Research and Practice in Technology Enhanced Learning
Vol. 8, No. 1 (2013) 171－199

ENGAGED LURKING – THE LESS VISIBLE FORM OF PARTICIPATION IN ONLINE SMALL GROUP LEARNING

FEI-CHING CHEN[†]

Research Center for Science & Technology for Learning &
Graduate Institute of Learning & Instruction, National Central University
No. 300, Jhongda Rd., Jhongli City, Taoyuan County 32001, Taiwan
fcc@cc.ncu.edu.tw

HSIU-MEI CHANG

Graduate Institute of Learning & Instruction, National Central University
No. 300, Jhongda Rd., Jhongli City, Taoyuan County 32001, Taiwan
auroraspp@gmail.com

Many approaches to lurking rely largely upon individual and quantitative contributions to forums and are commonly associated with large learning communities. Drawing upon recent developments in the theory of communities of practice that have resulted in the emergence of the idea that "the negotiation of meaning involves the interaction of participation and reification", this study proposes a collaborative-collective perspective on lurking. It argues that the phenomenon of lurking can be re-conceptualized to provide the basis for a more inclusive understanding of contribution within groups. By investigating online participation, the results reveal specifically the nuances and subtle negotiation of engaged lurkers and their team members in small group forums. Further classification of these lurkers' utterances provides an opportunity to highlight the neglected contribution of the types of lurkers who may only sporadically contribute to the conversation, but quite often make significant contributions when they do. Instead of focusing on the level of involvement at the-individual-posting level, the collaborative sense-making capability of lurking members was also perceived and recognized. Upon employing a more collectively-oriented theoretical framework for such a mode of learning, engaged lurking is revealed to be a reflexive, proactive, and co-constructive activity rather than a lazy, passive and independent activity.

Keywords: Lurk; knowledge building; online small group.

1. Introduction

To make sense of lurking, the context of postings must be considered. The phenomenon of lurking in asynchronous networked environments has received much attention for more than a decade. Some issues, such as "why do people lurk?", have been researched thoroughly (Preece, Nonnecke, & Andrews, 2004). However, studies on lurking in different contexts provide different pictures of lurking behavior. Lurking in a community with large number of loosely linked individuals can differ greatly from one in which tightly coupled members are engaged in small group collaboration. Some of them rely on

indirect association via shared repertoire, others rely on direct co-construction that leads to individual or group-level learning. Research on ways of identifying lurkers and on the meaning of lurking should therefore be re-examined.

Lurking in individual-oriented versus collaborative learning should also be understood differently. In an earlier stage, the term "lurking" was used extensively to describe a reluctance to post, a phenomenon that put constraints upon interactivity of forums (Bishop, 2007; Nonnecke, 2000). Most research focuses mainly on the learners as individuals with no regard for the collaborative environment in which the learners engage. Such studies focus on whether or not they still learn by observing silently in the forum, and why they do not contribute something to the forum. With this approach, learning activities appear limited to merely submitting individual assignments and receiving messages delivered by others.

Recently, however, a growing body of research on lurking has introduced a new focus into the debates about whether or not lurkers are still engaged and actually involved in collaborative learning even when not visibly involved in online discourse with other members (Arnold & Paulus, 2010; Beaudoin, 2008; Dennen, 2008; Neelen, 2010). Studies on lurking in collaborative learning contexts therefore need to pay attention to the dynamics existing between lurkers and other members of their groups. How do lurkers position themselves in such collective situations? Have they been ignored or considered unwelcome? Do they have alternative modes of learning other than posting?

In parallel with research into lurking, investigation of online learner participation is also increasing in popularity (Beaudoin, 2008; Hrastinski, 2008). Despite much progress, there remain questions regarding learning and patterns of interaction (Suthers, Dwyer, & Medina, 2010), and specifically about levels of engagement and the invisible as well as unmeasurable participation.

Whereas a tally of the number of postings participants contribute is the common basis for determining patterns of interaction in cognitive science investigations, many challenges and difficulties exist regarding what online participation actually is and how it can be studied empirically (Hrastinski, 2008). Analyzing online forum activities using social network analysis or uptake process (Suthers, 2011) is indeed a promising way to approach lurking, but it is also important to ask: Does dynamic interaction fully reflect online participation? Can visible postings capture entirely the texture of learning? For Rogoff (2003), learning through keen observation and listening, in anticipation of participation, seems to be valued empirically and emphasized in communities where children have access to learning from informal community involvement (Rogoff, 2003, p.176). Similarly, for Wenger (1998), participation and reification function as a fundamental duality; as two dimensions that interact, interplay, and imply each other. In other words, reified objects such as postings in a forum do not represent the whole picture of a lurker's online participation.

Researchers have come to recognize that there are forms of valid participation other than public posting (Nonnecke & Preece, 2003). Hence, several questions arise: How can learners with less visible participation be studied? And how can lurking behavior be

understood in small groups within which close relations are particularly necessary? The key focus is therefore shifted from how many postings a person contributes to the forum to whether the sporadic postings contribute significantly and whether benefit is derived from those postings.

The objectives of this study are: (1) to identify lurking learners in small groups; (2) to investigate the nature of intent behind lurkers' sporadic postings and their influence on the development learning within their groups; and (3) to make sense of engaged lurkers' participation in small group knowledge building.

1.1. *Challenges to the definition of lurking*

Lurker statistics and conclusions vary depending on the definition of the word. In the majority of research, lurkers have been defined as those who contribute nothing at all. This approach considers merely the quantity of reified postings and those lurkers who have been examined are the ones who never took an active role in online forums (Beaudoin, 1998), posted no online messages at all (Ebner & Holzinger, 2005), or observed a setting but did not contribute in any noticeable way (Dennen, 2008). Therefore, nothing other than the number of lurkers in specific context can be concluded and can serve as data for further lurker investigation.

As opposed to tallies of reified contributions, another approach is to consider online frequency. Lurking differs from attrition, in that it is characterized by "persisting in staying" according to the Merriam-Webster dictionary. Without simultaneously taking both elements, frequency of posting and frequency of login, into consideration, the picture of lurking is less complete.

To meet the above mentioned challenges, research has developed alternative way to define lurkers. The evolution of the definition of "lurker" showed that the term is not ineluctably restricted to those who post nothing at all. Participants with few postings, though greater than zero, have also been included in lurking studies in order to understand better, and in a broader sense, those learners with less visible behaviors. A few studies divided all participants into several categories of participation such as worker/poster/active, lurker, quoter, shirker, and so on (Egan, Johal & Jefferies, 2006; Lin & Tsai, 2011; Strijbos & De Laat, 2010). Others defined lurking behavior in terms of the number of postings from a relative viewpoint (Lee, Chen, & Jiang, 2006). Therefore different levels or types of lurking deserve more attention.

In keeping with this inquiry, we take a different perspective to develop our operationalization of lurkers. Lurking learners are defined as participants whose ratio of posts to logins is relatively low in comparison with that of other members of the group. We further classify their lurking behavior into different categories and investigate the dynamics between the lurkers and their forum colleagues in order to understand how they participate and how participation evolves in online collaborative knowledge building. By investigating the nature of the visible postings of these lurking learners, we trace their invisible social participation.

1.2. *Reified postings and less visible participation*

Lurking has been gaining increasing attention from researchers of online learning and has been included as one type of participation (Strijbos & De Laat, 2010). Different terms are given to similar online participation of lurking phenomena. To date, lurking has been regarded as having ambiguous, both negative and positive valence (Soroka & Rafaeli, 2006). On the one hand, much research claims that if there is no visible online interaction, little or no learning is likely to occur. The lurking participant is referred to with terms such as "passive recipient" (Knowlton, 2005; Romiszowski & Mason, 2004), "inactive or invisible online participant" (Beaudoin, 2008), "witness learner" (Fritsch, 1999), "free-rider & bystander" (Preece et al., 2004), "hidden participant" (Soroka & Rafaeli, 2006), "observer" (Ramirez, Zhang, McFrew, & Lin, 2007) or "quiet participant" (Hammond, 1999), and the phenomenon of lurking as "vicarious learning" (Hrastinski, 2008) and "limited student contribution" (Hew, Cheung, & Ng, 2010). On the other hand, current insights into lurking related literature suggest that, although some participants are less visible than others, this is not necessarily an indication that the learning benefits are being compromised (Ebner & Holzinger, 2005). Terms used by those taking this perspective are: "active lurker" (Orton-Johnson, 2007), "pedagogical lurking" (Dennen, 2008), "free-rider and lurker" (Soroka & Rafaeli, 2006), "non-public participation" (Nonnecke & Preece, 2003), and "marginally positioned individual" (Weimann, 1982).

