

EXAMINING PATTERNS OF PARTICIPATION AND MEANING-MAKING IN STUDENT BLOGS: A CASE STUDY IN HIGHER EDUCATION

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Abstract

The power of social media lies in its ability to easily connect people and ideas, and in being able to rapidly promote the spread of information via online networks. The ability to explicate one's ideas, engage in discussion, and refine one's thinking based on feedback is a fundamental precept of socio-constructivist and collaborative learning, and one that is key to the Web 2.0 ecology. Similar designs can be implemented in more formal educational contexts to support learners to engage in reflective discourse with peers. This paper reports on the use of blogs in an online course over multiple semesters and analyzes the quality and quantity of interaction between course participants. We use a combination of social network analyses and discourse analysis to show the patterns of participation and the quality of participation over two iterations of the course. We identified that patterns of participation were consistent with the course design and that blogs offer a viable medium to engage students authentically in Web 2.0 practices and to support meaning making and collaborative learning. Based on the data, recommendations for integrating social media in formal course designs are suggested.

INTRODUCTION

Online education is well established as a mode of post-secondary education. Since the early 2000s, universities across the United States have experienced a continuing increase in the number of students taking courses online (Allen and Seaman 2013; Radford 2011). As online learning has grown and matured, teachers and learning designers have sought to identify methods and tools that could more effectively leverage the unique affordances offered through the emergent technologies and tools associated with the World Wide Web.

The advent of Web 2.0 re-popularized and refocused attention on terms such as collaboration, participation, networked learning, and students as producers of knowledge (Ryberg, Buus, and

Georgsen 2012); however, these aspects of interaction have long been the focus of work in computer supported collaborative learning (CSCL) (e.g., Stahl 2006) and networked learning (Goodyear et al. 2004). But, social software (Alexander 2006) such as wikis, blogs, social bookmarking, and user generated content have been adopted and integrated into mainstream life to such an extent that they have been embraced as exciting new tools capable of promoting engagement and collaborative learning (Davies and Merchant 2009; Richardson, 2010). Efforts to integrate such technologies and practices into education have proven challenging (Dohn, 2009; Ertmer, et al. 2011; Brodahl, Hadjerrouit and Hansen 2011) because of conceptual and practical differences in applying principles of Web 2.0 into education. For example, one problematic assumption was that students would as easily and eagerly apply these tools in a classroom environment in order to achieve specific learning objectives as they did for recreational purposes (Crook 2011; Smith, 2012; Bennett and Maton 2010). What much of this research uncovered was that the challenge laid not in the technical infrastructure but rather in creating the conditions for a vibrant social ecosystem that encouraged learners to see learning and knowledge construction as a distributed enterprise (Kreijns, Kirschner, and Jochems 2003; Moore 2004).

In this paper, we use a case study approach to examine data from two iterations of a graduate, online course offered at a North American higher education institution in attempt to unpack some of the opportunities and challenges inherent in using Web 2.0 tools to support learning. Especially, we examine the ways in which uses of Web 2.0 within educational contexts support student interaction and meaning making in ways that are consonant with the practices of Web 2.0, with a focus on identifying important aspects of course / environmental design that impact student interaction and meaning making in the course.

THEORETICAL FRAMEWORK AND CONTEXT DESIGN

Social Web Technologies

The change from a static, consumer-driven web to a more participatory web was heralded by a large number of social software components (Alexander 2006), which allowed users to participate in increasingly connected communities through blogs, wikis, social networking sites, and similarly designed tools. Tools such as blogs and wikis offer the potential for supporting constructivist learning (Jonassen 1991) activities through social affordances that expand the opportunities for participation. With blogs, individuals can compose posts, as well as comment,

link, personalize, and interact with broader audiences outside the immediate classroom and therefore enhance the authenticity of the learning. In addition, this type of dialogue can also be seen as a form of collaborative learning, where learning occurs through a negotiation of meaning and co-construction of knowledge (Lazonder et al. 2003). Successful collaborative learning can be described by the amount of interaction and reflection taking place, including students' engagement in explaining and justifying their thinking through argumentation to reach mutual agreement (Iannou et al. 2014; Lazonder et al. 2003).

Research on the use of Web 2.0 tools such as blogs and wikis in higher education have primarily focused on aspects other than collaborative learning. For example, the application of blogs in educational contexts have been explored for their capacity for building community (Bartholomew, Jones, and Glassman 2012; Chen and Bonk 2008), reflective thinking (Xie and Sharma 2011; Xie and Sharma 2013) and engagement (Cakir, 2013; Junco, et al., 2010). Similarly, researchers have explored the use of wikis for promoting collaborative knowledge building (Donne, 2012; Bonk, et al., 2009; Larusson and Alterman 2009; Moskaliuk, Kimmerle, and Cress 2009), professional development (Lai and Ng 2011.; Benson, Brack and Samarwickrema 2012) and international or cross-cultural collaboration (Ertmer, et al., 2011; Twu, 2009).

