer -facilitated online courses (C, D, F) strongly emphasized that the instructor is needed to validate their ideas and thinking or to show an interest in student learning. As one participant stated,

But my preference is a bit of a balance, so the online courses that I've enjoyed are when the instructors will post a summary of the week, an introduction to think about some things, here's my voice adding to the conversation.

Another student also wanted the instructor more involved in the online course. She said,

I prefer hands-on. I think that allows the instructor to be with me in my learning journey. Also, when they're hands-on it seems like they're interested in what the class as a whole is learning and is studying, and I think that also develops the sense of community and deepens it because they are just more interested in what we're learning.

Conversely, students from instructor-facilitated online courses (A, B, E) felt that instructors are needed to keep the discussions on track by providing feedback. One participant stated,

I really like what the professor did. He was there all the time, he was constantly showing his presence online, so I knew that he was there and he would reply to us…. He seemed like he was one of us, but he chimed in to make some relevant points, and he's clarifying, and he's not letting us go on and build on misunderstandings because there are errors, and he didn't want us to develop a fake understanding of something or a wrong one or any equities to be promoted or other things.

Similarly, another participant shared how much she enjoyed her professor being involved in the online discussion and disliked the "hands-off" professor. Reflecting on the facilitation methods this participant experienced in other online courses, she stated,

I like the hands-on, the facilitator. I just don't want the hands-off prof. I would consider my professor hands-on, like I said she was engaged, she gave really good feedback, she scheduled phone calls with us, which was really nice to give us feedback and talk to us about our final project, so that was a nice…. So, a prof who uses their experiences to be hands-on and stepping in when they need to guide, share or clarify. So yeah, being a facilitator when it comes to the discussion.

Table 1 CCS Scores by Course and Facilitator Type

Course	n	CCS M	SD	Facilitator type	Community level
A	12	54.75	10.24	Instructor	High
B	8	57.38	3.24	Instructor	High
C	7	47.43	8.81	Peer	N/A[1]
D	14	47.36	8.50	Peer	Low
E	8	55.63	9.41	Instructor	High
F	6	39.67	9.56	Peer	Low

[1]The CCS score for course C did not differ significantly from any of the other courses.

In summary, all participants wanted the instructor to be involved in the online discussions. Instructor involvement reinforced the belief that the discussions would stay on track and that students would receive consistent feedback. More importantly, instructor participation allows students to feel as though the instructor values students' views and ideas and wants to be there.

Table 2 shows that there are significant differences based on the course's facilitation method for all student actions except Liking. It also shows that students from instructor-facilitated online courses posted more notes, performed more editing and linking actions, reread each others' notes more, and replied to a greater number of their classmates' notes.

In contrast, students in the peer-facilitated online courses were generally less active within the course, demonstrated slightly more sentiment in their prose, were more likely to communicate directly with their instructors, and participated in more private conversations.

Table 2 Descriptive and Inferential Statistics of Learner Use of the Pepper OLE

Student activity	Instructor-facilitated M	SD	Peer-facilitated M	SD	Mann-Whitney test U	p
Notes	55.28	37.01	37.91	29.53	940.50	.009
Private shared notes	0.36	1.29	0.79	1.44	1,086.50	.025
Messages to instructor	1.17	2.57	3.77	4.84	949.00	.008
Editing	25.27	31.54	11.62	16.97	921.00	.007
Liking	0.89	0.73	0.57	0.33	1,241.50	.522
Links created by note	0.04	0.08	0.01	0.04	1,071.00	.023
Note rereading	198.21	151.51	123.56	121.50	889.00	.003
Replies	44.17	34.53	28.46	25.87	988.00	.022
Sentiment	6.37	0.14	6.48	0.15	736.00	<.001

Student Usage Patterns

We describe the models that were identified for each of the targeted activities: note writing, note editing, note rereading, and note Liking (please see Table 3). Each of these descriptions is accompanied by a visualization that represents the activity level of the typical student from the cluster that is associated with the identified usage pattern. The median activity levels of all students from the identified cluster were used to generate this representative student.