When lurking is assumed to be a relatively explicit phenomenon, the learning process of a lurker can be oversimplified. These terms reflect the rather superficial perception of lurkers. Many studies equate "contribution" with "posting messages" and make the assumption that visible postings are the only evidence of online participation. For example, they consider such online forums as a place where there is no loss of data as the discussion forum allows records of an individual's written messages to be kept in the virtual space (Hew et al., 2010). They consider a sizeable number of participant postings to be a necessary condition for a discussion to be regarded as promoting learning (Mazzolini & Maddison, 2003). Studies based on this line of inquiry not only neglect everything but visible postings, they also regard online participation as sole available evidence for understanding learning.

Current trends seem to put emphasis largely upon visible learning behavior and the individual benefit derived from public resources. It is obvious that two things might therefore be neglected: First, the invisible aspect of the lurker's learning; and second, the potential contribution of lurkers to online collaboration. Since very few postings were available to study lurker's learning, few attempts have been made to ascertain the nature of lurker's postings and to determine the relationship between lurkers' postings and those of other forum members. Taken together, dissatisfaction with individual interpretations of lurking, a social behavior, has led the present study to re-investigate it based on a social learning framework as well as a collaborative knowledge building perspective (Scardamalia & Bereiter, 2003). Knowledge building may be defined as the production and continual improvement of ideas of value to a community, through means that increase the likelihood that what the community accomplishes will be greater than the

sum of individual contributions and part of broader cultural efforts. Many analyses of lurking learning consider only how lurkers benefits from the presence of others' postings in discussion or the vicarious learning for shared understanding (Dennen, 2008; Guzdial & Carroll, 2002). If the analysis examines the benefits alone, it could be assumed their sporadic postings would not have any value to others. Our analysis goes further to include any possible potential mutual benefits.

1.3. *Theoretical framework: Participation versus reification*

In seeking a theoretical underpinning for the exploration of lurking learning, most research has been based on the individual. Frameworks that have been borrowed from are Heider's balance theory (Weimann, 1982), Bandura's vicarious learning (McKendree, Stenning, Mayes, Lee, & Cox, 1998), Wenger's negotiability (Lee et al., 2006), Bourdieu's cultural capital theory (Soroka & Rafaeli, 2006), Maslow's hierarchical needs theory (Bishop, 2007), Walther's social information processing theory (Ramirez, Zhang, McFrew, & Lin, 2007) and Dewey's observation (Beaudoin, 2008). With the exception of Wenger's social theory of learning, the rest of these frameworks refer to individual learning.

The dominant influence of mainstream cognitive theories may be responsible for the fact that lurking is generally viewed as an individual learning activity. Many researchers from a Piaget or Vygotsky's tradition consider computer-supported collaborative learning environments to be a space for individual learning such as the exchange of personal opinions and the delivery of codified knowledge, rather than a stage for collaborative knowledge building. Lakkala, Rahikainen and Hakkarainen (2001) proposed two mechanisms that lead to having the ideas of knowledge building and collaborative learning interpreted from an individual-oriented perspective. Piaget's socio-cognitive conflict (Piaget, 1928) provides a traditional framework for interpreting the process of a shared understanding as individual gains taking place in individual minds (Guzdial & Carroll, 2002), rather than a product of collective knowledge building. In addition, Vygotsky's idea of the zone of proximal development (Vygotsky, 1978) interprets collaboration as a facilitator of individual cognitive development and a result of individual endeavor, rather than a matter of participation in a social process of knowledge construction.

In response to the theoretical mismatch that exists in previous research on lurking, the present study proposes one theoretical framework to facilitate the interpretation of lurking phenomena: E. Wenger's duality of participation and reification.

The work of Wenger provides a more adequate basis for understanding the social aspect of lurking learning. Wenger (1998) argues that negotiation of meaning involves the interaction of two constituent processes, participation and reification. He views participation and reification as a fundamental duality; as two dimensions that interact, interplay, and imply each other. Reification is therefore potentially a hurdle as well as a help to learning. Thus, additional work is required to make sense of the reification.

Obviously, reified objects such as postings in a forum do not represent the whole picture of a lurker's online participation. As Wenger puts it,

"A duality is a single conceptual unit that is formed by two inseparable and mutually constitutive elements whose inherent tensions and complementarity give the concept richness and dynamism." (Wenger, 1998, p.66)

Thus, analyzing online learning becomes a matter of taking both participation and reification into account together to enrich the meaning of lurking participants. Such a perspective offers a fresh perspective on the question of evidence of online learning. For most research, "reified postings" when used as evidence of learning, refers to whether participants are able to contribute ideas to forums. As a result there is a tendency to ascribe "failure to post" to inability on the part of the individuals. This diverts attention away from the inherent complementarity of participation and reification to reified objects. On the contrary, overlooking the inseparability of reified objects and invisible participation may conceal some possibilities for lurking learning and the potential contributions of lurkers to the group. Wenger's approach shows that putting a spotlight on less visible aspects of participation can illuminate the meaning of lurking learners. It is with this in mind and toward those possibilities that we direct this paper.

2. Methods

The purpose of organizing an inquiry-based learning environment was to help local high school students develop inquiry skills and to construct scientific knowledge collaboratively. In our country, the opportunity to attend science contests is quite often restricted to science-oriented brilliant students. Opportunities for humanity- or social science-oriented students to attend science contests in school are slim. The virtual science contest held by our research team, with the support of our university, attracted a lot of students with such backgrounds.

An inquiry-based learning environment called Porscin (Portfolio-oriented science content via Internet) was implemented on the website. Senior and junior high school students in this country attended this six-week virtual summer camp on a voluntary basis. There were five topics for them to choose from. Participants who chose the same topic were sorted into a set of groups with approximately five individuals per group. Each group then developed and tested its own focal hypotheses and came up with conclusions. Each group had its own group forum. Most of the time individuals stayed in their own forums to exchange ideas and develop team products based on their discussions. Each week, every group needed to achieve the following sub-goals: 1) individual claim proposing, 2) team hypothesis building, 3) strategies developing, 4) data locating, 5) data transforming, and 6) conclusion drawing. At the end of each week, group members as a whole were to submit a subset of products and selected relevant forum discussions as evidence. By the end of the 6th week, all groups would have accumulated all of their weekly artifacts and formed a final product for the science contest. Participants in this activity qualified for a certificate if they completed jointly all required tasks and were nominated by their teammates.

Besides staying on their group forums, they were also to spend a good deal of time on the database. The participants were also provided with primary observation data on meteorology in this particular website including figures, tables, 2D and 3D photos and satellite images of typhoon, drought, flood, front, thunderstorm, and fog events. The threaded discussion forum was scaffolded by inquiry rubrics, which were developed by experts and researchers for each inquiry stage.

A pair of volunteers served as mentors in each forum. In general, each pair was responsible for five to eight groups. Mentors were elementary to secondary school teachers or graduate students with majors in the learning sciences and were paired according to their academic backgrounds, those majoring in the sciences as cognitive mentors and those with non-science majors as affective mentors.

2.1. *The participants*

Eighty-two groups were formed to attend Porscin. At the group level, the average number of logins per group (N=5.37 participants/ per group) was 414.0 and the standard deviation was 133.3. The maximum and minimum number of logins were 650 (group E9) and 142 (group E2), respectively. The average number of posts per group was 282.6 and the standard deviation was 327.2. The maximum and minimum number of postings were 1623 (group D10) and 98 (group A7), respectively. It is clear that there was a large amount of variation between groups. Since group dynamics were so different, lurkers were identified based on individual group interaction and might have rather different numbers of postings and login frequency.

At the individual level, we noticed that the post/online ratio of each participant was greater than one, implying that participants tended to contribute more than one posting whenever they logged in. The average number of logins per participant was 55 and the standard deviation was 46.6. The average number of posts was 81.2 per participant and the standard deviation was 101.6. In contrast to much of the research conducted within the school context of mandatory scoring system, members with different levels of participation were to work things out in a voluntary environment. This resulted in an authentic situation within which lurking behaviors in the context of group learning were suitably investigated.

2.2. *Data collection and analysis*

In this section, we introduce how we identify the specific proportion of participants whose online participation was consistent and sustained but whose postings were meager. Adopting the concept of the duality of participation and reification, we then identified a specific type of lurker, the engaged lurker, who deserved further investigation. The individual postings of engaged lurkers were classified both according to their dialogue context and by referencing the adjacent postings of group members. Finally, an example is given to explore the relationship of collaborative knowledge building between group members to that found in lurkers' sporadic postings.

2.3. *Identifying the lurkers*

Based on the ideas of the complementarity of participation and reification introduced by Wenger (1998), we extend the duality of meaning for analyzing virtual interaction, in our case, transcripts of forum discussion for small group collaboration. Although Wenger's ideas referred specifically to practices in physical worlds, there is no indication as to how should they be applied to CSCL practice. This complementary perspective sheds new light on the dialogic nature of sporadic postings and the meaning of lurking participation.