Collaborative Learning and Meaning Making

Our work falls within the broader area of CSCL, and is based on the assumption that collaboration can support learning (Lazonder, Wilhelm, & Ootes, 2003), whereby meaning is negotiated and knowledge is jointly constructed. Interaction between participants is key to collaborative learning and examination of such interaction can afford useful insights into the process of learning. The practices of Web 2.0 are closely linked to engaging and sharing in communities, establishing social identity and roles, and moving beyond purely information sharing types of activities (e.g. Dohn 2009).

Meaning making is also identified as central to the research agenda of Computer-Supported Collaborative Learning (Koschman 2002). More specifically, the principal focus is on "... the practices of meaning-making in the context of joint activity and the ways in which these practices are mediated through designed artifacts" (Koschmann 2002, 20). An important element in this definition is the mediating role that tools play in the meaning making process. In contemporary learning environments where computers or web-based tools are often used to support collaborative learning, students can use the affordances of these tools to leverage the collective knowledge of the group in tackling learning-related challenges. In addition, these

tools present students or members of the group with affordances for interacting with the contributions of others through creating links, tags (keywords) and comments that others can build on. In digital environments such as blogs, these visible forms of interaction provide visible “documentation of how learners *do* something” (Koschmann 2002, 21). As learners in a group grapple with a given learning related challenge, this documentation reveals the processes they used to make meaning of it.

DESIGN OF CONTEXT

We implemented blogs in two semesters of a course in emerging technologies and learning. The course, designed primarily for practicing or in-service teachers and trainers, was geared towards helping them gain familiarity and proficiency with applying social web technologies in teaching and learning. The two sections were taught by two different instructors, and although the course goals and objectives across the two sections were generally the same, each instructor had the flexibility to tailor some of the assignments and course content in the way that appeared most appropriate for that particular implementation of the course. A brief summary description of each course section is described below.

In integrating the use of Web 2.0 tools, our design maps onto various activities or practices that are identified as being an integral part of Web 2.0 usages (Dohn 2009), including distributed authorship, active, multi-way communication, collaboration, and taking place on the WWW. By integrating blogs into the course, we provided tools that allowed students the affordance to build skills related to two aspects: one, the individual skills of reflection, clarification, and organization (Lazonder et al. 2003), and the collaborative skills of co-constructing and negotiating meaning (Iannou et al. 2014). As such our designs were consistent with the intersubjective epistemological view of learning in CSCL (Suthers 2006) where interpretations of knowledge can be created individually as well as jointly via interaction, and whereby “the process of meaning-making is itself constituted of social interactions” (318).

Design of Section A

This section of the course was conducted during the summer of 2013. In general, this section featured several major assignments that integrated Web 2.0 tools (e.g., blog, social bookmarking, wiki, podcast). 12 students were enrolled in the course and they produced 147 posts and 437 comments. In this section, all blog posts were centralized into one main course

blog rather than each student creating and maintaining their own blog. The majority of the content for the blog posts was produced by student reaction to the readings, guided by various instructor provided question-prompts. Each week, students were required to write a minimum of one post and two comments on other students' posts. Overall, blogging represented a significant component of the overall course grade (30%).

Design of Section B

This section was conducted during fall semester 2013. Student work in the course was based on blogging in response to provided texts, commenting on peers' posts, curating blog posts, using a social bookmarking tool for commenting, participating around focused questions and debates in discussion boards within the course LMS, writing an individual policy paper and a personal learning/teaching statement. The data for this section consisted of blog data from 15 students, including 147 blog posts and 673 comments. Blogging and commenting accounted for 45% of the total grade within the fall section. Students each set up an individual blog, and posted at least one blog post in response to instructor prompts on specific weeks. In addition, they were asked to respond to at least two peers' blog posts with comments. Students were also assigned to blog groups of 4-5 wherein they were asked to read and respond primarily to their blog groups although they were encouraged to read and respond to as many peers as possible.

RESEARCH QUESTIONS AND METHODOLOGY

Our main research questions were: (1) what are the patterns of participation visible in two sections of the same online course? (2) what kinds of meaning-making are exhibited in the two sections?

The focus of our study was to examine and describe the patterns of participation in the two sections of the course, as well as describe the types of meaning making that occurred. Thus, we chose a multiple case study design (Yin 2009) as our research framework. In this case, the two cases were the summer and fall sections of the emerging technologies and learning course, and the cases were chosen because while they dealt with the same content, there were differences in the design and structure of the interactions, such that they might offer opportunities for theoretical replication (Yin 2009).

Within each course, the data were analyzed using two different methods. To answer our first research question regarding patterns of participation, we used social network analysis (SNA) to examine and map interactions between participants in each version of the course. To answer our second question, we used discourse analysis to code the blogs and comments. Two researchers first coded 5 blogs and all associated comments together until they agreed on the code application. They then individually coded 5 more blogs and came back to discuss and refine their code application again. The researchers then independently coded all blogs and comments within one course section.