Table 3

The Number of Students and Instructors Assigned to Each Cluster for the Activities Where Usage Patterns Were Identified

Cluster label	No. of people per cluster by course type		
	Instructor-facilitated	*Student-facilitated*	*All*
Keeners	2	1	3
Outsiders	18	22	50
Respondents	17	22	39
Discussants	7	11	18
Perfectionists	5	1	6
Consistent Editors	4	3	7
Confident Writers	45	52	97
Keeners	1	1	2
Typical	21	46	67
Just-in-Time Readers	13	9	22
Outsiders	19	0	19
Maintainers	8	6	14
Nonsupporters	44	48	92
Supporters	2	2	4

Notes. The clustering algorithm identified four different usage patterns in students' posting of notes to the discussion forum (Figure 1):

- *Keeners* ($n = 3$): Members of this small group of instructors and students (see Table 3) had activity levels that were consistently higher than those of the other groups. The activity levels of these users often exceeded the combined activity of the other three groups.
- *Outsiders* ($n = 50$): These students performed the minimum activity required by their courses. Members of this group felt excluded from the community or opted out because they did not feel that being a part of a learning community was necessary or important. From Figure 1, we can see that they cease their participation during the final week of class (W13) and that they do not maintain their participation during the term break (W10).
- *Discussants* ($n = 18$): Members of this group initiate communication while the class is in session. They are the students who aim to start and maintain conversations
- *Respondents* ($n = 39$): Members of this group actively participate but may wait for others to start discussions. This is shown through their generally lower activity levels and the shape of their curve, which is similar to that of the Discussants but appears to be offset by about a week with activities continuing through the term break and into the exam period.

Interviewees from instructor-facilitated online courses (A, B, E) emphasized their awareness of their audience. Although they knew the professor would read and compare their notes to others, they focused more on contributing to the discussion by sharing their experiences and writing for their peers to connect with them and support their learning. For instance, one student stated,

You want to let others know that you read their stuff, that you understood them and the topic, as such. But also you want to connect it with your experience to make it meaningful…. So what I try to do is connect the reading, the article with my experience as a person. Perhaps, as a husband, as a brother, also as a language teacher. So, you try to put together many things and hopefully one of my peers can connect with it.

Similarly, another participant echoed the importance of sharing personal experiences to help students connect and relate and, more importantly, learn from each other. She states,

What I like to do was make a personal connection to what we were reading. So I'm trying teaching because I want to make it more applicable and something other people can relate to.

The idea of connecting with peers was more important to students because it was believed that this connection would lead to deeper thinking and more meaningful posts. Interestingly, these students knew the professor would be reading their notes but opted to focus on building relationships to produce a deeper and collaborative online dialogue. As one participant stressed,

[When] I create my initial post, I know that the audience will be my professor and my peers…. I'm trying to look and add to what people have to say, or maybe there was something in their post that reminded me of something that somehow relates to the course material that I could actually go to and share.

Overall, students in the instructor-facilitated online courses focused on creating notes that were more meaningful by sharing a personal experience in order to connect with their peers. These students stressed not only their own learning but the importance of their peers' learning too.
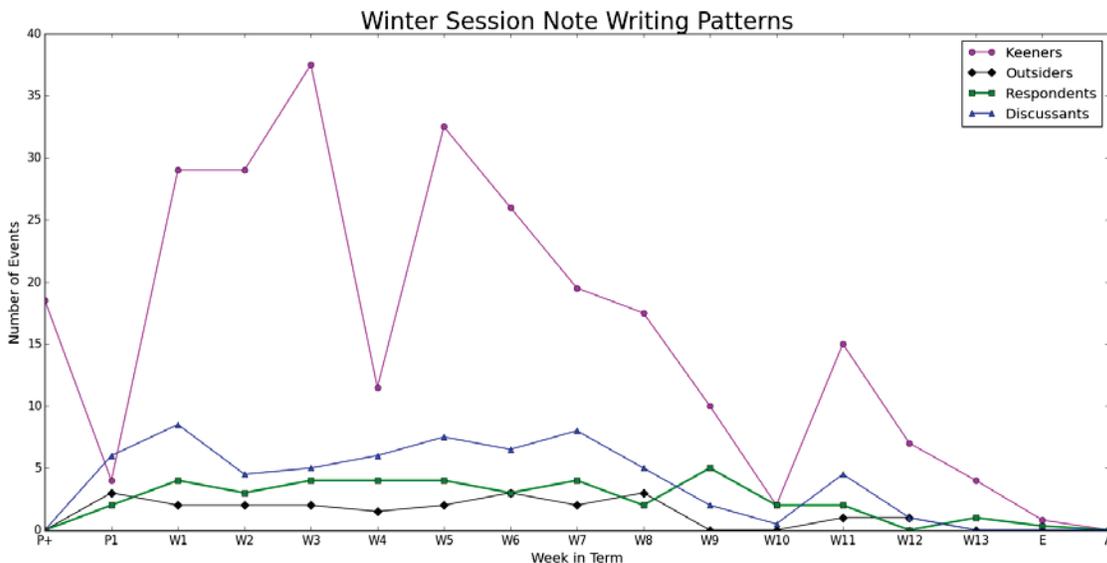

