

Web-Based Collaborative Learning Environment: Theoretical and Practical Discourse, and Future Directions

Seungyeon Han Beaumie Kim Shiang-Kwei Wang Kakali Bhattacharya

Abstract

The purpose of this paper is to discuss appropriate theoretical orientation for collaborative learning in a WBLE, identify current and potential challenges and solutions to collaborative learning on the web, and recommend future directions for research and development. The review of theoretical and empirical issues indicates, a research agenda is required to gain a better understanding of the social, affective, and cognitive processes involved in collaborative learning in a WBLE. The use of WBLE as a medium for collaborative learning has in many respects outstripped the development of theory on which to base such utilization.

The field of Web-based learning has evolved over the past decade; nevertheless, the development of Web-based learning environment (WBLE) has been focused on the use of emerging Internet technologies without fully considering the previous research on the learning as a social process (Hmelo, Guzdial, & Turns, 1998). The social process of learning can involve participation in a community where learners make inferences of phenomenon through group discussions. With the vast spread of the web, it was not until recently that collaborative learning became increasingly popular (Bull, Bull, & Sigmon, 1997). The goal of this paper is to discuss appropriate theoretical orientation for collaborative learning in a WBLE, identify current and potential challenges and solutions to collaborative learning on the web, and recommend future directions for research and development.

Theoretical Orientation

Research and development of web-based learning environment and activities rely heavily on the underlying theories of cognitive development, such as theories of Piaget, Vygotsky, and Spiro (O'Donnell & King, 1999; Topping & Ehly, 1998; Tudge & Rogoff, 1989).

Meaning-Making Through Collaboration: Piagetian Perspective

According to Piaget, children think and acquire knowledge through their actions; the successful action precedes the conceptual understanding in their learning. Thus, a learning environment should be designed to facilitate individual learners to initiate and complete their own activities, which leads them to make meaning, discover problems, and resolve problems within their minds (Driscoll, 1994; Lis & Golbeck, 1999). Piaget believed that peer interactions are essential in helping children move beyond egocentric thought. Learners who are close in age are likely to have similar cognitive structures; hence they can understand each other's logic of thinking better than adults (Piaget, 1951; Driscoll, 1994). Learning through a series of actions with peers, however, does

not guarantee that the learners in the group share the same level of understanding. Cognitive development, defined by Piaget, is a process where the learners reconcile their cognitive conflicts as expressed by their different points of views. This process allows learners to infer meaning through collaborative learning. An individual learner brings important value to the group that enhances the quality of learning and level of understanding (Lis & Golbeck, 1999; Topping & Ehly, 1998).

Overcoming Challenges Through Collaboration: Vygotskian Perspective

According to Vygotsky (1962, 1978), collaborative learning, either among students or between students and an expert (or a more competent peer), is essential to learners in advancing through their zone of proximal development (ZPD) (Warschauer, 1997). ZPD refers to the difference between the learner's actual independent problem solving ability and the potential ability to solve problems under expert guidance or in collaboration with more capable peers (Vygotsky, 1978). Unlike Piaget (1951), Vygotsky (1978) does not focus on the benefits of peer collaboration, but more on those of the adult-child interaction. His theory suggests that cognitive growth may occur not only when adults assist children but also when children collaborate with a more competent peer. It is important for learners to be exposed to a higher level of reasoning than their current level so that ZPD can be exposed and confronted (Hogan & Tudge, 1999).

Vygotskian scholars have stressed that learners need to take each other's perspective into account and come to joint understanding of a problem (Hogan & Tudge, 1999; Wertsch, 1985). Individuals bring their unique characteristics that are not only socially rooted but also shaped from their personal experiences to any kind of interactions (Vygotsky, 1994). Vygotsky's position is that knowledge does not preexist in the world, but is socially constructed first and then individually absorbed (Hogan & Tudge, 1999). In other words, Vygotsky's sense of collaboration is not just

learners simply working together or one person demonstrating solutions to the other, rather learners are co-constructing the solution to a problem in a joint decision-making process (Driscoll, 1994). Vygotskians maintain that construction of a ZPD facilitates the internalization of this shared knowledge. However the conditions under which shared knowledge is created and internalized by competent collaboration partners remains yet to be explained (Hogan & Tudge, 1999).