To define lurking members in small groups, this study focused not on participants with few or no postings but on those participants who had been relatively silent in terms of the ratio of postings to logins in comparison with their fellow group members. To be specific, the less familiar forms of interplay between participation and reification lead one to analyze the situation in terms of that duality. If participation prevails in our lurking cases while most of what matters is left unreified – then there may not be enough material present to discover its hidden meaning. When too much reliance is placed on reification, the continuity of the meaning of lurking learning is also problematic. Therefore, we proposed to focus on those participants who demonstrated an unusual distribution of participation and reification.

This study thus explored this unusual participation/reification relationship by putting more emphasis upon on instances of low postings to logins ratios than on the ordinary lurkers – those displaying both a low number of logins and of postings. The number of group members' postings as well as their online logins were tallied and analyzed. Using the group as the unit of analysis, we calculated the ratio of postings to logins per participant and per group. Participants with a score ratio below one SD (standard deviation) of the group score ratio were identified as the lurkers of the group.

2.4. *Classifying potential engaged lurkers*

It was predicted that, due to the varied dynamics within small groups, the lurker roster would be composed of lurkers with rather different numbers of postings and logins. For example, it might include lurkers from a group with total postings as high as 1000 or as low as 100. Owing to such individual group disparities, some of those identified as lurkers appear not to be as silent as would normally be expected and would thus need to be further classified. Four quadrants were applied to classify different types of lurkers (Figure 1). On the one hand, we were already familiar with lurkers with few to no postings (1st quadrant in Figure 1); on the other hand, it was also less valid to consider any participant whose numbers of postings were greater than the average number of postings across groups (3rd quadrant in Figure 1). The 4th quadrant involved lurkers whose login tally exceeded the mean across groups but whose postings total fell below it, thus making them the target of the present study.

The analysis of lurking is still in its infancy. Tacit assumptions made in previous studies may blind us to the learning process and to the contributive potentials of lurking learners. This is our initial attempt to distinguish lurking learning of different types and to

propose that lurkers fall into the 4th quadrant and be considered "engaged lurkers". We need to link Rogoff's concept of intent participation (2003) with Wenger's (1998) concept of the complementarity of participation and reification, and these two further with the commonly assumed dichotomy between active-passive learning (Reda, 2009). Rogoff's term "intent participation" refers to keenly observing and listening in anticipation of or in the process of engaging in an endeavor (Rogoff, 2003, p.178). She advances the distinction of "active" listening. This study regards lurking as "inherently passive", however, together with Wenger's idea, we believe lurking does not mean there is no "mental activity … there is something getting done there." The term "engaged lurker" is therefore coined to describe learners who were engaged deeply in related learning activities in the absence of significant speaking/posting. We also attempt to explore the nature of the postings of engaged lurkers, especially their role in small group collaboration.

2.5. *Exploring the nature of the reified postings*

This study started by coding single postings because the postings of engaged lurkers tended to be sporadic. However, a much more context-sensitive and holistic examination of what engaged lurkers' postings might mean within the discussion then followed. In other words, single postings were not treated as isolated acts of the engaged lurker but as components of dialogues created by this small group.

Three coding schemes were used to elaborate upon what kind of "something getting done there" the engaged lurkers were engaging in. In order to understand the nature of the postings of the lurkers in terms of their interaction with group members, content analysis of the postings of all the engaged lurkers was first performed as follows. The postings were sorted into three categories (Jiang & Chen, 2003): (1) Social Talk about affective and supporting aspects, (2) Coordination about scientific procedures and collaboration, (3) Cognitive Inquiry related to domain knowledge.

Cognitive coding schemes vary. Some are too simple while others are too complicated. For example, studies on synchronous chats use criteria such as questions, agreement, disagreement and referencing (Trausan-Matu & Rebedea, 2009), while studies of long-term activity on argumentative scientific inquiry developed coders such as clarification, elaboration, analogy, hypothesizing and authorization (Kim & Song, 2005). Different learning conditions provided participants with different opportunities for negotiation and refinement. The present study, a six-week long authentic inquiry in atmospheric science during summer vacation, could be considered a long-term online asynchronous activity. Instead of responding with agreement or disagreement right away, participants quite often took time to think about group members' posts and then presented inquiry acts. Given the relatively unrestricted time frame, it is also possible to distinguish levels of engagement of participants in asynchronous learning environments. Therefore this study employed a relational view for coding the apparently discrete postings and identifying the depth of the engaged lurkers' participation, as reflected in their postings.

The category of Cognitive Inquiry was further developed by defining eight sub-categories: (3A) complying with ideas, (3B) raising questions, (3C) sharing personal experiences and opinions, (3D) critiquing others, (3E) copying and pasting external resources, (3F) modifying others' ideas, (3G) wrapping up or converting divergent ideas, (3H) answering questions with elaboration. The first three sub-categories (3A-3C) were considered to be engaging in relatively light involvement; whereas the other five sub-categories (3D-3H) were considered engaging in relatively deep involvement.

Furthermore, to understand better how engaged lurkers' sporadic postings join in group discussion, we identified the position of these postings as existing in three places: (1) orphaned, (2) initiator, (3) interlocked. By sorting postings into these three location categories, we were able to generate a profile of the interplay of engaged lurkers and their fellow group members. For example, the place of (2) the initiator referred to the extent to which engaged lurkers engaged in starting a new thread - something that participants are often reluctant to do.

After the initial sorting of the postings by two researchers, the definitions of the three categories and eight sub-categories on Cognitive Inquiry were negotiated and revised, and the inter-rater reliability then reached 0.96.

2.6. *An example: Making sense of the engaged lurker*

In CSCL, although microanalysis and exploratory sequential data analysis are the norm, there have been many analytic challenges. Of these, the tension between the need to examine the sequential organization of interaction within an episode and the need to scale up such analyses to more episodes and larger scale organization have received much attention (Suthers et al., 2010). For example, microanalysis is usually applied to only a few selected cases, leading one to question the representativeness or "generality" of the study. However, since the postings of lurkers are already less reified, microanalysis of the remaining materials is fully appropriate for a study of lurking.

In analyzing one example of an engaged lurker, exploratory sequential data analysis was first used to examine collaborative knowledge building in this small group. A third coding scheme was borrowed from Waters and Gasson's (2006) approach and was used to examine how each posting functioned in relation to the postings of other members and how it accomplished collective knowledge building.

In contrast with the first coding scheme where "single posting" was used as the unit of analysis, Waters and Gasson's classification was more related to the concept of the "adjacency pair" (Schegloff, 2007). This was accomplished by progressing through the following three steps: (1) identifying the contribution of each posting through comparing the relationship of prior postings to the current one in order to recognize the level and the contribution of the posting; (2) tallying the total of each classification of posting of each group member, and (3) selecting the highest frequency as the most fitting classification with which to define the participation level of each group member. The eight learner-role behaviors are: Passive-learner, Knowledge-elicitor, Contributor, Vicarious-acknowledger, Closer, Facilitator, Initiator, and Complicator. The classification further provided a

framework for three levels of involvement: participation, involvement, and social engagement. In this way, the roles of each group member were determined by cumulative turn-taking actions and might result in a different picture of the engaged lurker than that arrived at in the single-posting approach.

Microanalysis was then conducted on one of the engaged lurkers in order to make sense of how "something getting done there" applied. The selection of threads was driven by the following criteria. We wanted to inspect threads that involved (a) more discussion on domain knowledge, (b) more group members involved, and (c) more postings by lurkers. The longest thread in this group was chosen to assess the potential influence of the sporadic postings of this lurker on the dynamics of the group in collaborative knowledge building. The basic operation includes chunking, coding, commenting, and comparing (Sanderson & Fisher, 1994).

Domain experts were also heavily involved in going beyond the threaded reply structure to identify when and how critical moments (Chang, Chen, Zhang, & Tzeng, 2011) of learning emerged. Besides common sequential analysis, our major efforts in coding emphasized key postings which made greater contributions in their collective achievement. Without the assessment of domain experts on subtle turning points, the collective progress of inquiry in each thread could not be identified. We not only identified the critical moments, but also constructed how these key postings emerged and were sustained in order to understand better what role the lurkers might be playing.

3. Results

The results are presented in two parts. First, the types of lurkers and the nature of their postings were categorized. In the second part, a microanalysis of one thread in one engaged lurker's group was applied to explore the role of the engaged lurker in this group. A collaborative knowledge building perspective was introduced to reconsider the meaning of lurking beyond the tallying of quantitative aspects of participation.

3.1. *The meaning of reified postings at the individual level*

Of the 82 registered groups, 45 lurkers from 44 groups were identified. As mentioned before, these lurkers were identified by their low ratio of postings to logins. That is, based on the engagement levels of the whole group, only those members with a ratio below one SD were considered to be lurking in their group. Thus viewed, the quantitative aspects of lurkers' participation varied significantly and merited further classification.