Figure 1. The number of new notes that each type of user typically wrote each week.

Although, students in the peer-facilitated online courses (C, D, F) expressed the importance of keeping the dialogue going and providing feedback to their peers, all admitted that they simply wanted to share their views and meet the requirements. More specifically, some of these requirements involved posting a certain number of notes and having to respond to all replies affiliated with those authored notes. One participant stated,

[I'm] trying to express my views. But if I'm writing a note in response to someone I'm   more focused on what they've said, their opinion, and if there's anything that I think   would   help   like   an article or something I'll attach it and be like, "Hey you'll enjoy this, it   fits   into   what   you're   talking about." So, it really depends what kind of note it is…. But usually it's me putting my thoughts out there.

Similarly, another participant echoed the importance of helping her peers but focused on the need to express her own views and meet the requirements. She stated,

I try to fulfill what's required and express my perspective because I'm explaining what I believe about it, but if I'm replying [then] I'm giving feedback from my point of view,   and also to help my peer like if they missed something but it's from my perspective…. I created   my   notes   to   meet   the requirements the professor gave us. I didn't do more.

It seems as though students in the peer-facilitated online courses created notes in hopes   of meeting the requirements, which included giving peer feedback and sharing their views   on   the   course readings.

It is important to mention that some participants from other peer- and instructor-facilitated online courses witnessed some of their peers feeling left out or ignored within the online discussion. One participant from an instructor-facilitated online course recalls a time when he stopped commenting on a peer's post because he assumed she was not interested, but he discovered that she just felt her voice had no place in the discussion. He stated,

She didn't participate as much as I expected…. She never answered me back and because of that I thought she was a distant person, so I stopped commenting on her post.... But then I get to meet her face-to-face and she's the opposite, she's a very kind and happy person, she's very sharing and the issue was that she felt overwhelmed.... She said, "Sometimes the professor would give some questions but people went of topic or they developed it in a certain way that I couldn't participate."

Similarly, a participant from the peer-facilitated online courses admits that she opted not to write more than the required amount of notes because she thought her peers would not understand or value her cultural experience. She stated,

No, I wrote notes to meet requirements. It's not pleasant for me because I'm an ESL student, and considering my cultural background being from Kuwait, I don't know maybe I just didn't feel like people would get my experience. So, it's just like why would I want to spend so much time anyways. I could take these hours and do something else, instead of just reading what other people were saying [because] some of them might be interesting and some of them will be boring.

Therefore, some students in both peer- and instructor-facilitated online courses in this study are opting to limit their participation because they assume that their views will not be valued or accepted by peers, thus feeling like outsiders.

Editing. Only three note-editing patterns were identified (Figure 2): students who performed very few editing actions at the beginning of the term (the Confident Writers, $n = 97$), edited each post that they made once or twice (the Consistent Editors, $n = 7$), or performed extensive editing activities that in some cases exceeded their note posting activities (the Perfectionists, $n = 6$).

All interview participants, regardless of course type, revealed that they edited their notes, mainly to fix grammatical errors that they caught after posting. Participants from instructor-led online courses (A,

B, E) seem to portray themselves as consistent editors. For example, one participant emphasized that it was extremely important to edit notes because of their permanency. She edited her notes "all the time because it's permanent it's different than an oral contribution. I'm doing my posts in the evening because I work, so I love the edit button. Thank God there's an edit button." Similarly, another participant found herself using the edit button regularly when writing posts because she knew others would be reading her work. She stated, "I post, and then I read it as if I'm the person who receives it, which is weird [laughs] and then I find something in it and I click the edit button and I re-edit." One participant emphasized that he consistently edited his notes before and after posting because he would find mistakes. He stated,

> Yes, I do. It mainly because as English is my foreign language and I learn it as a foreign language sometimes I make spelling or typo mistakes. I'm a kind of perfectionist, so I like to check before and after I've posted it. If you check my notes, sometimes the due date was March 15, but then you see that I edited it in April, and it was because I reread it and found a spelling mistake like *our* instead of *or*.