ANALYSIS

Level 1: Patterns of Participation

Social network analysis (SNA) allows the mapping and examination of relationships in a network (Knoke and Yang 2008), and offers various metrics for identifying the ways in which information flows and is shared, as well as how to identify prominent nodes and gatekeepers in the network. Our goal in using SNA was to identify the ways in which participation could be mapped in the different course designs, with a special focus on looking at how connections between students themselves and the instructor might have differed. We used measures of centrality (which refers to the role or prominence of individuals in the network) and density (which relates to the overall network of connections between individuals in the group) to further explore the ways in which the groups functioned. Communications between students (i.e. posts and comments) were coded within a matrix and sociograms and measures of centrality were generated using UCINET software.

Level 2: Quality of Participation

In identifying a coding scheme for the qualitative phase of our study, we carefully evaluated the coherence between our theoretical framework and the coding scheme, identified a meaningful unit of analysis, and established processes to reach inter-rater reliability (De Wever et al. 2006) in order to perform a rigorous content analysis. Our selection of the coding scheme was influenced by the theoretical framing of the activity as having an intersubjective epistemology, where it was important to look at interpretations at the individual and group level. Of the many coding schemes available, we selected Arvaja's (2012) scheme for analyzing meaning making in online discussions. This framework proposes meaning making as occurring on two levels: first, through the type of discourse, and second, by the way in which those types of discourse were

manifested through a range of epistemic activities. Figure 1 presents a visualization of Arvaja's analytical approach.

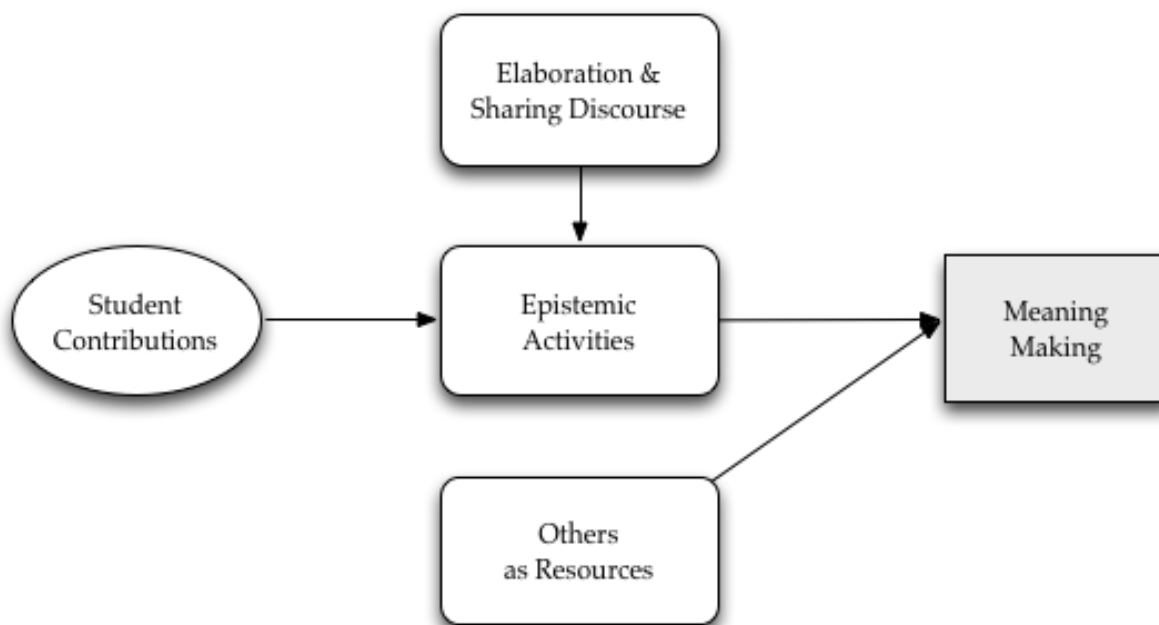


FIGURE 1: Analyzing Meaning Making in Online Discussions (adapted from Arvaja 2012)

At the individual level, Arvaja proposes three types of meaning making activity – *Applying*, *Forming or stating a conception*, and *Critiquing*. At the group level the types of discourse include: *Elaboration*, *Sharing*, and *Using others as personal resources for enhancing one's personal understanding* (103). *Elaboration* discourse occurred when "...students were developing the philosophical knowledge or ideas presented by others ... by offering a different perspective, critique, or new knowledge [and] thus elaborating others' thoughts and ideas" (97). The second type of discourse, *Sharing* occurred when students "...shared experiences or conceptions on some phenomena ...In sharing experiences, students often built their thoughts on several students' thoughts ..." (99-100).

Arvaja also identified epistemic activities or types of conversational moves that characterized the discussions for *Elaboration* and *Sharing* and suggested that the focus of analysis was "...on *how* the students built their contributions on one another's ideas and thoughts and *by what means* they advanced their shared meaning making and understanding of the phenomenon under discussion rather than on *what* they constructed through the discourse." (93)

Epistemic activities associated with *Elaboration* discourse, for example, included moves such as “asking for clarification,” “reasoning or developing ideas further” and “giving new knowledge” (103). Similarly, epistemic activities associated with *Sharing* discourse included moves such as “giving one’s own example” and “sharing criticism by repeating, rephrasing, or summarizing” (103).

