

Microanalytic case studies of individual participation patterns in an asynchronous online discussion in an undergraduate blended course

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Abstract

This study presents three case studies of students' participation patterns in an online discussion to address the gap in our current understanding of how individuals experience asynchronous learning environments. Cases were constructed via microanalysis of log-file data, post contents, and the evolving discussion structure. The first student was Thorough, reading all the posts in the forum in sequence, revisiting different posts multiple times, and creating posts outside of the discussion tool. The second student was Self-Monitoring, revisiting his own posts multiple times, checking the discussion frequently for replies, and replying to or editing his posts in response. Finally, the third student was Independent, using the forum as a tool for her own individual reflection. The behaviors found for these cases are aligned with a theoretical taxonomy for participation proposed by Knowlton (2005). The value and limitations of microanalytic case study approach are discussed, and implications for research and practice are suggested.

Keywords: Online Learning, Computer Mediated Communication, Asynchronous Discussion Groups, Learning Strategies, Student Participation, Mixed Methods

1. Introduction

While the initial attention given to online learning technologies often fades quickly, after several decades discussion forums continue to garner both interest and critique as a tool for supporting student-to-student interaction in higher education (e.g. Quinn, Mehan, Levin, & Black, 1983; Rovai, 2007). In both purely online and blended contexts, discussion forums are valued for the opportunities they afford to enable rich dialogue between learners (Swan & Shea, 2005); however, in many cases actual conversations remain shallow and this value is not fully realized (Reyes & Tchounikine, 2003). One distinctive feature of online discussions, to which both promise and problems are attributed, is their asynchronous nature. Asynchronicity decouples the timing of learners' participation in discussions, allowing them to control their individual pacing (Jonassen & Kwon, 2001). This is cited as creating opportunities for more reflective dialogue (Harasim, 2000) but also generating challenges in the coherence and flow of the conversation (Herring, 1999). Despite the importance placed on asynchronicity, only limited research has investigated online discussions from a temporal perspective (e.g. Jeong, 2005; Dringus & Ellis, 2010; Wise & Chiu, 2011). This work has provided insight into *group* timelines and processes; however, in an asynchronous environment this does not correspond to how any of the *individuals* involved in a discussion actually experience it. Research has not yet probed in detail the individual experience of participation in asynchronous discussions over time. This is an important, but missing, piece of the puzzle because both theory and research suggest a relationship between how students engage with discussions and what they get out of them (e.g. Morris, Finnegan, & Wu, 2005; Ho & Swan, 2007). This paper takes a first step towards addressing the gap by conducting a series of microanalytic case studies of individual students' participation patterns in an online discussion and comparing them with a theoretical taxonomy for participation proposed by Knowlton (2005).

1.1 *The continued promise and challenge of discussing online asynchronously*

Successful online discussions can encourage learners to share their thoughts, engage with alternate perspectives, and debate and negotiate ideas (Woo & Reeves, 2007). From a social-constructivist perspective, such discussions are beneficial for learning as they support knowledge construction both in the sense of a group's collective sense-making and individuals' development

of personal understanding (Jonassen, Davidson, Collins, Campbell, & Haag, 1995). In particular, asynchronous discussions can support these processes by shifting conversation away from a single timeline of engagement controlled by the instructor and towards multiple timelines of engagement managed by the students themselves (Jonassen & Kwon, 2001). For example, in online discussions students can participate at a time and place when they are ready, rather than being put on the spot or competing for a turn to talk during a limited class period (Gibbs, Simpson, & Bernas, 2008). The asynchronous format also allows students to take as much time as they need to reflect on the contributions of others and compose their own thoughts in response (Harasim, 2000). This means students can work with ideas at their own speed, rather than rushing to comment on a topic before the group moves on (Prester & Moller, 2001). As a result, students report spending increased time on discussions online, but also getting more out of them (Meyer, 2003). Contributing to online discussions has also been suggested to be less threatening than speaking in front of a group thus encouraging participation from a broader variety of students (Harasim, 1989).

At the same time that it provides these benefits, the asynchronicity of online discussions also presents challenges to meaningful conversation. For example students must make active efforts to repeatedly log-in to the discussion, waiting unknown and variable amounts of time for responses to their comments (Peters & Hewitt, 2010). Too much lag-time waiting for a reply violates students' expectations and need for acknowledgement, leading them to disengage and reducing the discussion's momentum (Dringus & Ellis, 2010). At the other end of the spectrum, a proliferation of posts can quickly become overwhelming (Rovai, 2007), and unorganized threads with deep nesting make it difficult for students to follow the conversation or get a sense of it as a whole (Dringus & Ellis, 2005). This can result in many posts remaining unread (Thomas, 2002), low or superficial levels of interaction between learners (Guzdial & Turns, 2000) and disjointed discussions that do not fulfill the purpose of a locus for meaning-making (Herring, 1999; Reyes & Tchounikine, 2003).

1.2 The need for research methods to understand individual students' participation over time

Despite the fact that many of the proposed advantages and challenges of online discussions stem from students' control over their own timeline of participation, the majority of

research on how students interact with discussions aggregates data over students and time. For example, common measures of individual involvement in discussions include the number of times students access an online discussion (Webb, Jones, Barker, & van Schaik, 2004), make posts (Palmer, Holt, & Bray, 2008), or open the posts of others (Hamann, Pollock, & Wilson, 2009). These studies paint a somewhat disheartening picture, confirming reports that students often do the minimum work necessary to fulfill participation requirements (Dennen, 2008), and use efficiency-oriented strategies such as reading selectively, skimming through messages, and focusing only on the most recently posted (Hewitt, 2003; 2005; Peters & Hewitt, 2010).

However, while these past studies provide a broad outline of the situation, they do not give detailed information about differences in how *individual* students interact with the discussion. This is important because there is no reason to presume that students all interact as the “average” one does. In addition, compiled measures of participation obscure important temporal information about which posts are opened, when, in what order, and for how long. This does not allow for examination of how students concentrate or distribute their involvement in the discussion or the relationship between their reading and posting behaviors. Thus, two students who interact with a discussion in quite different ways (viewing different posts in a different order at different times) could appear the same when their data is aggregated.