Overall, participants from instructor-led online courses presented themselves as consistent editors, especially when the forums got busier throughout the term. Students attributed the need for this consistency to pleasing their audience (i.e., their instructor and peers) by presenting confident writing in their notes, whereas participants from peer-facilitated online courses minimally edited their notes and seemed to be more confident writers from the start.

Although students from peer-facilitated online courses (C, D, F) acknowledged editing their notes for grammatical errors and to adding missing content, many emphasized that they did so minimally and stopped once a peer replied to a post. For instance, a participant stated,

> Usually before I post anything I definitely check it. I do it first on a Word document and then post to Pepper. But after I post it I rarely go back to check it. So, usually I would revise any grammar or spelling mistakes.

Similarly, a participant argued that editing for grammar is allowed before or after but editing to add content, such as revising a paragraph, is wrong. She stated,
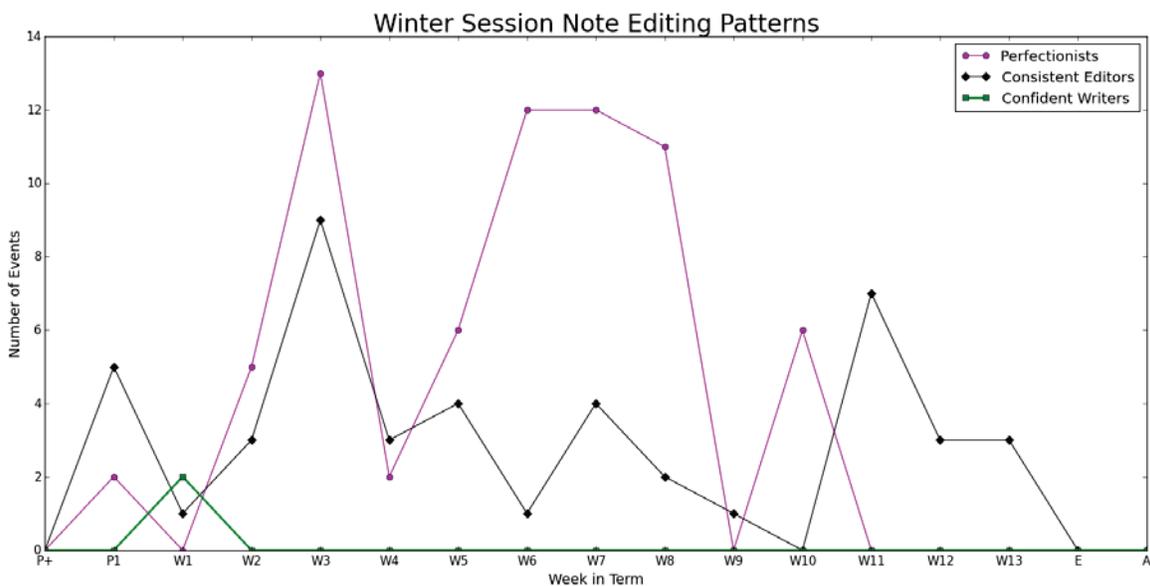

Figure 2. The number of weekly edits typically made by each user type to existing notes.

I don't really revise them because I feel like that's cheating. If you've written a note [pause]. If it's a typo you're fixing that's one thing, but if you've written a note [trails off]. I find this frustrating like someone wrote a note and I responded to it, and then they revised it and included a paragraph, which I commented on, then replied to me saying, "Oh, well what did you think about this?" And so, I just looked like an idiot because my comment made no sense anymore, so I think there are problems in there sometimes. So, yeah there was a whole other section they put in when I said, "Hey, have you thought about this side of the problem? I'm sure that would be a really conversation." So, I try to stay away from revising posts after that because it was just a strange experience…. I rather just write what I had to say knowing that I got gaps.