A graphical representation of the 45 lurkers was designed for the purpose of searching for particularly unusual participative behavior and to permit the best visualization of variations of lurking. In Figure 1, mean postings and mean logins across groups, 81 and 55 respectively, were used as the origin. Each lurker was placed in either the 1st, 3rd, or 4th quadrant. In line with this inquiry, we are concerned neither with Active nor Passive Lurkers because participants in these two categories either contributed as many postings as ordinary participants or as few as the type of lurkers we are already familiar with. In particular, Active Lurkers contributed posting counts above the average

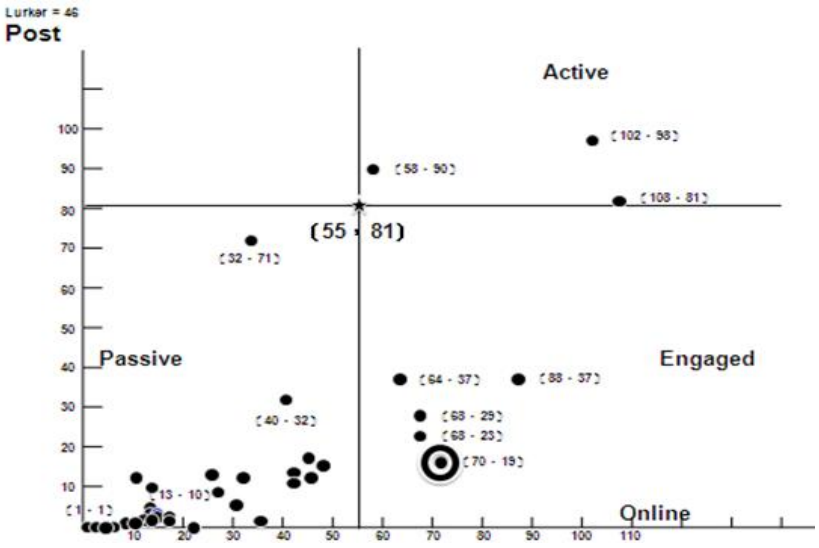

Figure 1. The distribution of lurkers in four quadrants.

across all groups, yet they were identified as lurkers simply because the rest of his/her group members were so exceedingly active that Active Lurkers were reduced statistically to lurker status. In contrast, 28 out of 38 Passive Lurkers contributed fewer than 10 postings during the six-week inquiry team work. Their levels of participation in general were far below the average. The engaged lurkers in the 4th quadrant are the ones who had above average login frequencies but unusually low posting frequency, and are the focus of this study.

The postings and online login numbers of five engaged lurkers are shown in Table 1. Five engaged lurkers contributed 145 postings in total. The average number of postings was 29 and 71.6 for online logins. The average ratio of the five engaged lurkers is 0.41, which is far lower than 1.47, the overall average of the 82 groups. To be specific, their

Table 1. The profile of five engaged lurkers.

Group	Lurker	Posting	Online	Ratio	Mean-Group -Ratio	1 SD
A16	Es1225246	37	88	0.42	1.08	.52
A18	70332	23	68	0.34	0.79	.39
C2	Snowlove	19	70	0.27	0.54	.22
D2	Kawai	37	64	0.58	1.47	.65
E11	Twyoyo71	29	68	0.43	1.76	1.17
	Total	145	358			
Mean of Engaged lurkers		29	71.60	0.40		
Mean across all groups		81	55	1.50		

Table 2. The distribution of the categories of postings.

Engaged Lurker	Coordination		Social Talk		Cognitive inquiry		Total
	Freq.	%	Freq.	%	Freq.	%	Freq.
Es1225246	19	51.4	0	0.0	18	48.6	37
70332	12	52.2	0	0.0	11	47.8	23
Snowlove	5	26.3	2	10.5	12	63.2	19
Kawai	25	67.6	1	2.7	11	29.7	37
Twyoyo71	9	27.6	4	20.7	16	55.2	29
Total	70		7		68		145
Mean		45.02		6.78		48.9	

average number of online logins is 71.6, which is higher than the average of the 82 groups. In contrast, their average number of postings is 29, which is much lower than the average of the 82 groups.

What do they post? Obviously, Social Talk is the category to which they contributed least often (Table 2). Indeed, two of them had no social and affective interaction with their team members at all. This result is in sharp contrast with previous research on lurkers in general (Chen, 2004) in which lurkers' postings were roughly distributed into the three categories (34%, 31%, 35%), indicating moderate participation in all aspects of group interaction. However, the findings of their study were based on 89 lurkers with a ratio of 0.75 whereas the ratio in the present study is 0.4. There must be mixed information within such a large collection of lurkers.

A comparative analysis of postings on these three categories between engaged lurkers and other lurkers is therefore followed (Table 3). We discovered that engaged lurkers showed roughly the same participation patterns as that of the active lurkers. Among three categories, Cognitive Inquiry is the category to which the two types of lurkers contributed the most, followed by Coordination and Social Talk. On the other hand, Coordination is the category to which the passive lurkers contributed the most, followed by Cognitive Inquiry and Social Talk. It is also notable that out of the three categories of participation patterns, social talk remains the least documented kind. Detailed analysis of the nature of the lurkers' postings showed that lurkers actually engaged in significant participation in contrast with the conventional understanding of lurkers in general that they had nominal engagement in domain knowledge and posted more often on off-topic talk.

Table 3. The distribution of the categories among three types of lurkers.

Lurker/Category	Social		Coordination		Cognitive Inquiry		Total
	Freq.	%	Freq.	%	Freq.	%	Freq.
Active lurker (N=3)	53	19.70	64	23.79	152	56.51	269
Engaged lurker (N=5)	21	14.19	59	39.86	68	45.95	148
Passive lurker (N=37)	66	20.50	134	41.61	122	37.89	322
Total	140	18.94	257	34.78	342	46.28	739

Table 4. The distribution of the eight sub-categories of Cognitive Inquiry.

Engaged Lurker	Level of involvement												
	Light					Strong							
	3A	3B	3C	Sub-total	%	3D	3E	3F	3G	3H	Sub-total	%	total	%
Es1225246	0	3	8	11	29.7	1	4	0	0	2	7	18.9	18	48.65
70332	0	3	1	4	17.3	0	6	0	0	1	7	30.4	11	47.83
Snowlove	0	2	3	5	26.3	1	3	1	0	2	7	36.8	12	63.16
Kawai	1	2	2	5	13.5	3	0	2	1	0	6	16.2	11	32.43
Twyoyo71	2	4	2	8	27.5	2	3	2	0	1	8	27.5	16	51.72
Total	3	14	16	33	22.7	7	16	5	1	6	35	24.1	68	46.90

3A = complying with ideas; 3B = raising questions; 3C = sharing personal experiences and opinions; 3D = critiquing others; 3E = copying & pasting external resources; 3F = modifying group discussion; 3G = wrapping up or converting divergent ideas; 3H = answering questions with elaboration.

To explore how engaged lurkers were involved in domain knowledge, the category of Cognitive inquiry was further divided into eight sub-categories (Table 4). In terms of the level of involvement, the distribution of strong and light involvement was roughly similar. Sub-category 3B and 3C in light level and sub-category 3E in strong level were the biggest ones and could not be ignored.

Lurkers were conventionally assumed to be merely playing a more social role in interaction (Lee, 2004). The sorted results of the Cognitive Inquiry sub-category, however, revealed a different picture. Engaged lurkers not only paid less attention to Social Talk, but also made moderate amount of contribution to Cognitive Inquiry. Light levels of involvement, such as those in sub-category raising questions (3B) and sub-category sharing personal experiences and opinions (3C), were examples. Interestingly, complying with others' opinions (3A) while an obvious, painless and easy response, was not a choice favored by them.

On the other hand, strong levels of involvement such as copying & pasting external resources (3E) were the biggest item. At first glance, one might assume that copying & pasting reflects a shallow level of involvement. However, a closer look within the interactional relationships around developing team argumentation shows that engaged lurkers often engage in justifying/rebutting group members' previous claims by providing relevant external sources rather than merely copying and pasting irrelevant sources. In other words, when inspecting postings containing "copying & pasting", one should definitely read the whole thread and even across threads to determine learning progress.

How do engaged lurkers join the group discussion? The placement of the 145 postings within each thread was used to identify them as belonging in one of three categories. Table 5 shows that only ten percent of postings were ignored as orphaned posts. Sixteen percent of them are the initiators of threads and seventy-four percent of postings were fully interwoven with those of their fellow group members.

Table 5. The place of postings in each thread.

