Building an Online Collaborative Learning Community in Ubiquitous Learning Environment

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Abstract: The paper aims at understanding to what extent the learners could engage in online collaborative discussion and generate sustained, productive knowledge building discourse in ubiquitous learning environment in a social context. Online discourse data in an inquiry case and a survey responses were analyzed to examine learners' effort for idea improvement and attitudes towards online building community respectively. The findings indicate that in ubiquitous learning environment discussions are strengthened by social networks and the collaborative learning community can be built on the social interactions and collective knowledge advancement by generating productive knowledge building discourse.

Keywords: Ubiquitous learning, online asynchronous discussion, collaborative learning community, knowledge building

1. Introduction

With ever increasing advanced capabilities of personal devices and popularity of novel web services, more learners have engaged in online collaboration learning to build shared understanding through social networking and computer-mediated communication, in addition to searching for required information. Rather than just acting as a repository for online reading, online asynchronous discussion forum has become an effective avenue for collaborative inquiry through identifying, examining and reflecting upon ideas (Collison, Elbaum, Haavind & Tinker, 2000). Moreover, it enables a collaborative space for the creation of positive collaboration learning environment and community culture (Wei, 2013; Xia, Fielder, & Siragusa, 2013), where a wide range of learners engage in an inquiry about a problem and collective idea is improved through the progressive collaborative inquiry from the perspective of knowledge building. However, not all the discussions is helpful in creating and sustaining an online community of inquiry. Advances in Internet and ubiquitous computing enable a new means for building collaborative learning community through synchronous discussion where learners could use multiple devices to access learning materials and to support their learning activities, anytime and anywhere.

The paper aims at understanding to what extent the learners could engage in online collaborative discussion and generate sustained, productive knowledge building discourse in ubiquitous learning environment in a social context. Following an overall description of the asynchronous discussion platform, Content analysis on an inquiry case in *Zhihu* was to examine learners' effort for idea improvement during the process of collaborative discussion. A survey responses were also analyzed to present learners' attitudes towards the formation and sustainment of learning community. This paper also tries to enlighten researchers and practitioners on effective ways for promoting learners' active participation in online discussion and facilitating the collaborative knowledge building processes. Specifically, the research questions are as follow:

1. How do learners engage in the discussion in ubiquitous learning environment?
2. During online asynchronous discussion activities, what are the characteristics of the learners' behavior contributing to idea improvement in the social context?
3. What are the learners' attitudes toward building online communities through online asynchronous discussion?

2. Literature Review

2.1 Online collaborative learning

Collaboration is commonly used to encourage learners' engagement and enhance their understanding through collaborative inquiry in online learning environments. In the past several decades, there has been an upsurge in research on computer-supported collaborative learning (CSCL). To attempt to initiate learners into a knowledge creating culture, researchers have developed the conceptual framework of knowledge building in which learners work together through CSCL to advance collective knowledge and understanding (Scardamalia & Bereiter, 2006). Knowledge building is defined as "the production and continual improvement of ideas of value to a community" (Scardamalia & Bereiter, 2003), which focuses on the social process of collaborative inquiry in asynchronous discussion environment where learners post ideas and comments to generate questions, co-construct explanations, and revise their ideas. In the process, learners' ideas are regarded as conceptual artefacts of inquiry to be discussed, inter-connected, revised, and superseded for achieving idea improvement (Stahl, 2006). Such collective idea improvement is of great value to online collaborative learning community of inquiry where learners collaboratively build upon each other's knowledge, resulting in the creation or modification of community knowledge through discourse and discussion.

2.2 Online learning environments

Asynchronous discussion forums have been used in a wide range of formal and informal learning setting. Despite the generalized BBS in daily lives, typical instructional management software environments, like Blackboard, Moodle and WebCT are also available to asynchronous discussion forum. It is considered an extension of instructional practices that promotes dialogue, reflection, knowledge construction and self-assessment (Gao et al., 2013). Although many researchers regard online Q&A discussion forums as a valuable learning