Multiple scholars have argued for the need to develop temporal analyses to understand learning processes in asynchronous online discussions (Swan & Shea, 2005; Gibbs et al., 2008) and collaborative learning more generally (Reimann, 2009; Kapur, 2011; Suthers, Dwyer, Medina, & Vatrappu, 2010). While these calls have been taken up in the analysis of discussion group processes (e.g. Jeong, 2005; Dringus & Ellis, 2010; Wise & Chiu, 2011), temporal analyses have not yet been applied to the analysis of individuals’ interactions in online discussion. As Peters and Hewitt (2010) note, “little is known about the moment-to-moment behaviors of students as they participate in asynchronous discussions” (p. 951). In this respect, the possibilities of data-mining for understanding individual students’ experiences in online discussions (e.g. Dringus & Ellis, 2005) remain untapped.

2. Framing the research

2.1 Microanalytic case study approach

This study takes a first step towards addressing the gap in understanding individual students' experiences in online discussions by conducting a series of microanalytic case studies in an undergraduate blended course. Case studies are useful in generating understanding of complex phenomena that have not been studied extensively (Yin, 2003). Specifically, this study advances a new microanalytic approach for making sense of the detailed log-file data available from online discussions. By unpacking data for individual students over time to reconstruct their experiences participating in an online discussion, the microanalytic approach extends previous work in educational data mining based on aggregate statistics. The approach also aligns with current efforts to support more informed instructional decision-making through the development of learning analytics (e.g. Ali, Hatala, Gašević & Jovanović, 2012; Dawson, 2009).

2.2 Theoretical taxonomy of discussion participation

While this study takes a data-driven approach to understand student behaviors, to ground the work conceptually the empirical patterns found are considered in relation to a theoretical taxonomy for discussion participation proposed by Knowlton (2005). This serves the dual purpose of testing the applicability of the framework and providing a conceptual lens for interpreting the behaviors. In addition, the temporal lens taken in this work can refine and add to the characterizations in the taxonomy.

Knowlton's (2005) taxonomy describes five kinds of student participation emerging from increasingly mature views of knowledge construction, collaboration, and the discussion environment (see Table 1). We find his conceptualization particularly useful because of its focus on asynchronous discussions, its grounding in learning theory, and its recognition that students' participation may evolve over time. While his focus is primarily on differences in students' understanding of learning through discussions and what this means for their participation holistically, some connections with specific actions are made or can be easily inferred.

Table 1. Overview of Knowlton's taxonomy for participating in online discussions

Participation type	Conception of discussions
Passive	Channel for class members to receive knowledge from those in authority
Developmental	Social conversations and locus for community-building
Generative	Space to develop one's ideas individually and report them to the instructor.
Dialogical	Forum for interacting with others and their ideas to build and clarify understandings
Metacognitive	Forum for interacting with others and their ideas to build and clarify understandings and an opportunity to reflect on the process of knowledge development

The most basic level of participation in Knowlton's (2005) model is passive. At this level, students conceptualize knowledge as something that comes from more authoritative others, with the discussion acting as a conduit for transmission and their role being to absorb information. Not seeing themselves as active constitutors of the discussion, they may read some posts in the discussion, but do not create their own. (In courses where posting is required, students post with minimal effort and frequency.) Knowlton acknowledges that some students may also be passive initially as a form of "legitimate peripheral participation" (Lave & Wenger, 1991) as they learn the norms and requirements of the discussion.

Moving up the taxonomy, at the developmental level, students view discussions as social conversations, placing value on creating a sense of community with their classmates rather than focusing on course content. As a result while they actively post to acknowledge and reciprocate their classmate's messages, their comments are superficial and they engage in very little actual construction of knowledge. At the generative level of participation, students do see the purpose of discussions as building ideas, but they view this as an individual process in response to the task. Seeing knowledge construction as a private enterprise, they are mainly concerned with the articulation of their own thoughts and may ignore the posts made by their classmates as they deliver a monologue about the course content. Such students may also focus heavily on reading

and replying to the posts made by their instructor, seeing the discussions as an opportunity to show them what they know.

At the two highest levels of participation (dialogical and metacognitive), participants recognize discussions as forums for collaboratively generating knowledge. In dialogical participation, learners are responsive to their classmates, going beyond developmental notions of sociability to engage with others in a substantive process of idea-building. They view multiple posts by other students and draw on them in formulating their own thoughts and ideas. They may also work to synthesize different views presented into a cohesive whole. In metacognitive participation, learners engage in dialogical processes and additionally reflect on the knowledge construction process. Students engaging at this level of participation seek to understand their own comprehension, monitoring the evolution of their knowledge and thinking about how others have helped them develop their thoughts. Knowlton (2005) notes that many characteristics of metacognitive participation manifest internally; one external indicator might be additional time spent reviewing one's own and others' posts.

2.3 Research questions

1. What are different patterns of behavior that individual student exhibit as they participate in an asynchronous online discussion?
2. How do these patterns relate to the theoretical levels of participation in Knowlton's (2005) taxonomy?

3. Methods

3.1 Learning environment and discussion task

The context for the study was an offering of a large undergraduate course on organizational behavior at a mid-sized Canadian university. The course followed a blended structure; the face-to-face component of the class occurred weekly on Fridays and included a two-hour whole-class lecture plus a one-hour tutorial session (20-24 students per tutorial).

For the online component, students were required to participate in three asynchronous discussions worth 9% of their grade. Students were divided into 10 to 12 person groups (half-tutorials) for these discussions. Each group was assigned to participate in three week-long

discussions (Saturday-Friday) that took place in Phorum, a basic asynchronous threaded discussion forum. The formal online discussions were preceded by an Introductions week in which the students were given a chance to get to know each other and the discussion tool. The discussion forum did not have subscription or download options enabled; all student interaction with the discussions took place in the web-based interface. It was possible however, for students to compose posts in an outside tool before inputting them into the discussion interface.