The third type of meaning making discourse, *Others as resources for enhancing one’s personal understanding*, focuses on how students made explicit connections or links to previous discussion board postings: “... in the third way of meaning making, ideas and thoughts presented in the other students’ writings and discussion postings were explicitly pointed to as resources for enhancing one’s personal understanding” (Arvaja 2012, 97). Table 1 presents further details about the coding scheme for meaning making with examples.

Discourse	Epistemic Activity	Description Example
Elaboration	Asking for clarification	Poster requests clarification on concept or idea raised by the course reading or curricular material Example: “What I would like to ask you is how you use and what benefits you see when using Pinterest”
	Answering clarification	Poster answers request for clarification articulated by previous student regarding concept, idea or course-related activity. Example: “To answer your question for commenters. I would try to us [sic] AR for instances where visual representation matters ...”
	Challenging others’ ideas	Poster challenges another to substantiate or defend their interpretive position. Example: “The focus should indeed be on the process, but why not the product at the same time?”
	Giving new knowledge	Poster adds a qualitatively new element added to the discussion -- either by bringing in a resource that was not part of the original discussion or that comes from a completely different disciplinary perspective. Example: You can go to the link I suggest you below and create your own badges.
	Giving new perspective	Poster continues to talk about the same topic but provides a completely new way of looking at it. Example: “I feel like it is not so much the teachers and maybe ever not the schools that are not ready, but the government.”

Discourse	Epistemic Activity	Description Example
	Reasoning or developing ideas further	When poster appears to be engaged in sense-making or reflections clearly intended for readers of the blog. They stay on the same topic or issue but they dig more deeply or elaborate further. Example: "This could be made easier by collaborative learning through web 2.0 tools. I might be going out on a limb here, but it could be a more authentic form of assessment. I'm thinking more middle-high school here."
Sharing	Agreeing on conception	Poster agrees with another's perspective or interpretive position Example: "I do agree with R--- [student] that the way we teach now turns a lot of students away from schooling and the use of technology could motivate them."
	Giving one's own example	When the poster uses examples from personal experience or context and/or disciplinary knowledge Example: "I can answer your last question since I am in a new position and we are implementing the Google Chromebook platform ..."
	Sharing criticism	Poster agrees with critical perspective articulated by other students Example: "My initial reaction to the badge system was similar to your ideas ..."
Others as resource	--	Poster makes clear reference to a previous comment or poster and how it helped them to better understand conceptions, ideas, or theories, or how it clarified or added to their understanding. Example: Your quote: "I, along with many of my students, ... made me think about my own interactions"

TABLE 1: Coding Scheme for Meaning Making

ANALYSIS AND FINDINGS

Level 1: Patterns of Participation

Social network analyses performed on data from the two sections of the course show some interesting differences. Figure 2 shows a sociogram from the summer section of the course, while Figure 3 shows a sociogram from the fall section of the course. The visual cues offered by the sociograms suggest that interaction among the participants is quite well distributed across the network in the summer section, with the instructor (represented by PRT) occupying as

prominent a role in the network as many other student participants. On the other hand, the fall section is clearly demarcated by cliques (generated by student participation in blog groups) and the role of the instructor (P) seems to be more prominent than that of other participants. The average degree, or the average number of connections made by participants in the summer and fall section seem to be relatively close, however the density of connections in the summer semester is much more than that of the fall. These numbers indicate that the design of blogs to be central vs. individual had different kinds of impact in terms of network behavior, but as well in the role of the instructor as indicated in the sociograms. Another metric that we examined was the average number of posts per person and comments per person. These numbers are displayed in Table 2. These numbers do not indicate huge differences in participation by individuals in each section; however, there is a clearly marked difference in the overall connectedness or density of the network in section A.

Term	Summer (Section A)	Fall (Section B)
Average Degree	9.75	8
Density	0.65	.4
Posts per person	12.25	.9.8
Comments per person	36.4	44.8