Overall, participants from peer-facilitated online courses edited their notes minimally for grammar and content compared to those from instructor-facilitated online courses. This behavior may be due to students knowing that their instructor was not observing their discussions consistently and their feeling more comfortable posting their notes with gaps. This finding is supported by previous research in which students in peer-facilitated courses were more likely to vocalize their views, challenge each other, and negotiate ideas (Baran & Correia, 2009; Rourke & Anderson, 2002). Lastly, it is important to recognize that despite course type, students stopped editing their note when a peer replied. The reason for doing so came from a desire to not disrupt the flow of the online conversation and to respect their peers' comments.
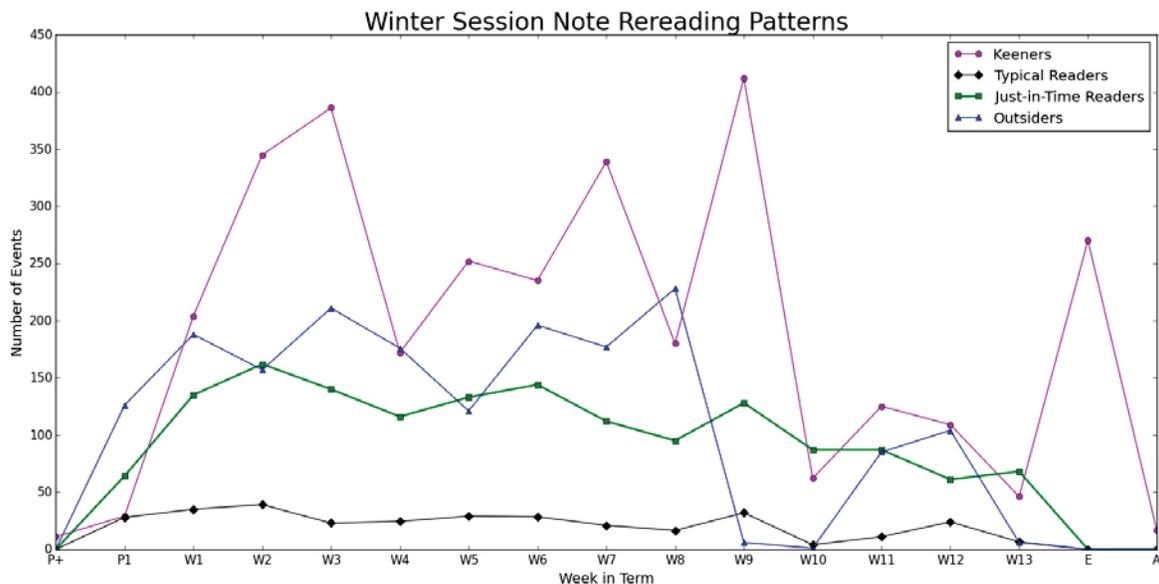

Figure 3. The typical number of note rereads that each user type performed.

Rereading. The rereading of a note by members of the community suggests its influence on the community or its importance to members of the community. As with note posting, two of the four rereading patterns that were identified (Figure 3) were those of the Keener ($n = 2$) and the Outsider ($n = 19$). In this case, the activity of Keeners extended beyond the term, which may represent attempts to understand instructor feedback in light of the course discussion or instructor grading activities. The Outsider rereading pattern was also different: Their reading activity levels were far higher than their posting activities. Outsiders reread instructor posts multiple times to try to understand instructor-provided summaries and the instructor's expectations. Outsiders also reread students' posts, possibly in an attempt to better understand postings where cultural references had hindered understanding, which may be why the shape of their curve resembles that of the Keeners and why the cessation of their rereading activities

coincided with the last week of class. The third group of students are the Typical Readers ($n = 67$), who did relatively little rereading. The final group was the Just-in-Time Readers ($n = 22$), whose consistent level of rereading seemed to follow course demands, continued through the term break, and ended with the exam period.

For participants in the instructor-facilitated online courses (A, B, E) rereading was seen as a key behavior in understanding and connecting with a peer's note. For these participants, rereading was done as an audience member to make sure their notes accurately and clearly reflected their thoughts. For instance, one participant stated she would write her note then leave it and return to it another day with fresh eyes. She shared her method:

> I would also go back in the morning, so I would do a Word document and then go back in the morning "Does this make sense?" Rereading for errors because it's something that's permanently going to be in cyberspace for everybody, and you can't take it back. So, yes I do reread often.