In each discussion, students were asked to work with their group to collectively solve an organizational behavior challenge, reporting their solution in the subsequent face-to-face tutorial. The challenges were authentic problems drawn from a pool of actual situations submitted by class members at the start of the course. Every week had a common theme based on the course material, but the challenges given to each group were unique. The first formal discussion of the term, and the focus of this research, was on the theme of “Motivation.”

In the Motivation discussions, students were prompted to make use of theories covered in class to analyze and solve their challenge. To support participation, students were given specific discussion questions (e.g. “Which theory best explains this situation? Why?”), posting guidelines (e.g. “Good posts are usually somewhere between three sentences and a paragraph in length”), and tips for how to proceed (e.g. “If you're stuck for ideas, try thinking about evaluation, synthesis, and analysis”). Students were required to be “actively involved” in the discussions by contributing more than once and making comments to progress the group’s discussion. On the Friday that the Motivation discussion was to end, the instructor extended the deadline to Sunday and encouraged more participation. Throughout the discussion period, the instructor participated as a facilitator, encouraging students to elaborate their ideas.

3.2 Data extraction and processing

Ninety-six of the 113 students enrolled in the course allowed the data from their discussion activity to be used. Log-file data for these students was collected as follows: every time a student clicked in the discussion forum, a data entry was created logging the action taken (view post, make post, review one’s own post, or edit one’s own post) with a time-date stamp. The content of posts was collected separately and aligned with the log-file data. The data set was

then filtered by participants' log-in ID, and the time between subsequent actions was subtracted to calculate action duration.

Because students did not have to formally log-out of the system, action length was calculated based on a continuous stream of data and needed to be manually divided into sessions of use. Following the procedure used by del Valle and Duffy (2007), frequency tables for action lengths were examined to determine a maximum allowed length of 60 minutes. Actions exceeding this length were marked as the end of a session and their duration was replaced with an estimate for the action. To identify skimming behaviors, view actions were sub-categorized as "scans" if they surpassed a speed threshold of 6.5 words per second (wps, calculated as length of post divided by time viewed) based on the maximum reading speed of 6.39 wps for online messages found by Hewitt, Brett, and Peters (2007). Views not exceeding the threshold were sub-categorized as reads. Students' final course grades were also collected from the instructor.

3.3 Selection and definition of cases

To aid the selection process and provide context for the upcoming microanalyses, we conducted a preliminary overview of potential cases. Summary variables (e.g. total participation time, number of sessions and post views, time spent posting, reviewing and editing) were calculated for all students and students who displayed extreme features of behavior were identified (e.g. many frequent visits, few but extended sessions, high number of self reviews, short overall times in the system etc.). We targeted interaction patterns in their extreme form (Patton, 2002) since this would allow for clear characterization that could be used to recognize weaker displays of the behaviors patterns in the future. Initially five cases exhibiting extreme patterns were identified. These cases were then compared with each other to ensure selection of distinct profiles. This examination revealed two pairs of cases that were similar to each other; for each pair, the more extreme version was selected for case study. This resulted in a final set of three cases that underwent more detailed analysis. Each case was defined as the complete collection of actions that the student took with respect to their Motivation discussion during the assigned week, plus up to two days before and after. The extended time frame was used to capture the full range of student interactions with the forum, including early or late activity.

3.4 Microanalytic case study construction

3.4.1 Overview of activity

The first task of the analysis was to get an overall sense of each student's behaviors by looking at their aggregate behavior in the Motivation discussion. Pie charts were created for each student based on the number and duration of each kind of action (read, scan, review, post, edit) to examine their relative proportion. In addition, a table was created to outline each student's activity broken out by session. From this data, an initial portrait was created; this description was treated as a tentative characterization about the learner's behaviors, one that would be tested and refined as the data was examined in more depth.

3.4.2 Temporal microanalysis of log-file data

The second and major task of the analysis was to reconstruct the experience each student had interacting in their discussion over the course of the week. Temporal microanalysis of log-file data is an approach we have developed in order to meaningfully reconstruct what students do step-by-step when they engage in an online discussion. A central part of the process is the creation of a dynamic discussion map: a record of the discussion posts and threads that can be filtered by time and date to show the historical appearance of the discussion forum at any point in time. Using the dynamic discussion map, the log-file data for each student was examined action by action in the context of how the discussion appeared at the time the behaviors were taken. In this way, we were able to create a narrative reconstructing each student's actions in the discussion. For example, we could detect when a student started a session by navigating straight to a particular post and spending substantial time on it. We could also recognize when a student read three sequential posts in a row even if by the end of the discussion replies had been inserted between them such that they no longer appeared sequentially. Thus the combination of the processed log-file data and the dynamic discussion maps supported a meaningful reconstruction of students' behaviors in the forum. In addition, the contents of student posts were used to help contextualize their actions in the discussion. The resulting narratives deepened the characterization of each student's participation.