TABLE 2: General participation and SNA metrics

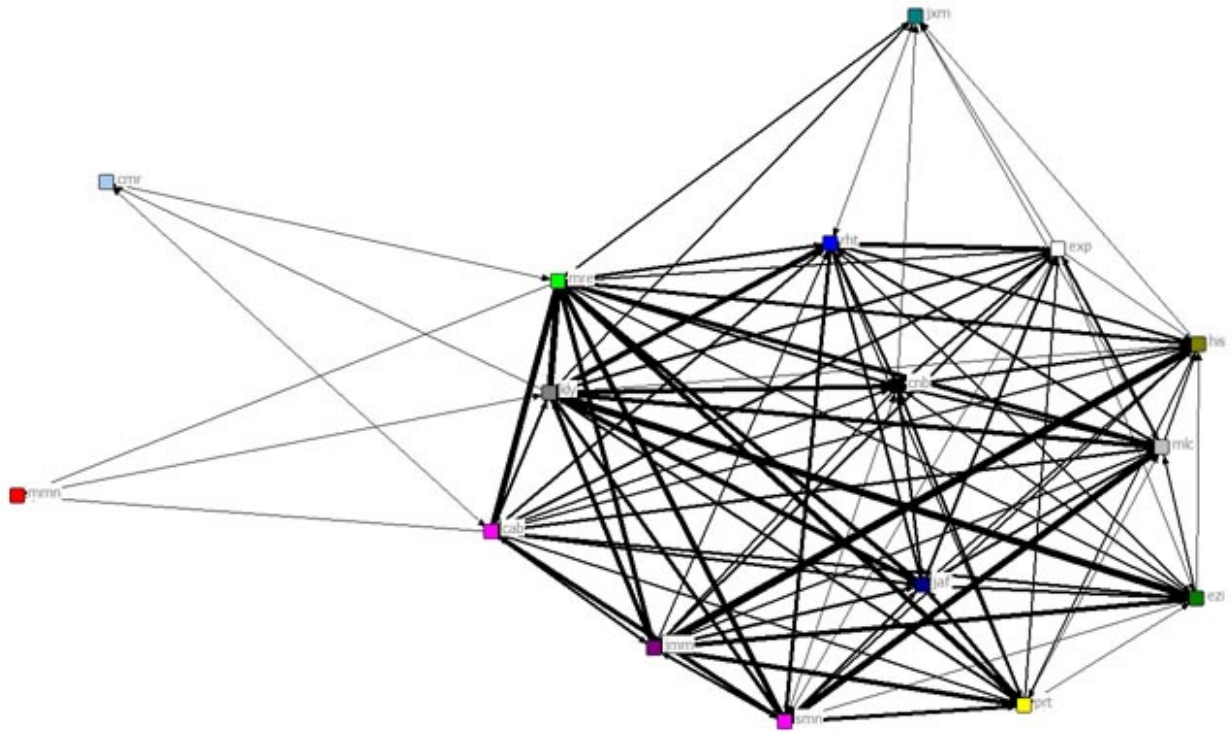


FIGURE 2: Sociogram of section A

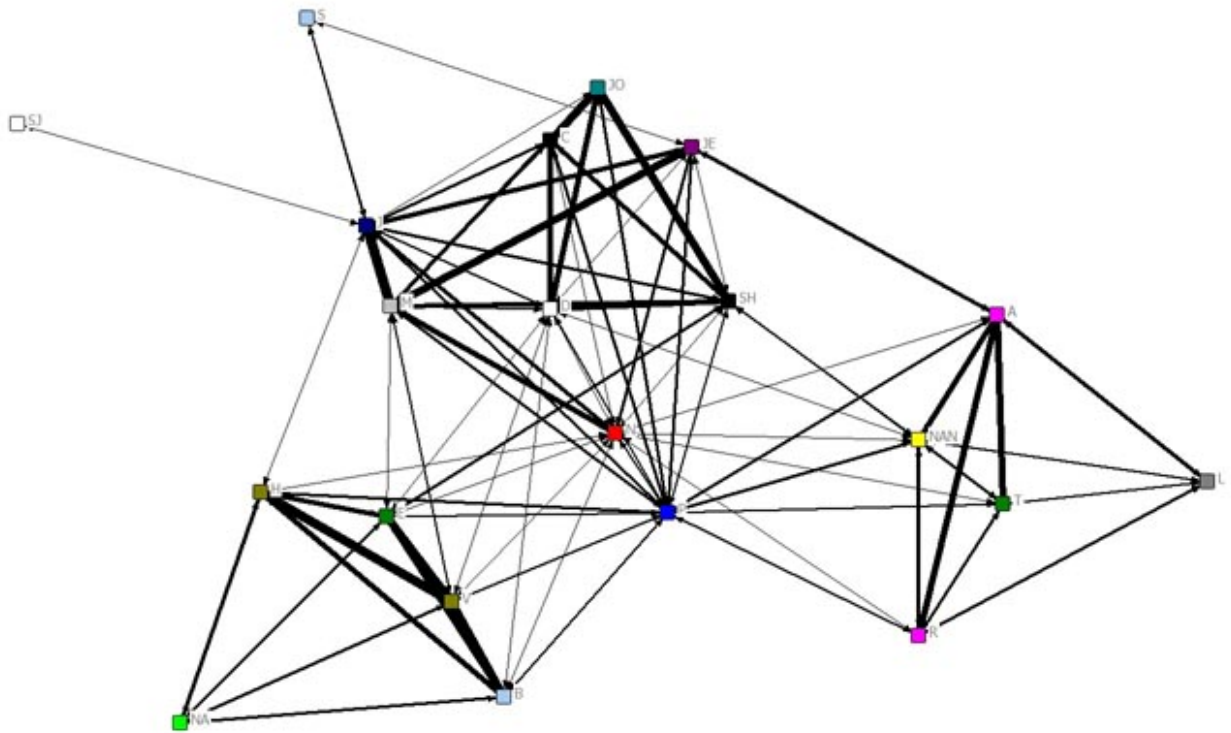


FIGURE 3: Sociogram of section B

Level 2: Quality of Participation

As indicated above, the qualitative analysis of this study was geared towards examining in what ways the student blog posts revealed instances of meaning making and to do this, we adapted Arvaja's (2012) analytical scheme. This was done by first identifying the type of discourse (e.g., Elaboration) and then second, the type of epistemic activity by which the discourse was exhibited (e.g., reasoning or developing ideas further, asking for clarification). Our qualitative data corpus consisted of 12 blogs, 147 posts and 437 comments. In analyzing for type of discourse, *Elaboration* showed the highest frequency (n=701) (See Figure 4). Interestingly, this finding echoes Arvaja's (2012) findings, who also found *Elaboration* to be the most common discourse. Following *Elaboration* discourse was *Sharing* (n=594). The third type of discourse, *Using others as resources for enhancing personal understanding*, ranked considerably lower; however, as noted earlier, Arvaja created this as a somewhat distinct type of discourse in that, unlike *Elaboration* and *Sharing*, it had no corresponding subset of epistemic activities and therefore, its total frequency count should be viewed with that difference in mind.