In the same way, another participant stated,

> To be honest, I did it a few times. It was mainly because I was preparing an answer, a reply for them, and I wanted to make sure to cover all the points and to not misinterpret what said but apart from this I didn't do it.

The idea of rereading as an audience member highlights a strategy these students used to avoid misunderstandings, provide accurate feedback, and show their peers that their work was valued. Perhaps adopting this particular rereading method produced more confident writers because students were able to reflect and synthesize their ideas before publicly posting them to the online discussion forum, which confirms Hewitt's claims (2005) that "the asynchronous nature of the interaction allows learners to reflect in greater depth before they share their ideas publicly" (p. 568). This is key to building confident writers, because it provides students with an opportunity to reread, reflect, and rewrite if needed. Another participant emphasized that it is important to reread because this leads to proper communication and a stronger connection in the forum, which is necessary since online platforms are missing various social cues. For her,

> So, I'm rereading as an audience member and one of my peers, and if you think about it, it's written communication and because you're missing other cues and the other face-to-face stuff, I found myself making sure it was polite enough by how it sounds so that it's not offensive. So, it's very important for me to pay attention to the way somebody who receives it might read it.

Students from the instructor-facilitated online courses reinforced the notion of rereading as an audience member, as a final proofing stage, to make sure they replied accurately without any misunderstanding. These students understood that such communication was critical in shaping and building a dialogue with their peers and made the effort to reread their notes before posting them publicly. Perhaps knowing and seeing the instructor's involvement in the course also motivated students to be aware of what they write and how they respond, hence their time and effort in rereading notes.

In contrast, students in peer-facilitated online courses (C, D, F) did little rereading. Their activities consisted of rereading their own notes to make sure there were no errors and rereading the instructor's notes to make sure they were meeting the requirements. As one participant stated,

> I reread because when I write it initially [pause] sometimes the sentence makes sense but it's out of context, so I just fix it by rephrasing. So, I do it to make sure it was clear, that I didn't make any mistakes here and there.

Another participant stated, "No, I didn't read my peers ever [laughs]. I might have gone back to reread if something that I had written before might have been relevant or something that I had read before was relevant." There is a focus from these students to reread only their notes rather than their peers'. If they did reread a peer's note, it was because it contributed to their own learning. For instance, another participant built on the idea of rereading because it was the professor's notes and it was beneficial to her work. She states,

> I've reread notes. I do it all the time, especially the professor's notes, but then sometimes I'll just remember a really good conversation. And because I'm working as well, if I think there's something in there that could really relate to what I'm doing at work or I think I should remember, then I'll go back and look at it.

Perhaps knowing that the instructor is not fully involved in the online course indirectly created such behaviors as minimally rereading and only doing so when it benefited students' own learning or if they had to. In comparison to students from the instructor-led online courses whose main purpose for rereading from the viewpoint of their audience was to support and benefit their peers, students from the peer-facilitated online courses reread less and did so only to benefit themselves.

Liking. Similar to editing, three patterns of note Liking were identified (Figure 4). The Nonsupporters ($n = 92$) are similar to the outsiders that were found when analyzing students' and instructors' rereading and note-posting habits: They were minimally active and did not attempt to support their classmates through the use of Liking. The Maintainers ($n = 14$) are typical students who are reciprocating the activities of others and trying to meet their social obligations, whereas the Supporters ($n = 4$) aim to give others the sense that they have contributed to the learning community. Supporters try to impart this sense of contribution by liking others' notes, which serves to acknowledge the contribution that is made by the note's author.