3.4.3 Comparison with participation taxonomy

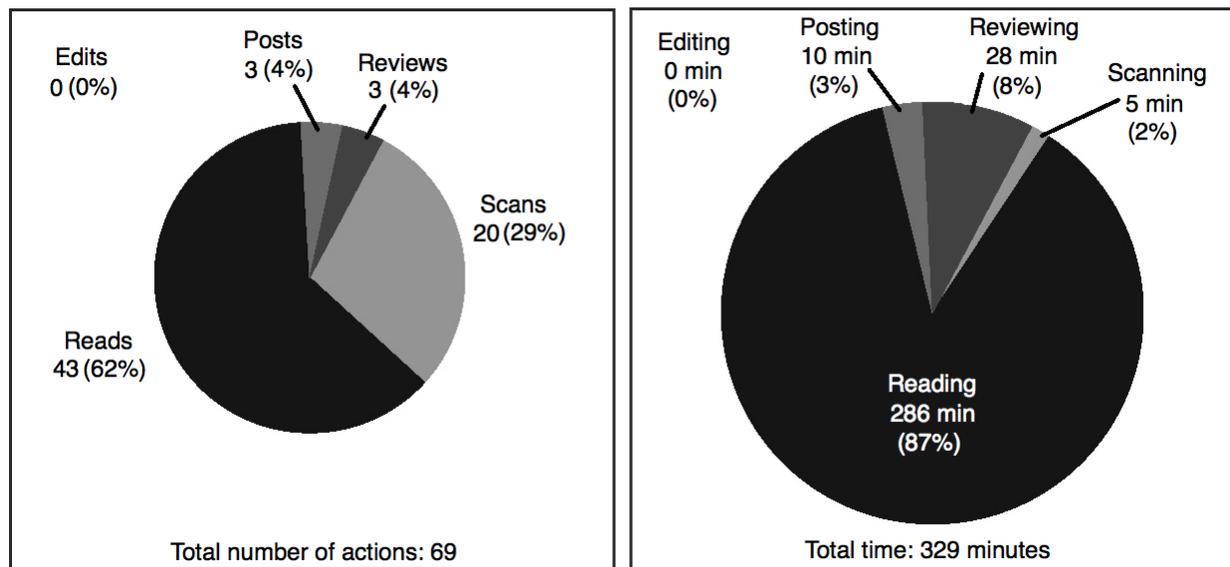
In the final step of analysis each students' behaviors in the discussion were compared with Knowlton's (2005) theoretical description of participation to determine if the case aligned with one or more participation types.

4. Results

4.1 *Tracey, a thorough student (course grade: B+)*

4.1.1 Overview of activity

Tracey spent a total of 5.5 hours in the Motivation discussion, using the vast majority of this time to read others' posts. See Figure 1 for a complete breakdown of her actions. She made a total of three posts, but spent very little time in the system creating them. While she only reviewed each of her posts once, she spent substantial time on this activity. Tracey divided her activity in the Motivation discussion into eight different sessions conducted on four different days (see Table 2). There was a large variation in the length of these sessions, ranging from a few minutes to almost two hours. The bulk of her activity (65% of time in the system, 2 of 3 posts made) took place on Thursday over three sessions. She met the participation requirement by the original Friday deadline, and did not take advantage of the extra two days added to the discussion time to make additional visits.



4.1.2 Reading and posting pattern

The detailed microanalysis of Tracey's actions in the discussion revealed that her visits to the system were characterized by a thorough reading pattern. Each time she visited the forum she viewed every new post in sequential order, starting at the top of the screen and moving down. After she finished viewing all the posts labeled as new, Tracey would then revisit posts distributed throughout the forum. The majority (two-thirds) of her post viewings were actual reads rather than scans, suggesting that she took the time to engage with the post content. By the end of the assignment week, Tracey had viewed every post that was made at least once, almost half of them at least twice and several posts over four times. When Tracey chose to make a post, she always located her post as a reply to a post she had viewed at least three times already.

In contrast to her extended reading behavior, Tracey spent a total of only 10 minutes in the system composing her three posts. However, examination of the content of her posts and the actions leading up to each post suggested that at least some of the composition was done outside of the tool, sometimes in a prior session. For example, in her final five-minute session, Tracey spent just 28 seconds in the system making her post, but this message contained an extensive summary of the discussion up to this point. In the previous session Tracey viewed almost half of the 24 posts in the forum, two for over 28 minutes each. Thus, it is likely that she was using this session to craft a post that she inputted into the system in the following session.

Table 2. Session-by-session breakdown of Tracey's actions in her Motivation discussion

Session #	1	2	3	4	5	6	7	8
Day	Mon	Tues	Thurs	Thurs	Thurs	Thurs	Fri	Fri
Time Started	10:11	22:11	11:03	12:20	19:24	22:16	18:37	22:43
Duration (min)	4	17	3	112	41	58	91	5
# of Scans	0	3	0	10	2	1	3	1
# of Reads	1	4	1	14	4	8	11	0
# of Posts	0	0	0	1	0	1	0	1
# of Edits	0	0	0	0	0	0	0	0
# of Reviews	0	0	0	1	0	1	0	1

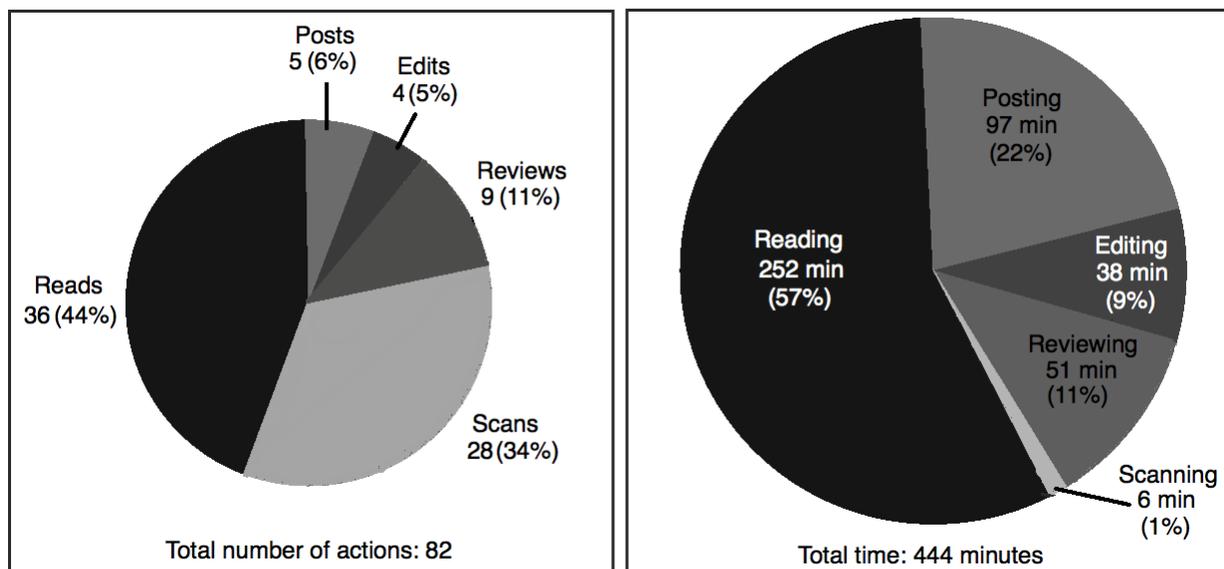
4.1.3 Relation to participation taxonomy