After coding the data for discourse type, we then coded it on the more granular level of epistemic activity (see Figure 5). The code that showed the highest frequency was a form of *Elaboration* discourse, "Reasoning or developing ideas further" (n=424). The next two codes that showed the highest frequencies were a form of *Sharing* discourse, namely, "Agreeing on conception" (n=346) and "Giving one's own example" (n=224). Much less dominant were the epistemic activities of "Sharing criticism" (n=6), "Challenging others' ideas" (n=22) and "Giving new knowledge" (n=43). This latter finding also echoed Arvaja's (2012) study, which also found little evidence of students "challenging each others' ideas" (99).

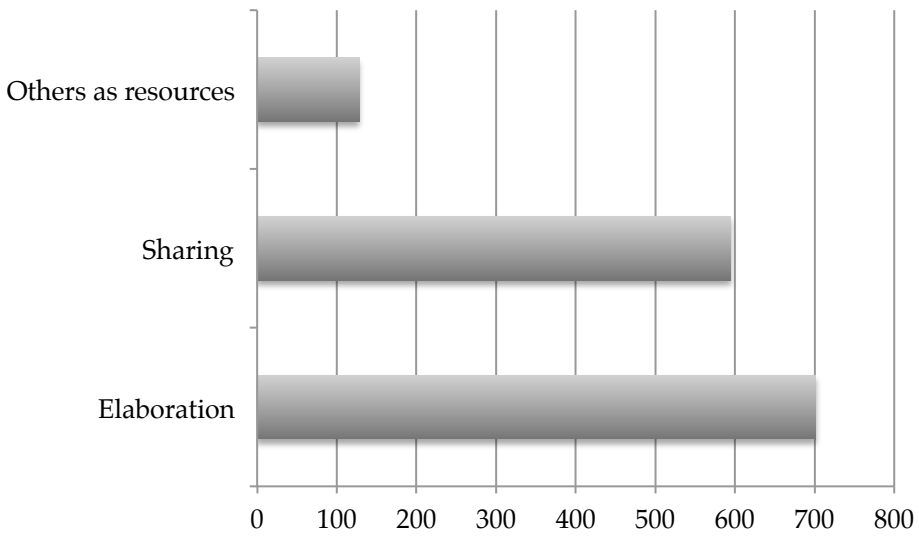


FIGURE 4: Discourse Frequency

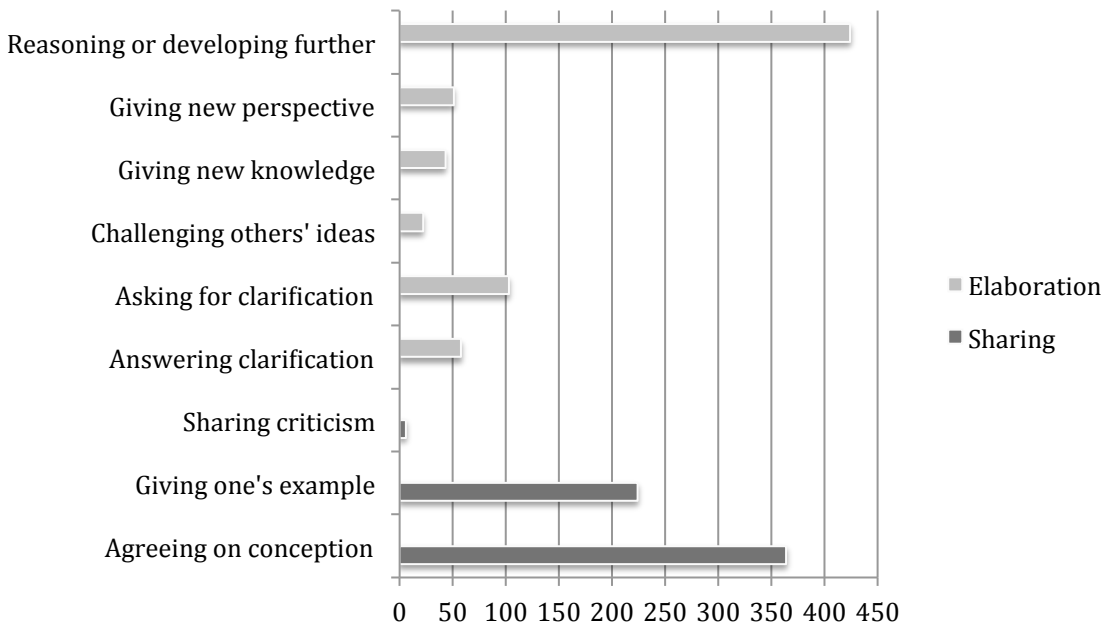


FIGURE 5: Epistemic Activities

Detailed Discourse Analysis

Due to space constraints, we present only two excerpts to illustrate the detailed discourse analysis. The analysis of each of these excerpted examples consists of three elements: a brief statement of the context, the quoted excerpt and analysis. (Note: excerpts have not been edited for spelling, syntax or grammar.)