Participants admitted to using the Like button minimally when engaging in online discussions. Those in the instructor-facilitated online courses (A, B, E) were eager to emphasize the importance of both the instructor and students using the Like button. As one student indicated, Liking validated the work she was sharing and that her peers valued her ideas.
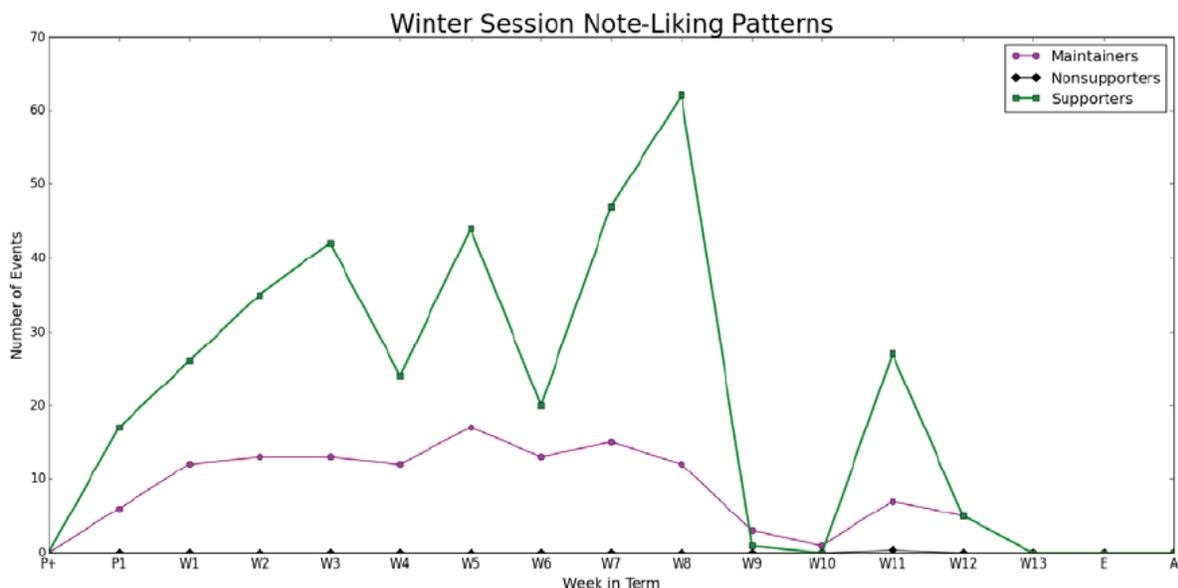

Figure 4. The number of likes that each user type gave.

She states,

> Also, do you know how important the Like feature is? I look at who Liked my note. And I'm thinking, "Oh wow somebody Liked my note." And so, I found myself looking for how many Likes I got, or if somebody Liked my note because it validated that I was on track, or that they Liked my stuff.

Another participant highlighted that when the instructor used the Like button, it reinforced their support and validation for students' ideas and views. As another participant expressed,

> I really like when the instructor answers your notes. Even to say "Like," you know using the Like button, or just to chime in and say good job because you know that she cares about you. I mean the instructor is actually reading your work.

Perhaps having an instructor who oversees the online discussions and peers who write for each other diminishes the use and purpose of the Like button in this type of course. Yet, for many of these students, the Like button is a useful feature that supports and validates their work in a quick and simple way.

Participants from peer-facilitated online courses (C, D, F) also used Liking to simply acknowledge a peer's contribution rather than write a response. As one participant summarized,

> Sometimes it was just a really good conversation that other people were having, so I would be Liking some of those because they were really good, and I was thinking, "You guys have this covered." Maybe you don't log on for a few days and you see that. But they just had an amazing conversation and you learnt a lot from that, and I don't necessarily have anything to add, so I'd just Like it.

These students seem to use the Like button as a social cue to let their peers know that they had read a note, because they did not submit a formal reply. Not having an instructor consistently involved in the online discussions seemed to motivate students to strategically use the Like button to acknowledge their peers' work, thus meeting their social obligation of acknowledging the conversations. Overall, students in both course types used the Like button to support their peers' work. However, it held more meaning for students in the instructor-facilitated online courses; they emphasized that this button is needed to provide quick and continual validation of their work from their peers and the instructor, which confirms previous research (Phirangee & Hewitt, 2016. Therefore, Liking seems to play an essential role in fostering a sense of community within OLEs.