resource (e.g., Cheng, Liu, & Shieh, 2012), the quality of online discussion and communication were questioned. Thomas (2002) argued that they "might not be the best technology to support the interactive and collaborative processes essential to a conversational model of learning". The main problem is that they may fail to foster naturally productive discussions that are focused, interactive and in-depth (Gao et al., 2013), thus failing to promote collaborative learning (Guzdial & Turns, 2000) and militating against deepening inquiry (Scardamalia & Bereiter, 2006). Because the isolation among the learners in asynchronous discussion, can hinder them from interacting and building knowledge together, discussions can be invaluable toward creating and sustaining an online community of inquiry (DeNoyelles et al., 2014). In view of this, it's need to integrate the emerging technologies to design online learning environments that have the capability to facilitate complex learning and sustain a strong sense of community that supports students' learning socially and cognitively (DeNoyelles et al., 2014; Gao et al., 2013; Wei & Chen, 2006). Some systems are designed or introduced to enable collaborative learning through discussion forums. Guzdial and Turns (2000) designed a computer-mediated anchored forum to increase the effectiveness of sustained, broad participation and on-topic discussions by using anchors. An anchor is a topic that students find worthy of discussion in the forum, but the anchors are static and not initiated by students. Lin, Hou et al.(2013) used a popular SNS, Facebook, to support students' asynchronous online discussions of project-based learning activities and found that the essential social nature of Facebook play an important role. In the same way, LeNoue et al. (2011) suggest that a well-designed social networking site can provide probability for diversified opportunities for learners by facilitating both broad and deep interactions.

2.3 Using ubiquitous computing tools to support discussion activity

The rapid developments of wireless networking technology and powerful mobile devices have led to the landscape of ubiquitous computing as Weiser proposed, and have given rise to the emergence of ubiquitous learning environments where learners can become completely immersed in the learning process or learning activity in any situation (Jones & Jo, 2004). Supported by proper technological affordances and activity structures in ubiquitous learning environments, learners can easily access rich resources and actively participate in learning activities anytime and anywhere through any device (Jones & Jo, 2004; Wei & Chen, 2006). Thus we unconsciously and effortlessly harness their digital abilities as effort-saving strategies for achieving the benefits of distributed intelligence (Pea & Maldonado, 2006). Ubiquitous learning environment was featured by Yahya et al. (2010) in the following characteristics: 1) Permanency, 2) Accessibility, 3) Immediacy, 4) Interactivity, 5) Context-awareness, and 6) Adaptability. Previous studies have proved the great potentiality of ubiquitous computing tools in improving discussion activities accordingly. Researchers have indicated that using mobile devices to support discussion activities may promote acquisition and exchange of authentic learning experience, improve collaborative interaction encourage active learning (Lan, Tsai, Yang, & Hung, 2012; Wei & Chen, 2006). For instance, Yang and Lin (2010) integrated tablet computers with personal digital assistants (PDAs) together to facilitate collaborative discussions and information sharing, and improve learners' abilities on classifying plants. Wong et al.(2010) presented a seamless learning environment with mobile device where

learners can use smart phones to capture photos of real-life contexts pertaining to Chinese idioms, and engage in in-class or out-of-class sharing and discussions in personal and social learning spaces. Therefore, various types of discussions and learning activities are enabled in ubiquitous learning environment.

3. Methodology

This research employed the method of content analysis to analyze an inquiry case and survey response, to explore the formation and sustainment of a community of inquiry by examining the process and motivation about collaborative knowledge building in asynchronous discussion forum, *Zhihu*.

3.1 Research context

Zhihu, is a well-known open online question and answer discussion forum based on social networking in China, where many authentic, complex and novel problems are being discussed by the public. It emphasizes on posting problems and seeking help from peers, facilitating collaborative thinking, and building a community. Meanwhile, a mobile App called *Zhihu Daily* has been designed to present dozens of valuable contents generated in the process of discussion. According to *Alexa* (a web traffic tracking subsidiary of amazon, http://www.alexa.cn/) , the number of Daily Pageviews per Visitor in *Zhihu* (http://www.*Zhihu* .com/) and *Zhihu Daily* (http://www.*Zhihu* daily.net/) is higher than similar Q&A sites as *Baidu Knows* (http://zhidao.baidu.com/) and *IASK* (http://iask.sina.com.cn/), see in table 1. It means that users in *Zhihu* tends to be more engaged and deep thinking in the discussions.

Table 1: the number of Daily Pageviews per Visitor in August 11, 2014.