Tracey's activity meets several of the indicators for dialogical participation, one of the more advanced levels in Knowlton's (2005) taxonomy. In dialogical participation, learners understand discussions as tools for collaborative knowledge construction and are actively engaged in reading others' ideas and drawing on them to contribute. Tracey spent a great deal of time reading, re-reading, and replying to her classmate's posts in a thorough, systematic manner, indicating that she tried to situate herself in the conversation substantively and clarify her understating through interacting with others. Her multi-pass strategy of reading all posts in sequence then going back to re-read them while using an external tool to compose her ideas also suggests that she valued her classmates' ideas in formulating her own thoughts and saw the discussion as a tool for collaborative (rather than individual) work. In addition, Tracey made a post synthesizing the ideas in the discussion, one of Knowlton's prototypical indicators for dialogical participation. Because many of the additional characteristics of metacognitive participation are not exhibited externally, it is possible that Tracey was engaged at this level; however, she did not exhibit extensive reviewing of her own posts, nor did she use the extra days added on the discussion to revisit it, suggesting that she was not heavily engaged in reflective activity.

4.2 Sam, a self-monitoring student (course grade: B)

4.2.1 Overview of activity

On the surface, there are several features of Sam's discussion forum activity that are similar to Tracey's. He spent an extensive amount of time in the Motivation discussion (7.4 hours in total) and had a high number of actions overall. See Figure 2 for a complete breakdown of his actions. Sam visited the discussion 10 separate times across six different days (see Table 3) and read a high proportion of the posts made by his classmates. His sessions also varied in length, though while the majority of his activity took place on a single day (Friday), the differences in activity between his days were not as pronounced as for Tracey. Sam also exhibited several characteristics not seen for Tracey. First, he spent a long time in the tool composing his posts. Second, he spent extensive time reviewing and editing his posts; together reviewing and editing behaviors add up to almost as much time as he spent composing the posts originally. Sam met the discussion requirements by Friday, and did not post in the two days that the discussion was extended, though he did visit the forum on both of these days to view others' posts.



4.2.2 Reading and posting pattern

Despite the global similarities to Tracey's profile, the detailed microanalysis of Sam's actions in the discussion revealed a very different pattern of activity. His behaviors in the

discussion suggest that he was strategic and self-monitoring, both in choosing which posts to attend to and about what he said in his posts. Sam's self-monitoring nature was most clearly evident in his posting behavior. In the sessions in which he posted, Sam tended to read or scan a few posts, then make a post of his own, review it, read one or more other posts and then edit his own. For example, on Wednesday he read the two existing posts in response to the instructor's prompt and contributed his first post. He then checked back twice that same evening with very short sessions (potentially looking for responses) and, in one case, edited his initial post. In total, Sam revisited his five posts nine times and edited them four times.

Table 3. Session-by-session breakdown of Sam's actions in his Motivation discussion

Session #	1	2	3	4	5	6	7	8	9	10
Day	Fri*	Wed	Wed	Wed	Thurs	Fri	Fri	Fri	Sat	Sun
Time Started	23:22	13:22	18:39	22:39	20:25	10:19	14:32	23:34	17:50	11:35
Duration (min)	19	40	3	< 1	80	86	47	162	4	4
# of Scans	1	2	1	1	5	1	0	11	2	4
# of Reads	1	1	1	0	7	1	2	19	2	2
# of Posts	0	1	0	0	0	1	0	3	0	0
# of Edits	0	0	1	0	0	0	1	2	0	0
# of Reviews	0	1	1	0	1	0	1	5	0	0

* Prior to discussion start

In his reading behaviors, Sam seemed to use the top-level posts in threads to orient himself and he kept track of the discussions that he was a part of by consistently viewing and replying to posts that were related to his own. For example, in his Thursday session he first viewed a top-level post by a classmate (Andrew), then its reply, and one later post in the thread. Then he jumped to another thread where he had posted previously to review his own post, before returning to view Andrew's post and its reply again. After scanning the discussion prompt twice, he viewed a reply to his post, and then Andrew's post and its reply for the third time. While he opened these same posts over and over, there were others that he did not view at all during this session. Because Sam frequently checked the replies to his posts, he often constructed later posts in reference to these replies. For example, on Friday evening he made three posts, each

responding to replies other students had made to his earlier posts. Sam's posts generally acknowledged others' posts, using statements such as "Great post Ellen!" and "I concur;" however, the rest of the content of his posts was independent, failing to build on or respond substantively to the ideas he was complimenting. Throughout his five posts in the Motivation discussion he maintained great consistency in his idea of the importance of a climate of trust for motivation. He supported this idea with evidence from his peers, class and the textbook.