Engaged Lurker	orphaned	%	initiator	%	interlocked	%	Total
Es1225246	7	18.9	12	32.4	18	48.65	37
70332	5	21.7	6	26.1	12	52.2	23
snowlove	0	0.0	0	0.00	19	100.00	19
kawai	0	0.0	0	0.00	37	100.00	37
twyoyo71	2	6.9	4	13.8	23	79.3	29
Total	15		23		107		145
Average		10.3		15.9		73.8	

By analyzing lurkers' sporadic postings at the individual level, we found that engaged lurkers did present a different mode of learning in groups. First, they seldom engaged in Social Talk even though they contributed less. The common impression of lurkers in general is that they are less engaged and therefore less able to take turns in serious inquiry dialogue and thus their focus shifts to social talk to show their social presence. Our findings with respect to the significant amount of Cognitive Inquiry activity suggest, on the contrary, that engaged lurkers were more deeply engaged than expected. Sub-category 3C in light level and 3E in strong level of involvement were the biggest sub-categories. When viewed together, these two large sub-categories together show that engaged lurkers spent a good deal of time in using both internal and external resources to contribute to their groups. They were less willing to wrap up or synthesize multiple thoughts into consensus (3F) but they dared to ask (3B) and answer (3H) questions or modify others' ideas (3F).

In the following section, a micro-analysis of engaged lurkers was performed to explore how they interacted with team members and to determine how they benefited from or contributed to the group.

3.2. *The meaning of reified postings at the adjacency pair level*

Engaged lurker Snowlove and her group members were selected as the target of our microanalysis. This group consisted of five members whose postings totaled 312 and whose online presence frequency totaled 525 (see Table 6). The ratio of this group was 0.54. Obviously, 010124 and Milkbottle were the most frequent contributors and Snowlove was the only lurker whose ratio was below one SD of this group.

Table 6. The profile of Snowlove's group members.

Member	Posting	Online	Ratio
010124	119	182	0.65
Milkbottle	101	119	0.85
Cathyjudy	49	94	0.52
Icebox	24	60	0.40
Snowlove	19	70	0.27
Total	312	525	2.69
Mean	62.4	105	0.54

Table 7. The classification of primary learner-role behaviors.

Level	Form of Behavior	Milkbottle	Cathyjudy	010124	Snowlove
I. Participation	Passive-learner				
	Knowledge-elicitor	1	3		
	Contributor			13*	
II. Involvement	Vicarious-acknowledger	1	1	1	
	Closer	7		1	
III. Social engagement	Facilitator	19*	8*	1	1
	Initiator	2			
	Complicator				3*
	Total	30	12	16	4

Note: The result of the classification of each member is indicated with *.

The 15th thread consisted of 69 postings by five members during the second week team hypothesis building Stage. This long thread lasted for five days and almost monopolized discussion of that stage the whole week. Each member's learner-role behavior and participation level is reported in Table 7. The number of contributions for each team member was 30, 16, 12, and 4, respectively. 010124 was considered as Contributor in level II, involvement level; the rest of them fell into the III, social engagement level. Milkbottle and Cathyjudy were classified as the Facilitators and the only lurker, Snowlove, as the Complicator.

Although Snowlove did not contribute much, most of her postings were categorized as the most advanced level, based on "adjacency pair" as unit of analysis. The level of her engagement is defined by Waters and Gasson as: "Active commitment to the social facilitation and direction of the community learning process." Waters and Gasson's (2006, p.719) definition of a complicator is as follows:

"A complicator is a participant who forces the community to reflect on assumptions and who suggests alternative interpretations. The complicator points out inconsistencies in arguments and may reframe questions in an original way. A student in the complicator role behavior communicates a perspective that redefines an initial position (an initial question or someone else's response) or suggests alternative perspectives to a proposed point of view and shows complications that arise from an approach."

To be able to identify a message in the forum as Complicator, one must read more than one posting and this context must include those that precede and follow so that inconsistencies in arguments or alternativeness to his/her interpretation can be discovered. When examined from a collaborative knowledge building point of view, however, Snowlove irrefragably played a dramatic and decisive role.

3.3. *Making sense of engaged lurking in group co-construction*

Our aim in this section is to draw on and interpret excerpts of online inquiry practice and accounts of engaged lurker practice to generate a dialogue around aspects of engaged

lurking as a way of participation in this small group. We explore how interactions are jointly organized and what possible consequence these forms of organization may have for engaged lurker participation as well as that of other members in group dynamics. Our interpretation brings to the foreground issues such as forms of reflection, the risk and bravery of being an engaged lurker, and speaking and silence.

The 69-post-long thread, on which our analysis is based, is set in the context of C2, working on team hypothesis building. There were 71 postings in week 2. In other words, by analyzing this specific thread we can grasp the whole picture of the collaborative formation of team hypotheses. The group was engaged in a propose-and-evaluate routine with each other in order to reach an agreement on team hypotheses. The main topic of the C2 group discussion was "Fog". Many hypotheses had been proposed and members engaged in modifying each other's claims.

This group was struggling over selecting the major factors responsible for the formation of the fog. However, their efforts were invalid because different types of fogs are formed under different conditions. There is no single factor can determine all types of fog and even a single one type of fog cannot always be attributed to one single factor. For example, they spent 15 postings on one single factor "wind", and another 10 postings on the factor "low temperature". Their team mentor, Tau, intervened once at posting #20: " … Maybe your confusion is coming from the misconception that you mixed different types of fogs when working on their cause-and-effect relationship …"

The following episode reveals when the engaged lurker delurked. Snowlove's (the Complicator) opinion at #45-47 was suddenly raised after 44 postings by other team-members had been interchanged.

No	Time	Member	*Title* / Content
40	0:50	010124	*Hypothesis!/* Fog is easier to take place at night than during the day!!!
41	0:51	Milkbottle	*Hypothesis!/* 010124! Give the reasons of your hypothesis or you will not be able to convince anyone.
42	0:52	Milkbottle	*A question/* It is drizzly in spring. Is it a kind of fog-like rain?
43	1:00	010124	*Answer/* Wind at high altitude is stronger than at lower altitude, so I proposed the first hypothesis. Wind over the sea is stronger than over the land, so I proposed the second one. The reason of the third one is that wind is always stronger during the day than at night.
44	1:03	Cathyjudy	*After reading the student book/* I come up with a hypothesis …, If the condition of **wind speed and** direction is appropriate, it is easier to form fogs.
45	3:00	Snowlove	*My view point about the wind … (radiation fog)/* (copying & pasting about the specific conditions for forming *radiation fog*) This is the resources I posted earlier (#3-

No	Time	Member	*Title* / Content
			2~4) … So I think radiation fog takes place under calm or light breeze (air) condition and **mostly over land** …
46	3:28	Snowlove	*My view point about the wind … (advection fog)/* (copying & pasting about the specific conditions for forming *advection fog*) Therefore, advection fog is likely to happen either in the sea or on the land. However, it is **more likely to happen in the sea.**
47	3:56	Snowlove	*Fogs…have many types indeed…/* (copying & pasting about the different conditions for the formation of different types of fog). My point is that maybe a few teams are also working on radiation fog and advection fog, so can we try a different way, look for materials of other kind of fog, and explore for some unique aspect of fog? (I am so sorry that I didn't propose this idea until now. I tried so many times but couldn't post it.)
48	9:22	Cathyjudy	*According to thread #15-43/* According to 010124, can we integrate many into one hypothesis? The occurrence of fog is closely related to wind, just as 010124 mentioned: the only key variable is wind.
49	9:40	Milkbottle	*According to thread #15-43/* So far we have proposed many conditions for the formation of fog: 1. low temperature, 2 high humidity, 3. less wind,
50	9:55	Milkbottle	*According to thread #15-49/* and 4. more condensation nuclei …
51	10:24	010124	*Frontal fog/* (copying & pasting about frontal fog)
52	10:25	010124	*Fog/* (copying & pasting about advection-radiation fog)
53	10:25	Milkbottle	Frontal fog/ (copying & pasting about the conditions for forming frontal fog.) … **It seems that this is a great topic to explore, what do you guys think?**
54	10:32	010124	Steam fog / (copying & pasting about the steam fog)
55	10:35	010124	*Steam Fog/* (continued)
56	10:35	Milkbottle	*Hypothesis*/ We could generate our main hypotheses from two approaches. One is based on factors (Low temperature is a better condition for the formation of fog.). **We can also base on the types of fogs** (Frontal fog is thicker when the difference of temperature of two air masses is larger.)
57	10:37	010124	*Upslope fog/* (copying & pasting about upslope fog)
58	10:42	010124	*Spring fog in early morning is a sign of clear sky/* (copying & pasting about the springtime radiation and advection fog)

No	Time	Member	*Title* / Content
59	10:44	010124	*Summer fog in early morning/* (copying & pasting about advection fog)
60	10:46	010124	*Heavy rain in early summer/* (copying & pasting the frontal fog)
61	11:11	Milkbottle	*The main hypothesis/* Under the conditions of large temperature difference, high humidity, and more condensation nuclei, the fog forms easily.
62	11:29	Cathyjudy	*The main hypothesis/* Fogs would take place under these conditions: the temperature difference is larger when the cold and warm air contact each other, the wind speed is appropriate, more moisture in the warm air and more condensation nuclei. I specially point out the humidity of warm air because it won't work out if it is under cool air …
63	11:50	Tau	*Worries about thread #15-23/* Is wind a required condition for forming frontal fog? Is it some kind of speculation or based on facts?
64	14:59	Milkbottle	*Answer/* Out of speculation~~~ The front would cause larger pressure difference, so the wind comes.
65	15:34	Milkbottle	*The main hypothesis/* In nature, cold air is below warm air when cold and warm air contact each other. A big temperature difference means the difference between the temperature of cold air and warm air. Under the conditions of more temperature difference, suitable wind speed, higher humidity and more nuclei in the air, fog forms easily.
66	15:40	Milkbottle	*Other factors related to common hypotheses/* such as orography, location, latitude, …
67	20:07	Milkbottle	*The variables of common hypothesis/* The main hypothesis is 'the humidity of warm air mass.'
68	20:30	Cathyjudy	*Some interpretations about the major variables/* The main variable is not just humidity, but the humidity of warm air. If the humidity of warm air is not high enough and the saturated water vapor pressure becomes lower, it does not reach saturation.
69	22:15	Snowlove	*Some interpretations about the major variables/* This is what I think … (omitted by the authors)…Beside humidity (because it is caused by droplets), the difference of temperature should also be critical to the formation of fog.