	Baidu Knows	*IASK*	*Zhihu*	*Zhihu Daily*
Daily Pageviews per Visitor	4.21	1.45	5.75	6.1

Zhihu and *Zhihu Daily* can be accessed using a web browser or by using the mobile app, which helps learners to easily engage in a community of inquiry about a problem via different digital devices (e.g. smart phones) anytime and anywhere. *Zhihu* has adopted typical features of search, endorse, wiki and follow in social networking. Thus as an asynchronous discussion forum, its features enable learners engage in collaborative inquiries to solve authentic and in-depth problems in a more interactive way, such as raising questions for inquiry about a problem; clarifying questions by revising anyone's question; endorsing and commenting quality answers to actively discuss and construct deep explanation; following up an answer for a discussion in a new thread through commenting; searching and following related problems or inquiry topic, proper learners to engage in the inquiry and a community of inquiry. It turns out that diverse ideas are generated and exchanged, learners engage in sustained progressive discourse to revise, combine, synthesize and produce rise-above ideas to advance the collective knowledge in the online platform. Gradually, a knowledge-building community has been built and their social networks have been reinforced through continuously interaction, thus contributing to effective knowledge work in the community space. In this study, *Zhihu* is described as a ubiquitous

learning environment for its nature of interaction and community of inquiry, where learners can easily get immersed in the inquiry about a contextual problem and achieve the sustainment of community by means of collaborative effort.

Figure 1. Features of the platform *Zhihu*.

3.2 Data collection and analysis

Our data collection was comprised two parts: notes in an inquiry and a survey in *Zhihu*. Content analysis were employed to analyze online interaction in the inquiry and survey response. In the study, a typical scientific inquiry case in *Zhihu* were analyzed to explore how learners engage and advance knowledge in discussion. And the problem in the inquiry is:

Birds'「Knees」bend backward, human knees bend forward, why did they evolve so differently?

The problem was posted on December 30 2013, but the inquiry on it were lasted until now, along with 500 learners following the inquiry. For this study, all the responses (including questions, answers, and comments) involved in the inquiry were collected. Thus we collected a total of 260 notes on the day of August 13 2014, among which 221 notes were comments to quality or interesting answers, excluding the notes without any obvious meaning. But not all the notes were address the problem, some were about social interaction within the community. So we divides each note to idea unit—the smallest unit of text that conveyed a distinct idea or meaning, and each unit were coded into the coding categories (shown in Table 2.).

To understand deeply the motivation of sustainment in the discussion, we analyze a survey "Why did you participate in discussions in *Zhihu*?" posted in *Zhihu*. There are over 300 users

participate by answering, commenting and endorsing on the responses to it. We collected 73 responses and used qualitative coding techniques, to code and analyze the responses. We then categorized the codes to explore learners' attitudes and explain the sustainment of building online community in asynchronous discussion.

Table 2. Coding categories

Categories	Description
progressive inquiry	Raising questions or making explanations to the problem
Social interaction	Complimenting, appreciating the answer, greeting, connecting or sharing with other learners and expressing emotions

4. Results and discussion

4.1 How did learners engage in addressing problem in the discussion?

Although the inquiry was lasted about one year, the discussions were continued with active participation and timely responses. In the inquiry, the ideas generated in the inquiry received 2448 endorsements. And once a theory or personal idea was posted, learners can be quickly informed to response to the idea. The results of coding showed most discourse activities in the inquiry(65%) were related to community building through social interaction, such as complimenting, expressing emotions, appreciating the answer, greeting, connecting or sharing with other learners using the features of social networking(e.g. @ sb.) and so on. 38% of notes were devoted to extending or deepening the inquiry, such as continuing a thread by arguing or quoting from other's messages, referring explicitly to other messages and raising a new discussion thread, stating learners' personal ideas. Progressive inquiry was evident in the notes addressing the problem that were characterized in a network of learners' interaction represented in Figure 1. The network revealed how the learners set forth their ideas and question, and addressed increasingly complex problems. And the ideas were improved in extended discourse about reviewing progress, identifying the synthesis, rise-above new ideas and lines for the collaboration inquiry. For example, the learner (XKC) answer made an explanation on bird's bones of leg, leading other learners to the understanding that birds are digitigrade. Based on this understanding, learners generated further problems and statements of what they needed to know in comments, such as: "If dogs' knees bend backwards"? (by CG). They could also comment on an existing thread to build up the argument related to the discussion thread, such as the learner (LL).