Discussion and Conclusion

Recent research suggests that students prefer instructor-facilitated online courses (Hew, 2015), despite the reported benefits of peer facilitation. Like Hew's (2015) students, those from this investigation preferred instructor facilitation because instructors are the "subject matter experts," are able to keep discussions on topic and ensure equity, and are better at guiding learning. Lastly, students prefer them because they want instructors to facilitate discussions rather than act as sages; students expressed a need, want, and preference for instructor facilitation regardless of the facilitation method that had been used in their course. Moreover, the developed models detail how this preference is manifested through student behaviors. This finding supports Shea, Li, and Pickett's (2006) research, which found a strong connection between teaching presence, learning, and community:

The respondents to the survey were significantly more likely to report higher levels of learning and community when they also reported that their instructors exhibited more salient "teaching presence" behaviors…. This study reveals that a strong and active presence on the part of the instructor—one in which she or he actively guides and orchestrates the discourse—is related both to students' sense of connectedness and learning. (pp. 184–185)

Additionally, some studies found that instructors needed to stay involved to promote collaboration and conversations among students in OLEs because higher levels of engagement and interactions among students lead to deeper and more critical thinking (Zach & Agosto, 2009; Agosto, Copeland, & Zach, 2013). Furthermore, in the community of inquiry (CoI) model, teaching presence is presented as one of the needed elements for building a community in an OLE. This element emphasizes that the teacher is needed to do the following: design and establish the learning experience before and during the course; teach, which involves implementing activities to encourage interaction between students, groups, the content, and teacher; and move beyond the moderator role and provide subject matter expertise through direct instruction (Anderson, Rourke, Garrison, & Archer, 2001). Therefore, instructors fulfill an important role in developing a sense of community in online courses. Perhaps deep background knowledge in a discipline is simply a necessary prerequisite for effective facilitation. Instructors can add content and perspective that adds value to discussions and makes them more engaging. Students tend to lack background knowledge in the subject matter, and their peers probably do not trust what little knowledge they do have. This is probably why peer-facilitated online courses were fundamentally less effective.

The quantitative data suggest that higher community scores, as measured by Rovai's (2002b) classroom community scale, were associated with instructor-facilitated online courses, whereas peer-facilitated online courses had lower community scores. Although students from both types of courses exhibited similar amounts of system use (i.e., hours spent online and number of sessions), specific student activities revealed that online behavior differed significantly between peer- and instructor-facilitated courses. Overall, data analytics showed that students in peer-facilitated online courses were privately communicating with each other more often, possibly relating to behind-the-scenes prep work for assignments or discussion moderation, whereas students in the instructor-facilitated online courses had higher participation levels in the online discussions, with more notes, replies, edits, rereads, and links created to other notes. Perhaps the higher levels of student activity in the instructor-facilitated online courses is partially due to a sense of constant surveillance. Students in instructor-facilitated online courses may expend more effort because there is a greater sense that the instructor is constantly present, which affects learner behavior. Students are more likely to engage in class discussions because they know the instructor is personally involved in those interactions and monitoring what everyone says. Interestingly, the cluster analysis also revealed that for notes, edits, rereads, and Liking, students in instructor-facilitated online courses were always thinking about their peers' learning, in hopes of connecting with them. However, those in peer-facilitated online courses focused more on themselves and their own learning.

Based on the developed analytics, an instructor-facilitated online course is more likely to stimulate student participation and build a stronger sense of community. These findings advance Hew's (2015) research by "measur[ing] the impact of peer or instructor facilitation on student outcomes such as the number of their postings" (p. 36). Our data provided a clear suggestion as to which online facilitation strategy instructors should adopt, when designing a course, to foster a sense of community in an OLE. Should an instructor want to employ peer facilitation, the developed analytics could be used to identify students who may feel excluded. The instructor could then intervene to bring those students into the community. This approach and use of analytics may help instructors and students to mitigate or overcome some of the risks that appear to be associated with peer facilitation. The use of these analytics by instructors as an early warning system and the study of its relationship to student outcomes is a reasonable next step, as is tracking the relationship between student activity patterns and the development of

students' sense of community over the course of a term. Lastly, although instructors and graduate students use Pepper widely at our academic institution, it is not used across a variety of disciplines or institutions, which may limit the generalizability of our findings.

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Appendix A - Transcription Legend

Mark-up	Purpose
…	Content was deleted.
[ ]	Content inserted to clarify or convey participants' body language.
Italics	Highlights the content participants' emphasized during the interview.
""	To illustrate that participants are quoting a peer or discussing their own thoughts while they were in the situation at the time.