This episode shows that the effort of engaged lurkers in small group collaboration is threefold: 1) "copying and pasting" might be one of the major forms of reflection; 2) uprootedness is an occupational hazard of lurking; and 3) to enter actively into the perspective of another necessitates concentration and silence.

3.3.1. *"Copying and pasting" as forms of invisible reflections*

Although team mentor, Tau, intervened succinctly at #20, the group still didn't realize the core problem of their discussion. The concept of "wind" as the main variable in team hypothesis (#43) was started back in #18, and went through 25 postings (#18~#43), eventually to be accepted and integrated by the group member who had engaged more over a long period of time. But, the Complicator, Snowlove, who always remained silent in the group, broke her silence and submitted three postings (#45, #46, #47) at this stage to address the inappropriateness of the concept of "wind" as the main hypothesis.

Using mainly the "copying & pasting" strategy, Snowlove showed her opinion. In #45, she wrote "… radiation fog takes place … mostly over land …" under the title "My view point about the wind … (radiation fog)". In #46, she wrote "it is more likely to happen in the sea." under the title "My view point about the wind … (advection fog)". Snowlove clearly addressed the issue that the conditions for forming different types of fogs vary. She even re-addressed the difference in the titles. And then, in #47, she put "Fogs … have many types indeed" as the title in order to gain attention from her group. Copying and pasting external and authoritative resources at critical moments is used extensively by Snowlove to persuade her team members to diverge from the current direction.

However, given that Snowlove had not posted anything previously in this long thread, group members ignored her three new proposals by responding directly back to #43, posted by 010124. Group members even chose posting titles in such an ironic fashion: "According to thread #15-43" as well as "According to thread #15-49". This implied "We are not accepting your ideas". In #48-50, both Cathyjudy and Milkbottle kept summarizing group members' opinions on team hypotheses but excluded Snowlove's proposal and did not respond to her. We could see a silent and conflicted atmosphere after Snowlove attempted to raise a point counter to the direction of current group discussion. At this point, Snowlove's postings were regarded by the group members as being of little value.

"Copying and pasting" as a productive strategy for collaborative inquiry is not limited to engaged lurkers. It appeared that nobody cared for Snowlove's claims (#45, #46, #47), but 010124 did pay sufficient attention to it. Instead of using personal internal resources, 010124 also sought external resources to evaluate Snowlove's claim. 010124 took Snowlove's opinion and looked for authoritative references to check it, then copied and pasted eight authoritative references (#51, #52, #54, #55, #57, #58, #59, #60) to verify Snowlove's opinion as right. As a result, 010124's posting eventually evoked negotiation within the group.

3.3.2. *The risk and bravery of being an engaged lurker*

It takes time to recognize the legitimacy of the engaged lurker's participation. Snowlove is surely a legitimate member of this small group and, after initially rejecting it, the group members renewed discussion and consideration of the value of Snowlove's claim. Milkbottle also sought out an external resource to justify Snowlove's posting (#53) and then, convinced of its validity, supported her argument. In #53, he added his comments at end of the external resources: "It seems that this is a great topic to explore, what do you guys think?" Similarly, in #56, he wrote "We can also base on the types of fogs (Frontal fog is thicker when the difference of temperature of two air masses is larger.)". Clearly, he, as the most proactive member in this small group, began to shift the direction from investigating fog in general to specific types of fog.

Snowlove's argument became legitimate knowledge for the group members. Cathyjudy and Milkbottle, adopted the Complicator, Snowlove's, opinion which resulted in an adjustment to the direction of group discussion (#61~#68). From then on, all their discussion treated specifically the conditions of frontal fog. We can see that the vindication of this perspective revived the progress of group discussion which then went forward again toward a more workable team hypothesis.

Engaged lurkers seem to thrive on being lurkers: they love to engage in "lurk-delurk", and so would rather keep silent online than post something less thoughtful or of minimal value. Analyzing the sporadic postings the engaged lurkers have provided, we have reached a new understanding - that engaged lurkers are a less voluble type of participant but may well be passionate learners who have strong opinions about what to post and what not to post. For example, in week 4, Snowlove left a message: "Hello, I am back! I have read all the dialogues … I just haven't figured out what to reply to … You guys have worked so hard these days … I really feel sorry about that." (#24-4) Even though she had not posted anything for seven days, when she did delurk, she did not simply want to comply with the ideas of the others which would clearly have been the easiest way to show her co-presence.

The status of the engaged lurker is complex. It requires enough legitimacy to influence the development of the dialogues, mobilize attention, and address critical moments. However, as demonstrated before, engaged lurker, Snowlove, had an ambivalent type of membership and acceptance in the group. She is, by default, a legitimate member of this group, but often undermines her legitimacy by being only intermittently active in group discussion. Whenever she delurked, she had to face and overcome the stigma of being regarded as an intruder and the attendant rejection of her contributions. Group members' "sense of ourselves" quite often has to be redefined in this case. The engaged lurker therefore requires an ability to manage carefully the co-existence of membership and non-membership, yielding enough distance to bring a different perspective, but also retaining enough legitimacy to be listened to. Interestingly, the engaged lurker's profile is somewhat similar to that of broker, as described by Wenger (1998, p.110).

3.3.3. *Speaking and silence act in a reciprocal fashion*

We found it particularly interesting that most contributions and turns of threads could not be predicted from the active-passive dichotomy of the behavior of learners in online collaboration. Learners who were identified as engaged lurkers contributed in very important ways to the development of strong threads. In several of the preceding excerpts, we observed many cases in which the threads followed the suggestions made by the engaged lurking learner.

How did the contributions of engaged lurkers become so powerful? What did they do when they lurked? Given the evidence of Snowlove's experience, our study confirms that engaged lurkers allow themselves some space for reflective contemplation (Heller, 1996-1997) when they lurk. On the other hand, two facilitators, Cathyjudy and Milkbottle, were very proactive. They were too involved with what they wanted to say to really comprehend what was happening in group discussion. They didn't catch the team mentor's reminder, nor did they realize their discussion got stuck in the mud. Mary Reda's Between Speaking and Silence offers an important perspective: to enter actively into the perspective of another, to "listen with the intent to receive" requires focused energy that necessitates concentration and, yes, silence (Reda, 2009). Silence and language act in a reciprocal and complementary fashion in the construction of knowledge. When Snowlove finally positioned herself as a critic, we suddenly realize that she had spent an extensive amount of time pondering, engaging with group members in a silent way. The findings in the present study were an example.

This does not mean that we are recalling the old idea of abandoning the notion that "nothing is happening" when it is silent (Palmer, 1983). Rather, the results of the microanalysis challenge the individual-oriented framework view of lurker's online learning as seen in previous studies. The conventional approach in general pursues a more even level of contribution and an independent, self-regulated participation in lurking literature. Thus viewed, the less active members are examined on how much they learn from vicarious learning. However, from a collective view of learning, it is not how much they posted, but what they posted, and how it influenced knowledge advancement (Scardamalia, 1997) of the group that matters. Divisional differences do not necessarily lead to rifts along knowledge give-or-take lines. Instead, collaborative knowledge building is a collective enterprise with complementary contributions from diversified members. Given the support of the industrious members (i.e. 010124) in the collaborative inquiry process, the engaged lurker who was regarded as demonstrating very little contribution played a critical role. Her sporadic but critical comments were as important as those of the active members.