4.2 How did learners change their understanding within their discourse space?

In the inquiry, learners used the public space to invite peer input, and to generate potential solutions on the problem. After the first question about the problem of birds' knees was posted, questions on it were clarified and refined constantly in seven times by modifying or raising new questions. And in the process, the problem was clarified from a misunderstanding to generate a series of good questions, such as "Look carefully, you will find that (the joint bending backwards) is not the knees, but the ankle joint."[by ZH], "Why would humans followed with their heel?" [by YY], "Comparing to the way of plantigrade, what's the advantage in way of

digitigrade? ”[by YY] .These results indicate that learners changed their understanding of birds’ knees from a misunderstanding towards a more scientific view.

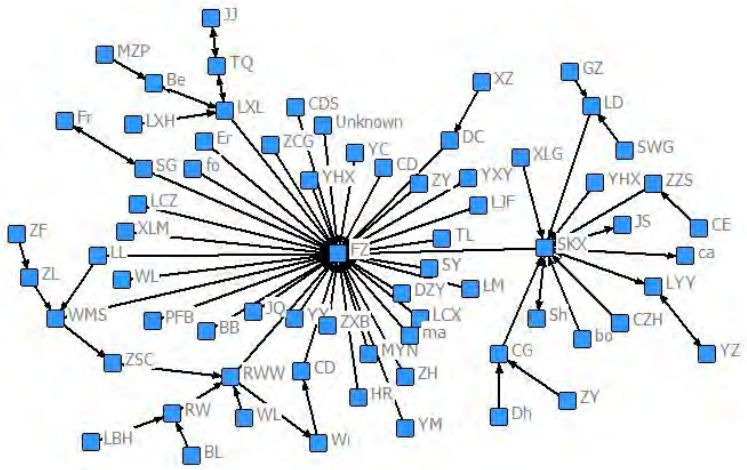

Figure 1. Network of learners’ interaction in the inquiry.

Table 3 reports the number of notes (a) raising factual problems that’s seeking for factual information for peers to address; (b) raising explanatory problems that’s explanations about “why”, “how” and so on. Empirical data such as experimental results, personal observations, and life experiences were found in 16 notes (64%) among all the explanation in the main discussion thread. According to the two patterns using empirical data proposed by Zhang et al. (2007), empirical data can be used in descriptive or explanatory approach.10 notes were a description of experiments, observations, or experiences without elaboration of ideas, other 6 notes were integrated empirical data to justify and improve learners’ ideas and received most endorsements and comments during the inquiry, that is productive to the knowledge building community (Zhang et al., 2007). So there’re 5 discussions thread continued and 11 new discussion threads raised in these comments altogether in addition to these notes to examine and interpret these evidence critically. Meanwhile, other expert resources were introduced as evidences to support their ideas, which are helpful to deeper understanding in the community. These results indicate how learners changed their understanding of birds’ knees from an observed phenomena in real lives towards a more scientific view.

Table 3: Number of problems in the inquiry.

	Number of notes raising factual questions	Number of notes raising explanatory questions
Total in the inquiry	11	5
Total in comments	9	2

4.3 What are the learners’ attitudes toward building online communities?

What is most essential to the sustainment of online learning community to advance collective knowledge like *Zhihu*, is the participation of its learners. What motivates learners to essentially provide knowledge services for others without any explicit rewards and teachers’ instruction?

Most of our understanding of learners' attitudes comes from the survey "Why did you participate in discussions in *Zhihu?*" in it. In the survey, most learners gave multiple reasons. By far, the most often mentioned reasons were enjoy helping, learning, hobby, which is in accordance with prior research (Lou, Fang, Lim, & Peng, 2013) expectedly. Thus a platform supporting ubiquitous learning can be characterized from their survey responses to explain the community building. We will discuss each in below.