Example 1

The initial student blogger or “Initial Poster” (IP) writes a blog post in response to a text by education scholar, Chris Dede, who explores how a Cartesian view of learning may be challenged by a more contemporary, Web 2.0-oriented philosophy that implies a “fluid epistemology.” The IP concludes her blog post with a question for any interested respondents to take up, which is how the first Responding Poster (RP) chooses to begin her post. The excerpt of this conversation is presented below.

IP: I think that I personally am in full agreement of the idea of a fluid epistemology. ... I'd like you to consider this question posed by Dede 2008. "But can a Web 2.0 view of knowledge, expertise, and learning overcome these problems?" (standardized testing, not being prepared for reality etc) What do you think?

RP1: I struggle to answer Dede's questions you ended with, "But can a Web 2.0 view of knowledge, expertise, and learning overcome these problems?" I think as teachers, we know we need to move towards a Web 2.0 view of knowledge and we can all clearly see the benefits. ...

RP2: I might be going out on a limb here, but it could be a more authentic form of assessment. I'm thinking more middle-high school here.

Analysis

This first example illustrates the epistemic activity of *Reasoning or developing ideas further*. This happens by the way in which the comments extend and build on an open-ended question posed by the IP. In the first comment, the RP1 openly describes her “struggle” to answer the question posed by another student. By beginning her post in this way, she publicly shares her reasoning and related intellectual struggle with any subsequent readers or visitors to the blog. In addition, by sharing this struggle in the social context of the blog, she invites others to reflect and comment on it, which would not be possible if she were writing this within the enclosed, private space of a word-processing document. RP1 then shares her thinking on the question posed by the IP by asserting that “...need to move towards a Web 2.0 view of knowledge” and that once they do, they will “clearly see the benefits.” In response to RP1, a subsequent post by RP2 also shows a willingness to use the blog as a place to test thoughts and ideas that may be seen as a little risky or not fully formed - “I might be going out on a limb here, ...” More specifically, RP2 extends the depth of RP1's comment by suggesting that one of the benefits of a “Web 2.0

view of knowledge" could be its impact on assessment, namely that it could offer a more "authentic form."

Example 2

The excerpt below comes from a blog post in which the IP is responding to course readings that describe the capacity of Web 2.0 technologies for enabling the crowdsourcing of knowledge.

IP: One of the topics brought up in Learning, Working & Playing in the Digital Age reminded me of a book that I have read. Brown discussed the idea that not one person is the expert when it comes to learning within the context of Web 2.0. Brown says that the real expert is the "community mind." The Wisdom of Crowds: ... by James Surowiecki is a fascinating read. The book highlights many examples proving that large groups of people are smarter than an elite few, no matter how brilliant those elite few are.

RP: Your point from the article about the "community mind" is very interesting as well as the book suggestion. In science, a popular topic right now is Citizen Science (see [inserts link... For instance, if we wanted to catalog the numbers of a particular songbird because its numbers were decreasing, a web site could be created for citizen scientists to report on sightings of that bird. In astronomy, citizen scientists discovered two new planets! (see [inserts link]). This is also exciting for small colleges like my own, because we have very limited resources to use for undergraduate research. But in this way, we can have students learn some basic scientific research processes while sharing in a much larger project. ...

*...
IP: [Name of student]-Thank you for sharing your knowledge about this topic. After doing a little research on it and exploring the resources you have shared, it is amazing to me how activities and experiments can take "many forms". What a great way to make "real-life connections" for your students! ...*

Analysis

In this excerpt, meaning making emerges through three types of epistemic activities: *Giving new knowledge*, *Giving one's example*, and *Others as resources*. In responding to the IP's post, the RP uses the IP's phrase "community mind" as a basis for expanding the conversation into what she sees as the related phenomenon of Citizen Science. The RP not only provides a definition of Citizen Science but also contributes hyperlinks to external websites that contain additional details. In doing this, the RP gives new knowledge to the group by bringing in a resource that was not previously part of the original discussion. A second type of epistemic activity occurs near the end of the RP's comment, where she further explains why the topic of Citizen Science became relevant to her as a professional educator. This happens by giving a personal example from the context of her professional workplace ("This is also exciting for colleges like my own ..."). In doing this, the RP uses the experience gained from a different context to and applies it as a tool for making further sense of the connection between the IP's blog post and her

responsive comment. The third type of epistemic activity surfaces in the form of “Others as resources” In this case, the IP refers back to a resource contained within a previous comment by the RP. More specifically, the IP describes how these resources initially shared by the RP have helped her in two ways: first, by using it as a spark for further learning about the topic of citizen science; and second, as a means of forming a new insight about its impact on the teaching and learning of science (“it is amazing to me how ...”).