The threefold characteristics of the engaged lurker were interrelated and could not be understood in isolation. Silence and language act in a reciprocal fashion in the construction of knowledge (Kalamaras, 1994). Although the sporadic postings made it difficult for lurkers to become recognized and trusted by their teammates, the invisible engagement and participation cannot be ignored and neglected. Were we to assume that lurkers made little contribution due to the paucity of reified objects in this episode, we

might misinterpret their absence as a lack of participation. Understood in this way, visible postings and invisible participation are not interchangeable and do not substitute for each other. A closed and detail-oriented analysis of what transpired in the thread reveals that engaged lurkers engaged in rather discursive participation than what we thought.

4. Summary and Discussion

Many important aspects of asynchronous online discussion as it relates to learner contributions remain understudied. Lurking, as treated in this paper, is indeed one of those aspects. Learning may take place through reified objects that we can measure, but also through invisible participation that we ignore. The paucity of research done in lurking learning is not due to irrelevance or narrowness. It is, however, hampered by an inability to deal with both the visible and less visible aspects of learning. The lurker's "limited" contribution is therefore yet to be analyzed and the meaning of lurking has generally remained predetermined.

The framework reported in this paper is the result of our primary effort to provide theoretical coherence to our research while also addressing some inconsistencies found in the current literature on lurking learning. By adopting the duality perspective of online forum learning, this study reveals greater interplay between reified postings and less visible participation than has usually been interpreted by previous literature. Borrowing this duality, we do not mean to imply that one is visible and the other is invisible. In other words, they are not opposite or mutually exclusive. Participation is not merely what is not reified. They take place together. For example, we found the lurking learners observed (participation) keenly in order to contribute a post (reification). Without engaging in the forum discussion to certain degree, lurkers would not be able to congeal their meaning into a post. Thus, by analyzing the nature of the postings, the turn-taking, and the aspects their postings concern, this study reveals how postings and participation imply each other and accomplish lurker's learning in a particular way.

Lurking, based on this framework, was identified by examining unusual frequency ratios of online frequency to number of postings in small group forums as opposed to those of lurkers in large community forums whose postings were exiguous or nonexistent. Using a confluence of methods and taking a highly contextualized approach to analyzing the messages posted by lurkers, we discovered that one specific type of engaged lurker is highly contributive to collaborative knowledge building in our study ─ Snowlove is simply one example of them. Lurking with engaged participation in small groups re-conceptualizes the meaning of lurking, rendering the label less pejorative. This study therefore prefers the term "Engaged lurking" to "lurking" because there indeed exist different types of lurking. In particular, we even discovered that the proactive posters might not know the most and that, on the contrary, engaged lurking learners might be more knowledgeable than the rest. Certain themes which surfaced in this study are consistent with the findings found in prior research. For example, terms such as "pedagogical lurking" (Dennen, 2008), "non-public participation" (Nonnecke & Preece, 2003) and concentrated listeners (Wise, Marbouti, Speer, & Hsiao, 2011) were proposed

to be used instead of lurking because there are other forms of valid participation other than public postings.

The second objective is to investigate the nature of intent behind lurkers' sporadic postings and their influence on the development learning within their groups. It is to be hoped that this study opens somewhat the black box of what engaged lurkers do and improves the understanding of how learning takes place in the interplay between posters and their less visible but engaged partners. Little to no research has explored the nature of the lurking learners' postings because previous definition of lurkers was limited to participants who posted little or not at all. In our study, there an average of 29 postings was developed by these engaged lurkers. We are able to open the black box of what engaged lurkers do. It is adequate to evaluate only isolated messages, but the inter-subjectivity of these messages matters if we want to get a more complete picture of how members contributed to group learning. In the present study, Snowlove, who posted sporadically but logged in frequently, de-lurked surprisingly to be a Complicator at critical moments in group collaborative knowledge building. Although it is not uncommon to have learners such as Snowlove who pose sporadically after intense observation and incubation but with fruitful comments, it quite often happens in large communities without mutual accountability rather than in small group interaction. Online discussion, as a kind of knowledge building activity, is never a matter of submitting or stealing individual ideas, but a matter of sharing and scaffolding each other.

The third objective is to make sense of engaged lurkers' participation in small group knowledge building. Our research in general has contributed to the body of knowledge on visible-nonvisible moves that bring about knowledge building. Two issues revealed - critical contribution to group discussion and the risk to and bravery required of the engaged lurker, subjects which have not hitherto surfaced in research findings on online lurking.

First, rather than stealing knowledge from others, engaged lurkers may contribute significantly to the group. The concern of this study is collaborative rather than individual learning. Previous research has shown that online learner participation has been dominated by low-level conceptions of online participation, which have relied upon frequency counts as measures of participation (Hrastinski, 2008). Previous research on lurking has also been overwhelmingly concerned with the concept of "vicarious learning", recognizing the fact that lurkers benefit from observation of other posters. Nevertheless, the current conceptualization of lurking, based on individual learning, was insufficient to describe the phenomenon of lurking in CSCL environments. By analyzing both the discussion threads and the contextual surroundings, the engaged lurker in our study was found to be a Complicator, had the insight into the critical point under discussion, and revived the progress of group discussion which had been stymied. In other words, engaged lurker Snowlove was definitely one of the members who accomplished the team work. From a CSCL perspective, the engaged lurker participated deeply in group knowledge building.

Second, posting regularly may not work for everyone equally well. By identifying engaged lurkers in small group, we discovered a different portrait of the lurker: the risk and bravery of being an engaged lurker. The majority of research in CSCL puts more emphasis upon proactive members than on less talkative members while exploring the process of productive learning. Alternatively, the analysis of the less visible forms of participation suggests that engaged lurkers happened to play an important role in collaborative knowledge building. However, being an engaged lurker, the legitimacy of their membership was fragile and hazardous. Their sporadic postings created the perception on the part of group members that the lurker was less faithful and deserving of trust. Interestingly enough, the engaged lurker insisted on posting intermittently. Contrary to most of the lurking studies which encourage educators to increase the likelihood of individual contribution or delurking, this study appreciates and acknowledges the beauty of the heterogeneous practices and approaches and produces evidence of productive contributions stemming from diversity and variety.

As with any research, certain limitations of our findings must be noted. The results occurred very probably because our 82 small groups consist of all voluntary participants. Group members were free to participate at their own pace for six weeks. There was no specific mandate to produce a minimum number of messages. Any individual member of a group was to receive a certificate at end only if the group members as a whole agreed to put that member's name on the co-author list. That is to say, group members are supposed to care about co-presence if they wanted to be on the list. Paradoxically, if they don't care about being in a group, why would s/he lurk so often? This scenario is unlikely to be found by researchers in any formal institution. The operationalized definition of engaged lurker – members with a ratio of postings to logins of one standard deviation below the average – was appropriate and responsive to the data present. The findings therefore need to be viewed with caution as they would not necessarily be representative of other types of online collaborative learning environments. It is not our intent to imply that engaged lurkers were all engaged in the deepest level of involvement, but to unlock the value to collaborative knowledge building of the kind of engaged lurkers such as Snowlove in a group and to expand the spectrum of the lurking learners' potential position in small groups.

Moreover, one may be curious about how engaged lurkers differ from regular posters across groups. Although a comparative analysis was provided in Table 3, comparisons of the behavior of engaged lurkers versus regular posters may be inconsistent because the dynamics in each group vary. To study lurkers in small group, we calculated the ratio of postings to online logins and found a target at the extreme of this dimension and name them "engaged lurkers". As reported before, there was a large amount of variation between groups. It is not appropriate to provide a portrait of regular posters as well as of lurkers across groups. We therefore purposely selected only one long thread which covered postings of almost the entire week to explore the interaction between an engaged lurker and her members.

5. Conclusion

Past research on lurking has focused primarily either upon individual progress or on passive approaches to learning. However, a theoretical framework on the duality of participation and reification demands that attention be paid to the invisible engagement of lurkers in online discussions. This study shows that sporadic postings often reflect an ability to have insights into the critical points under discussion. It highlights the importance of investigating lurking behavior using methodologies such as the discourse analysis approach employed here. In addition, this study identifies three distinct types of lurkers and proposes that engaged lurkers shed new light on the understanding of conventional passive lurking behavior. Future work can investigate the context in which these different lurking behaviors were developed, examine the respective roles they each played in group knowledge building, explore techniques for early detection of reluctant lurking and can apply design-based interventions in support of more productive knowledge co-construction in online discussions.

Acknowledgments

This work was supported, in part, by National Science Counsel Grants NSC 97-2511-S-008-002-MY3, NSC 99-2631-S-008-001-, and NSC 100-2511-S-008-015-MY3.

References

Arnold, N., & Paulus, T. (2010). Using a social networking site for experiential learning: Appropriating, lurking, modeling and community building. *Internet and Higher Education*, *13*, 188–196.

Beaudoin, M. F. (1998). Guest editorial: Leadership in distance education. *American Journal of Distance Education*, *12*(2), 1–4.