4.3.1 Supporting collaborative inquiry on authentic problems

Although various novel internet technologies have emerged, the argument that "it is difficult to find a place where you would feel funny in the Internet" was common in the survey responses. For learners in *Zhihu*, it's a place that can "acquire knowledge in reality along with novel ideas" to meet curiosity and interests, thus getting immersed. Authentic problem held some of learners' learning motivations and provided question sources for inquiry from a cognitive perspective. It's important implications for developing a community where learners can pursue their own questions and contribute ideas for inquiry to build on ideas, concepts and explanations about problem through discussion in society. So the community supporting the collaborative work of improving ideas on authentic problem is critical. Regarding *Zhihu*, Said one respondent:

> *When there is a related problem in front of you, you can express and examine your ideas (in Zhihu).*

The problems contribute greatly to collaborative inquiry, as a respondent stated:

> *At the beginning (I) contributed a lot of answers to the questions relating my own profession. It's not only to let others understand the area more comprehensively, but also to tease my knowledge better. Then the problems in this area were almost answered. But I found I know little about other area…… Participating in Zhihu can be considered as an inspiration for me to read more books and to explore more.*

4.3.2 Distributed Expertise

A progressive inquiry intends to engage the community in a shared process of knowledge advancement and to convey simultaneously the cognitive goals for collaboration (Muukkonen, Hakkarainen, & Lakkala, 2004). Not only delivering tasks or productions on time, employing socially distributed cognitive resource in the inquiry process is high valued by many respondents in the survey. With the help of social networking, learners can easily assemble right experts to engage in or deepen the inquiry and even generate new knowledge by introducing empirical data and expert resources to build social knowledge network and advance collective knowledge. Diversity in expertise among participants, and interaction with expert cultures, promotes knowledge advancement (Muukkonen, Hakkarainen, & Lakkala, 2004). So benefiting from the distributed expertise, the platform impresses learners that valid solution to problem is right there and it can meet their need of just-in-time learning anywhere. A respondent stated his online learning needs:

> *We need systematic fragmentation information…… There's someone answer your question systematically once question posted in Zhihu without much time……An anonymous users in it can provide awesome goods, and it's second to none.*

4.3.3 Peer help

Like-minded peers were frequently mentioned in the responses. Peer help with numerous pedagogical advantages (Wei & Chen, 2006) is of great helpful when Web-based learning environments have become quite common without enough teachers' instructions. Many respondents indicated the ability to dialogue with friends with common topics increased the activity of the discussion, and encouraged a sense of community with helping each other. Hew and Cheung (2011) believed that it's helpful for knowledge advancement when peers provided comments, showed appreciation and encouragement, and summarized the discussions. The Internet spirit of openness, equality, collaboration and sharing was used to express the cognitive value of social collaboration the cognitive value of social collaboration in a response:

> *Zhihu is open and equal to all people without any differences in professional and identity. Each questioner would need and respect the exchange of ideas and you. Collaboration: A question will be answered by all kinds of people, eventually integrate of the most appropriate answer through collaboration. Sharing: a useful answer, would pass to people in most need through other people.*

A certified public accountants stated the benefits considerably from peer help:

> *My expertise shared through Zhihu and Zhihu Daily were recognized and praised by many people including knowledgeable expert. This motivation inspired by the recognition is far more than that in other Internet platforms.*

5. Conclusion and implications

In this study, we analyzed an online collaborative inquiry in social context to examine learners' efforts for idea improvement by generation of deepening questions, social interactions focusing on idea advancement, constructive use of empirical data and authoritative sources in notes. The findings show that the social networking provide possibility for learners to continue discussions, facilitate ideas to spread and sustain community of inquiry in communal space through encouragement, drawing in participants, endorsement, appreciation. In ubiquitous learning environment, the community has been sustained by enabling learners to access inquiry process anytime and anywhere. And supporting with collaborative inquiry on authentic problems, distributed expertise, peer help, increased question generation and consequent knowledge construction can lead to a virtuous cycle within the community through productive knowledge building discourse, where learners can ask better questions, construct their own knowledge when participating in collective idea improvement.

As for the limitations in the study, there's only an inquiry case analyzed to examine the process of idea improvement. And adding more inquiry cases is need. And it is important to use more diverse methods to analyze online synchronous discussions in ubiquitous learning environment. As social learning interactions play an important role, in addition to the use of quantitative content analysis, future researchers should include methods such as social network analysis and sequential analysis.

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