4.2.3 Relation to participation taxonomy

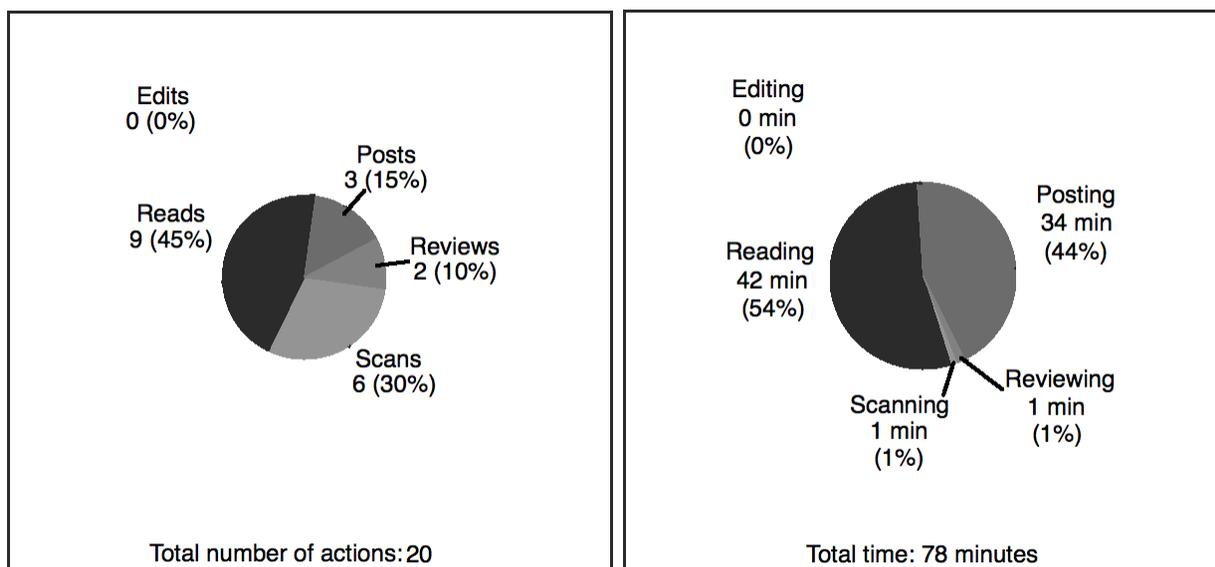
It is clear in his posts that Sam values community and building morale in the discussions; he repeatedly acknowledged his classmates' comments, and showed reciprocity by focusing on posts that replied to him. However, his posts did not respond meaningfully to the content of those posts and his unchanging position throughout the discussion suggests that he did not consider their ideas in a way that could alter his thinking. This focus on sociability and reciprocity aligns well with the developmental level of Knowlton's (2005) taxonomy. While Knowlton suggests that generative participation can be co-present with developmental, the fact that Sam's ideas and opinions did not seem to evolve at all throughout the discussion suggests that he failed to engage in even individual knowledge construction.

Sam also allocated a large amount of his time to reviewing and editing his own posts. This initially seems to indicate reflective activity and thus the metacognitive level of Knowlton's (2005) taxonomy; however the consistency of his ideas and shallow responsiveness of his posts suggests that these behaviors may have actually been a result of a focus on how he appeared to his peers. Previous work has shown that students can feel insecure about how they are perceived by others in online discussions resulting in attempts to project a certain "image" of themselves (Peters & Hewitt, 2010). This performance orientation seems to align conceptually with developmental notions of participation, thus this study proposes a potential linkage between the two and illustrates some representative behaviors in which students may engage. Since Sam's self-monitoring is a purposeful behavior new to the literature, further attention to the performative aspect of discussion participation is needed.

4.3 Isabel, an independent student (course grade: B)

4.3.1 Overview of activity

Distinct from the previous two students, Isabel spent a relatively short amount of time (1.3 hours) in the Motivation discussion and almost half of this was spent composing her posts. See Figure 3 for a complete breakdown of her actions. She had four sessions in the discussions and made three posts in total, including one during the extension period (see Table 4). While Isabel made use of the extra time given to post, she spent little time reviewing her posts and did not edit any of them. In addition, she only viewed one third of all the posts made in the discussion. Isabel did not enter the discussion for the first time until near the end of the initial discussion period (Thursday) and spent over half her total time in this first session. Her subsequent sessions were relatively brief, though she made a post during two of them.



4.3.2 Reading and posting pattern

The detailed microanalysis of Isabel's actions showed a very different pattern of behavior than the other two cases. Her participation in the discussion was mostly independent from the other students and showed a clear focus on the instructor's voice. The majority of her views centered on instructor-contributed content and throughout her sessions she only read four posts made by her classmates (spending an average of less than one minute on each). For example, in

her first session, she spent thirty minutes on the instructor's discussion prompt, then scanned the first reply on the list, and read the instructor's response to this post. She ignored all the other posts her classmates' had made but spent 15 minutes replying to the reply she had scanned. In the post she explained her ideas about the organizational challenge without referring to the post to which she was replying. Before she logged-out, she read a final post by the instructor (asking the group to come to a conclusion) which had appeared at the end of the forum during her session.

Isabel was also unique in that she seemed to use the discussion as an opportunity for individual reflection on the course material, adapting her opinions as she gained new information. Her second post replied directly to her initial one by adding new ideas she learned in class that day to clarify her previous views. Again in this session she viewed very few of her classmates' posts. In her final post, she followed the form of concluding the conversation as requested by the instructor, but her "summary" explicitly referred only to her own ideas, beginning with the phrase "To conclude all of my opinions..."

Table 4. Session-by-session breakdown of Isabel's actions in her Motivation discussion

Session #	1	2	3	4
Day	Thursday	Friday	Friday	Saturday
Time Started	21:17	14:29	22:00	8:29
Duration (min)	50	5	11	11
# of Scans	1	2	2	1
# of Reads	3	4	1	1
# of Posts	1	0	1	1
# of Edits	0	0	0	0
# of Reviews	0	1	1	0

4.3.3 Relation to participation taxonomy

Isabel's low time and number of actions in the discussions initially might imply that she was a passive participant who tried to meet the class requirements with the minimum amount of effort. However, as described earlier, Isabel went beyond this to use the discussion forum as a tool for personal reflection and thus her behavior fits well with the generative level of participation in Knowlton's (2005) taxonomy. In this level, students see discussions as a venue

for constructing their knowledge individually and exhibiting what they know to the instructor. This matches Isabel's pattern of spending a relatively high amount of time making posts (compared to reading those of others), focusing on the instructor's posts while ignoring those made by her classmates, and using the discussion to publicly document the development of her ideas. Her posts provide an example of the notion of monologue that Knowlton describes to typify this kind of participation.