Beaudoin, M. F. (2008). Reflections on seeking the 'invisible' online learner. In J. Visser & M. Visser-Valfrey (Eds.), *Learners in a changing learning landscape: Reflections from a dialogue on new roles and expectations* (pp. 213–226). London: Springer.

Bishop, J. (2007). Increasing participation in online communities: A framework for human-computer interaction. *Computers in Human Behavior*, *23*, 1881–1893.

Chang, H. M., Chen, F. C., Zhang, K. T., & Tzeng, R. Y. (2011). *The critical moments of knowledge co-construction: Reconsidering meaning-making of postings in online group discussion*. Paper presented at the proceedings of the Computer Supported Collaborative Learning Conference, Hong Kong, China. July 4-8, 2011.

Chen, F. (2004, June). *Passive forum (lurking) behaviors: A community perspective*. Proceedings of the 6th International Conference of the Learning Sciences(ICLS): Embracing Diversity of the Learning Sciences (pp. 128–135). (ISBN 0-8058-5301-4)

Dennen, V. P. (2008). Pedagogical lurking: Student engagement in non-posting discussion behavior. *Computers in Human Behavior*, *24*, 1624–1633.

Ebner, M., & Holzinger, A. (2005). Lurking – An underestimated human–computer phenomenon in closed online courses. *IEEE MultiMedia*, *12*(4), 70–75.

Egan, C., Johal, J., & Jefferies, A. (2006). *Providing fine-grain feedback within an online learning system – Identifying the workers from the lurkers and the shirkers*. Paper presented at the 4th European Conference on e-Learning (ECEL04), Amsterdam.

Fritsch, H. (1999). Host contacted, waiting for reply. In U. Bernath & E. Rubin (Eds.), *Final report and documentation of the virtual seminar for professional development in distance education* (pp. 355–378). Oldenburg, Germany: Bibliotheks- und Informationssystems der Universität Oldenburg.

Guzdial, M., & Carroll, K. (2002). *Exploring the lack of dialogue in computer-supported collaborative learning*. Paper presented at the Proceedings of CSCL 2002. Boulder, CO: Lawrence Erlbaum Associates.

Hammond, M. (1999). Issues associated with participation in on line forums – The case of the communicative learner. *Education and Information Technologies, 4*, 353–367.

Heller, M. (1996-1997). A proposal for silence. *Friends Association for Higher Education, 2*, 7.

Hew, K. F., Cheung, W. S., & Ng, C. S. L. (2010). Student contribution in asynchronous online discussion: A review of the research and empirical exploration. *Instructional Science, 38*(6), 571–606.

Hrastinski, S. (2008). What is online learner participation? A literature review. *Computers & Education, 51*(4), 1755–1765.

Jiang, H. M., & Chen, F. C. (2003). *Attributes of drop-outs in inquiry-based online community*. The 7th Global Chinese Conference on Computing in Education Conference (GCCCE), Nanjing, China.

Kalamaras, G. (1994). *Reclaiming the tacit dimension: Symbolic form in the rhetoric of silence*. Albany: State University of New York Press.

Kim, H., & Song, J. (2005). The features of peer argumentation in middle school students' scientific inquiry. *Research in Science Education, 36*(3), 211–233.

Knowlton, D. (2005). A taxonomy of learning through asynchronous discussion. *Journal of Interactive Learning Research, 16*(2), 115–178.

Lakkala, M., Rahikainen, M., & Hakkarainen, K. (2001). What promotes learning in the context of CSCL? In M. Lakkala, M. Rahikainen & K. Hakkarainen (Eds.), *Perspectives of CSCL in Europe: A review* (pp. 10). Retrieved October 18, 2010, from http://www.euro-cscl.org/site/itcole/ D2_1_review_of_cscl.pdf

Lee, Y. W. (2004). *Passive lurking behavior in the online learning community: A neglected full participation*. Unpublished master's thesis. National Central University, Taoyuan, Taiwan.

Lee, Y. W., Chen, F. C., & Jiang, H. M. (2006). Lurking as participation: A community perspective on lurking behaviors. *The Official Journal of Global Chinese Society for Computer in Education, 4*(1).

Lin, C. C., & Tsai, C. C. (2011). Applying social bookmarking to collective information searching (CIS): An analysis of behavioral pattern and peer interaction for co-exploring quality online resources. *Computers in Human Behavior, 27*(3), 1249–1257.

Mazzolini, M., & Maddison, S. (2003). Sage guide or ghost? The effect of instructor intervention on student participation in online discussion forums. *Computers & Education, 40*, 237–253.

McKendree, J., Stenning, K., Mayes, T., Lee J., & Cox, R. (1998). Why observing a dialogue may benefit learning: The vicarious learner. *Journal of Computer Assisted Learning, 14*(2), 110–119.

Neelen, M. (2010). Lurking: A challenge or a fruitful strategy? A comparison between lurkers and active participants in an online corporate community of practice. *Int. J. Knowledge Learning, 6*(4), 269–284.

Nonnecke, B. (2000). *Lurking in email-based discussion lists*. Unpublished doctoral dissertation, South Bank University, London.

Nonnecke, B., & Preece, J. (2003). Silent participants: Getting to know lurkers better. In C. Lueg & D. Fisher (Eds.), *From Usenet to CoWebs: Interacting with social information spaces*. Retrieved from http://www.springer.com/computer/ hci/book/978-1-85233-532-8

Orton-Johnson, K. (2007). *The online student: Lurking, chatting, flaming and joking*. Retrieved October 18, 2010, from http://www.socresonline.org.uk/12/6/3.html

Palmer, P. (1983). *To know as we are known: A spirituality of education*. San Francisco: Harper and Row.

Piaget, J. (1928). *The judgment and reasoning in children*. London: Routledge and Kegan.

Preece, J., Nonnecke, B., & Andrews, D. (2004). The top 5 reasons for lurking: Improving community experiences for everyone. *Computers in Human Behavior*, *20*(2), 201–223.

Ramirez, A., Zhang, S., McFrew, C., & Lin, S. F. (2007). Relational communication in computer-mediated interaction revisited: A comparison of participant-observer perspectives. *Communication Monographs*, *74*(4), 492–516.

Reda, M. M. (2009). *Between speaking and silence: A study of quiet students*. New York, NY: SUNY press.

Rogoff, B. (2003). *The cultural nature of human development.* Oxford: Oxford University Press.

Romiszowski, A., & Mason, R. (2004). Computer-mediated communication. In D. H. Jonassen (Ed.), *Handbook of research for educational communications and technology* (pp. 397–431). NJ: Lawrence Erlbaum.

Sanderson, P. M., & Fisher, C. (1994). Exploratory sequential data analysis: Foundations. *Human-Computer Interaction, 9*, 251–317.

Scardamalia, M. (1997). *Networked communities focused on knowledge advancement*. Presented at the AERA annual meeting, Chicago, IL.

Scardamalia, M., & Bereiter, C. (2003). Knowledge building. In *Encyclopedia of education*. New York: Macmillan Reference, USA.

Schegloff, E. A. (2007). *Sequence organization in interaction: A primer in conversation analysis*. Cambridge, UK: Cambridge University Press.

Soroka, V., & Rafaeli, S. (2006). *Invisible participants: How cultural capital relates to lurking behavior*. Paper presented at the proceedings of the 15th International Conference on World Wide Web (pp. 163–172).

Strijbos, J. W., & De Laat, M. F. (2010). Developing the role concept for computer-supported collaborative learning: An explorative synthesis. *Computers in Human Behavior, 26*, 495–505.

Suthers, D. D. (2011). *Interaction, mediation, and ties: An analytic hierarchy for socio-technical systems*. Paper presented at the proceedings of the Hawaii International Conference on the System Sciences (HICSS-44), January 4-7, 2011, Kauai, Hawaii.

Suthers, D., Dwyer, N., & Medina, R. (2010). A framework for conceptualizing, representing, and analyzing distributed interaction. *Journal of Computer-Supported Collaborative Learning, 5*(1), 5–42.

Trausan-Matu, S., & Rebedea, T. (2009). Polyphonic inter-animation of voices in VMT. In G. Stahl (Ed.), *Studying virtual math teams* (pp.451–473). NY: Springer.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological process*. Cambridge, MA: Harvard University Press.

Waters, J., & Gasson, S. (2006). *Social engagement in an online community of inquiry*. Paper presented at the 27th International Conference on Information Systems (ICIS 2006), Milwaukee, WI.

Weimann, G. (1982). On the importance of marginality: One more step into the two-step flow of communication. *American Sociological Review, 47*, 764–773.

Wenger, E. (1998). *Communities of practice: Learning, meaning and identity*. Cambridge: Cambridge University Press.

Wise, A. F., Marbouti, F. Speer, J., & Hsiao, Y. T. (2011). *Towards an understanding of "listening" in online discussions: A cluster analysis of learners' interaction patterns*. Paper presented at the International Conference on Computer Supported Collaborative Learning 2011, Hong Kong, China.