DISCUSSION

Our intent in this study was to examine patterns of participation and quality of meaning making in two sections of an online course in emerging technologies and learning. We used SNA for analyzing the patterns of participation and discourse analysis to identify quality of meaning making. The SNA of the two courses suggested that interaction among the participants were different with one section showing very dense network structure, where almost all students were connected with each other, with the instructor playing a role that was very similar to those played by the students. In the other course, the student interaction was more cliquish with the instructor playing a more prominent role in network and in connecting participants to each other. Both of these analyses are consistent with the design of the course sections in that one section was geared for open participation while the second course had assigned groups for blogging and commenting.

What appears interesting in this regard is that both courses showed types of participation that are consonant with the practices of Web 2.0, such as active, multi-way interaction, and bottom-up participation (Dohn 2009). This same interaction can also be considered from the perspective of social presence (Garrison et al. 2001), which is highly correlated with quality of cognitive presence or ability to construct meaning through sustained communication (Lee 2014). However, differences in the configuration of the networks illustrate some considerations for design: integrating a single class blog opens opportunities for participation to everyone and reduces the overall prominence of the role of the instructor. This type of participation suggests that information and ideas can flow more openly throughout the entire community and the gatekeepers or weak links that control flow of information are fewer. In contrast, multiple blogs with blog groups develop very strong cliques of participation, where interaction between groups of participants is much stronger and much deeper within the clique, but also pushes the instructor to a role of centrality (Knoke and Yang, 2007) both in being connected to many individuals in the networks as well as acting as information broker.

In terms of quality of meaning making, the overall analyses suggest that a majority of the students engaged in high levels of *Sharing* and *Elaboration* discourse. By elaborating, students are encouraged to clarify their understandings and reorganize the material to make it understandable to others (Lazonder et al 2003), which results in benefits for both posters and commenters. A significant portion of the epistemic activities associated with the discourses were related to *reasoning or developing ideas further, giving one's own example, and agreeing on conception*. The detailed excerpts presented illustrate how the learners use these types of epistemic activities to make meaning. As this occurs within the context of a blogging environment, the meaning making that happens is publicly articulated; it creates opportunities for one to build on another. As they build on one another's contributions, students also build knowledge (Scardamalia and Bereiter 2006). In Excerpt 1 there are two RPs who use the blog as a space for openly reflecting on the difficulty associated with tackling a question related to the course reading. By sharing this struggle in the social context of the blog, it shows how blogs can be used to promote reflection (Xie and Sharma 2011).

Excerpt 2 features a noteworthy illustration of students using resources provided by others as resources for meaning making. As Arvaja (2012) noted, this type of meaning making activity occurs when "... students explicitly express that the other students individual writings or postings had helped their own understanding by giving them a new perspective or clarifying their thoughts" (102). In this example, the IP explicitly refers back to a resource on the topic of Citizen Science that was previously provided by an RP. This interaction with the resource suggests that she is not only reading the post but strategically acting on it. In addition, the resources provided by the RP help the IP realize new perspectives on Citizen Science such as the multiple ways in which the production of scientific knowledge can take place (e.g., "it is amazing to me how activities and experiments can take "many forms") and (2) contexts for authentic learning (e.g., "What a great way to make 'real-life connections' for your students!").

CONCLUSIONS AND IMPLICATIONS FOR FURTHER RESEARCH

Nearly ten years since the time when Tim O'Reilly first coined the term "Web 2.0" and seven years since education researchers Brown and Adler (2008) envisioned a congruence between a Web 2.0 perspective and Dewey's "Productive Inquiry," the question is no longer whether educators will integrate social web technologies into their learning environments but how. As discussed above, research suggests that insufficient attention has been given to the social

dimensions that are key to building distributed, peer-centric learning networks. Rather than focusing exclusively on cognitive learning outcomes, this study has examined interactive and social components from two different perspectives: patterns of participation (SNA) and discursively negotiated meaning making. The combination of macro-level analyses, such as SNA, that examine structures of participation and roles, along with micro-level analysis of discourse that illustrate the dynamics and granular details of these interactions provides information that can shape course design and activity design in multiple ways. For example, instructors can make specific choices about blog design based on their preference for type of student interaction and role for a specific learning goal. In addition, making sociograms and participation metrics available to students can present interesting opportunities to provide feedback and learning analytics data to help student learning. From the micro-level perspective, identifying the types of discourse that are most prominent can allow designers and instructors to focus on providing prompts for types of discourse that might be most pertinent or valued in a specific context and community. Yet, applying such a dual-level analysis to the application of social web technologies in learning environments remains in a relatively nascent stage and deserves further work. This research represents a contribution to that effort, but much more work needs to be done to gain a full understanding of the complexities and nuances with associated engendering collaborative learning and Web 2.0-like practices in educational contexts.

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