4.4 Summary

The alignment of the behaviors observed in the three cases with Knowlton's (2005) theoretical participation taxonomy is summarized in Table 5.

Table 5. Alignment of results with Knowlton's (2005) participation taxonomy

Participation Type	Expected Behaviours	Observed Behaviours
<i>Passive</i> Understands discussions as a channel for class members to receive knowledge from those in authority	<ul style="list-style-type: none"> - Read some posts of others - Contribute no posts or very few with little effort 	
<i>Developmental</i> Sees discussions as social conversations and a locus for building community	<ul style="list-style-type: none"> - Posts acknowledge classmates comments - Only share existing ideas, don't work to build new ones 	<i>Sam</i> <ul style="list-style-type: none"> -Frequent but shallow references to peers' posts - High consistency in ideas expressed throughout discussion - Reviewed and edited his own post multiple times*
<i>Generative</i> Views discussions as a space to develop one's ideas individually and report them to the instructor.	<ul style="list-style-type: none"> - Read and reply to posts made by instructor. - Posts are independent of other students' contributions 	<i>Isabel</i> <ul style="list-style-type: none"> - Read all of the instructor's posts - Left many peer posts un-viewed - Built her own ideas in a series of independent posts
<i>Dialogical</i> Understands discussions as a forum for interacting with others and their ideas to build and clarify understandings	<ul style="list-style-type: none"> - View multiple posts by other students - Synthesize others' ideas and draw on them in own posts 	<i>Tracey</i> <ul style="list-style-type: none"> - Viewed all peer posts methodically; reviewed several multiple times - Posts drew on and synthesized peers' comments; composed in outside tool - Limited review of own posts
<i>Metacognitive</i> Takes a dialogical perspective plus sees the opportunity to reflect on the process of knowledge development	<ul style="list-style-type: none"> - Dialogical behaviors - Reflectively review own and others' posts throughout discussion 	

* This behavior could be oriented either towards projecting an image in the discussion or reflective practice. In Sam's case, analysis of his posts' contents revealed it to be the former.

5. Discussion

Past research has indicated that students often engage simply and minimally in online discussion (see section 1.1). However, these findings are based on analysis of student behavior in aggregate. Research has not previously examined the behaviors of individual students in detail over time, nor focused on the sequences of actions they take in the process of participating in discussions. The three students examined here present a stark contrast to the research cited earlier, exhibiting distinct, complex, and seemingly purposeful patterns of behavior. In particular, the temporal microanalysis provided insight into individual students' experiences in the discussions, deepening and often dramatically altering the interpretation suggested by the aggregate data. At a basic level this demonstrates the value of using a microanalytic case study approach to provide a previously unavailable on-the-ground view of student participation in online discussions.

These findings also suggest that the picture of how students interact with asynchronous online discussions is more varied and nuanced than previously known and highlight some of the dimensions across which student behavior varies. For example, each student appeared to use a particular selection strategy to choose which posts to read: Tracey used a linear strategy followed by re-visits; Sam selectively focused on top-level posts and replies to his own posts; and Isabel concentrated on the instructor's contributions. The students also differed in how they expressed their voice in the discussions. Both Tracey and Sam spoke to their classmates, using language that referred to others' contributions; however, Sam simply acknowledged people while Tracey responded to their ideas. Sam's constant reviewing and editing behaviors may also indicate a concern with how his voice is perceived by others. Isabel focused only on her own voice (and not those of her peers), but also seemed to be aware of the instructor as an implicit audience for her posts.

The participation patterns found in this study align well with three of the levels in Knowlton's (2005) taxonomy, suggesting that it can be a useful framework in this line of research. In addition, the study has enriched the framework by describing concrete actions that associate with several of the categories of participation, and also suggesting that the performative aspect of participation merits further attention. While Knowlton's original work focused on student's understanding of discussion forums and their creation of posts in them, it is clear that

mining of log-file data to understand the less publicly visible aspects of participation can aid further development of the framework and identification of participation forms in practice.

5.1 Limitations

This study reports findings for three students participating in an asynchronous online discussion as part of a blended undergraduate business course. Other students studying different subject matter, at different points in their education, in different class settings, or a fully online learning format may exhibit different patterns of participation. In addition, study of students' participation over longer discussion periods may reveal additional patterns.

While microanalytic case studies were useful in understanding students' discussion forum actions, this approach also has some limitations. Log-file data tracks what discussion forum elements learners open at what time, but there is no way to verify that students are attending to these discussion elements for the entire time they are on the screen. They may take a break from their discussion activity to engage in off-task activities (e.g. browse facebook pages), or engage in other actions simultaneously (e.g. read discussion posts while watching television). Setting a maximum action length threshold during data processing helped to remove extreme examples of this (e.g. the student who accidentally leaves the discussion open overnight), but shorter diversions could still inflate students' action lengths. Students may also take part in discussion-related activities outside of the tool (e.g. looking up ideas in their textbook, composing their post in a word processing program) resulting in underestimation of action lengths. Some of these behaviors can be identified by examining action sequences and post contents (see section 4.1.2), but there will always be incidences that are not detected. For this reason it is important to also employ other research methods which gather data directly from students themselves to triangulate these results.

5.2 Recommendations for Future Research and Implications for Practice

Many questions about student participation in online discussions still remain. From a theoretical perspective, the two forms of participation suggested by Knowlton (2005) that were not observed here (passive, metacognitive) remain to be identified empirically. In addition, Knowlton suggests that students may exhibit more than one form of participation at a time;

however, this was not observed in the present study. This is an interesting proposition requiring further investigation given that each kind of participation is associated with a distinct understanding of discussions. Additionally, future research can probe how learners' participation in discussions may relate to individual demographic variables such as their age, gender, cultural background and language abilities.

There is also a need to carefully document how participation patterns affect the learning of students individually and the group collectively. Theoretically, more advanced levels of participation from members of a discussion group are more likely to lead to learning as group members negotiate and build their ideas collaboratively; however, this needs to be examined empirically. Previous work has shown a basic relationship between the duration and frequency of students' post viewings and their achievement (Morris et al., 2005), but more careful research is needed to unravel the processes by which this occurs. In particular, we need to move beyond simple measures of behavioral quantity to assess their quality. As a case in point, Sam had the highest number and length of actions in the discussion in this study, but microanalysis revealed shallow participation. Better tools are also needed to meaningfully assess learning outcomes. Global metrics like course grade and persistence tell us something about students' overall achievement and ability, but little about what they learned in a particular discussion.

Finally, presuming that more advanced forms of participation are connected with greater learning, there is the question of how to help students progress along this trajectory. Knowlton (2005) acknowledges that this is a complex process, rather than linear, thus detailed empirical design work is needed. As this line of research develops, instructors can begin to recognize particular participation patterns students may exhibit and connect them to related beliefs about learning through discussions. This may further instructors' understanding of different learners' needs in a discussion, helping them to better support students in moving towards more advanced forms of participation. In the following section we outline several ways in which instructors may be able to support students' participation in asynchronous online discussion.

One way for instructors to support students is to help them understand the purpose of an online discussion. To encourage richer participation, an instructor could spend time at the start of a course talking with the students about the purpose of the discussion as a tool for helping them build (and change) their ideas by interacting with other students around their own ideas. This

may start to change the views of students who see discussions as a social exercise or place to simply show the instructor what they know. In addition instructors should think about how their presence in the discussion may affect students' understanding of its purpose. Specifically, too strong a presence or too many direct responses to individual students are unlikely to support an interpretation of the discussion as a space for the students to build ideas with each other (Rovai, 2007).

Another way to support students' participation practices is through explicit expectations for interacting with the discussions. Instructors may assume that because of university students' general fluency with technology, they know how to effectively engage in an online discussion. However, the three students in this study were all provided with the same basic instructions on the quantity and quality of posts required and yet interacted quite differently. Prior work on online discussions has emphasized that students do better when they are given clear guidelines on what is expected of them (Hew, Cheung, & Ng, 2008). This needs to be extended beyond the number of posts and their contents to also include schemes for the less visible parts of discussion participation. For example, at a basic level, instructors can emphasize the importance of engaging with the posts of others before contributing one's own. They can also suggest different purposes for viewing others' posts (e.g. encounter new ideas, review others' individual ideas after getting a sense of the discussion as a whole, reflect on how the group's ideas have changed over time) and for revisiting their own (e.g. to monitor and reflect on how their ideas have changed through the discussion). Instructors might address the issue of skimming posts by explaining it as a strategy that has value in certain circumstances (e.g. reminding oneself of the earlier discussion, finding a particular idea in a previously-read post) but not as a global approach for interacting with all discussion posts. Expectations could also be clarified through the use of examples of how dialogical students work through the discussions. For novice or struggling students there can be a strong benefit to seeing models (Gilbert & Dabbagh, 2005), not only of quality posts but also the process that led to their creation. Seeing an example of how Tracey took multiple passes through the discussion to incorporate the ideas of others into her posts, could give students like Sam and Isabel alternative models to consider for interacting with the discussion.

Guidelines and examples provided to students also need to be carried through to the assessment of discussions. For example, specific rubrics based on log-file data metrics could be used to clearly communicate expectations and give students a set of criteria against which to self-assess (Rovai, 2007). Another approach we are exploring is to ask students to complete a reflective assignment at the end of the discussion documenting how they have both drawn on and contributed to the ideas of others. Both approaches encourage students to monitor and reflect on their participation during the discussion. Instructors can further support monitoring and reflecting by giving students access to various log-file data metrics of their participation while the discussion is in progress to help them evaluate their participation (Dawson, 2009). Most online learning management systems already track this data; the key is providing access to it in a useful form (Ali et al., 2012). Development of a dashboard that allows students to easily see useful learning analytics such as their time spent and number of posts scanned, read and made, combined with the ability to compare these to the class averages, could help them be more conscious of their behaviors (Fritz, 2011). For example, a student like Isabel might be surprised to see how much time her fellow classmates spend reading each others' posts and could use that information to change her actions in the future. However, Fritz (2011) raises the important question of if becoming aware of their behavior in this way will actually motivate students to change. In addition, there are also privacy concerns in making data available to other students that must be addressed. Given these issues, instructors may find a more workable immediate strategy in using monitoring tools to provide themselves with early warning signals for students needing individualized support.

6. Conclusion

This research used microanalytic case studies of log-file data to construct initial empirical participation profiles for three students in a blended undergraduate business course. The microanalytic case study approach proved valuable in generating an understanding of these students' behavioral patterns in an online discussion, providing insight beyond that available from aggregate data. Additional studies in different learning environments with different kinds of students and content are needed to see if and how these profiles generalize across contexts. In addition, it is important for future research to attend to the ways in which specific discussion

technologies may drive certain behaviors and if participation patterns vary over longer discussion periods. We have begun such work in a fully online education class (Wise, Hsiao, Marbouti, Speer & Perera, 2012) and are also using cluster analysis methods to explore rapid characterization of participation profiles for the larger data set collected here (Wise, Speer, Marbouti & Hsiao, in review). Another interesting direction for a related line of research is to examine the ways in which students' understanding of the purpose of learning discussions relates to their participation patterns in face-to-face contexts. Together, this work lays the groundwork for building a more detailed understanding of the different ways students participate in learning discussions and builds a theoretical foundation for designing future interventions to support more effective participation behaviors.

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