Acquiring Advanced Knowledge Through Collaboration: Cognitive Flexibility Theory

According to Spiro, Feltovich, Jacobson, & Coulson (1993), information acquired in a real-world context is better retained, results of the learning is more generative, higher order, more meaningful, and the transfer of that learning is broader and more accurate. Rather than treating practical, professional problems as simple, linear sequences of decisions, learning of complex knowledge domains should include an authentic experience of facing real-world practitioners by providing a variety of cases to illustrate the content (Jonassen et al., 1997). Authentic cases should require the same thinking and activities that is required in the real-world context. Working on these cases in groups can provide opportunities to brainstorm and collaborate with each other to compare and contrast the similarities and differences between the complex cases as practitioners do in the real-world situations (Jonassen et al., 1997)

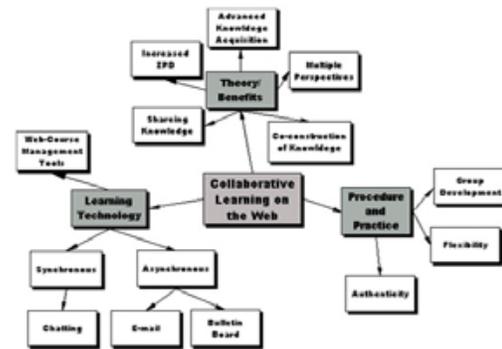
Cognitive flexibility theory also suggests that revisiting the same material from different conceptual perspectives is essential for acquiring advanced knowledge (Spiro et al., 1993). Any object or event can be well described only through the use of multiple schemata, concepts, and thematic perspectives so that the representation of it can correspond to complex nature of the content area (Jacobson, 1990; Jonassen et al., 1997). In a collaborative learning environment, each learner can provide a different perspective and a group of learners in a team can revisit the material from the different perspectives. Through collaboration, different learners also contribute in providing their own different representations of knowledge. Through this experience, they develop “internal collaboration” skill, which refers to the ability to approach the content from different epistemic perspectives, different content perspectives, different goal orientations, and especially from the worldviews of other individuals (Feltovich, Spiro, Coulson, & Feltovich, 1996).

Our Vision of Web-Based Collaborative Learning

Collaborative learning means that both teachers and students are active participants in the shared task of understanding and applying the concepts and techniques to co-labor to master the subject matter and

teach it to one another (Hiltz, 1994). Knowledge is not something that is “delivered” to learner, but rather emerges from active communications among individuals who seek to understand and apply concepts and techniques. The theory behind collaborative learning is that the social construction of knowledge leads to deeper processing and understanding than does learning alone (Slavin, 1990). A review of literature indicates that the essence of collaboration is convergence: communicative knowledge (mutual understanding and social knowledge) and construction of shared knowledge (Brown & Palincsar, 1989; Rochelle 1992; Cranton, 1996; Bruffee, 1999). Our practical definition of collaborative learning is any learning activity carried out using peer interaction, evaluation, and/or cooperation, structured or monitored by the instructor.

Figure 1. Collaborative Learning on the Web — A Concept Map



As a meaningful environment, WBLE is particularly suited to the implementation of collaborative learning strategies or approaches. Figure 1 shows the concepts that constitute web-based collaborative learning: learning technologies, practice and procedure, and theory and benefits. Based on cognitive perspectives, learners achieve tasks within their ZPD and acquire the advanced knowledge through collaboration. Sophisticated web-based collaborative learning environments incorporate asynchronous as well as synchronous communication. The bulletin board and the chat room have become the main tools of communications for most WBI/WBLE. The current procedure and practice of creating, maintaining and improving a web-based learning environment calls for variation and flexibility on the part of instructional designers, teachers/facilitators, and participants. Learning environment on the web is most effective when participants are assigned authentic tasks simulating real world examples that elicit participation thereby contributing group development. This creates an environment where participants share cognitive

loads, co-create process and products, and come to a shared understanding.

Current Development of Web-Based Collaborative Learning

Some educational institutes, businesses, and government organizations currently practice collaborative learning on the web. Emerging out of these practices, are significant advantages and disadvantages that generate strategies and tools with which the learning experience can be maximized. In order to maximize the experience gained through collaboration, tasks need to be complex in design and students should work in groups to distribute the cognitive load and obtain meaningful experiences through shared understanding (Hmelo et. al., 1998). It is also critical that the students are given opportunities for reflection, as without reflection they would just focus on completing the tasks (Royer, 1997).

Application of Web-Based Collaborative Learning

As with any new medium, it brings with itself advantages and an experience that is varied from the pre-existing medium. Web-based collaborative learning is a complex experience and mixed reactions persist when assessing advantages. Royer (1997) observed in her study that active participation from the students allowed them to create a more meaningful experience. Moreover, students, who took pride in their writing, were greatly benefited when the activities included posting information.

One of the key advantages of collaborative learning on the web is the flexibility it provides. Web-based learning environment can offer flexibility in the mode of instruction, presentation, and communication. Learning and communication can be done both synchronously and asynchronously with a myriad of tools. Bulletin Boards are predominantly used as asynchronous tools allowing participants to post questions, thoughts and comments to threads of discussions. Chat rooms allow the participants to discuss issues, exchange ideas and obtain shared understanding through synchronous communication.

Collaborative learning on the web also offers the flexibility of information access (Boettcher & Conrad, 1999). Effective web-based learning environments are designed with information and access to current events, experts, student networking and faculty networking. Thus, collaborative learning on the web can provide opportunities where participants have a variety of options in communication and interaction with the content through synchronous and asynchronous discussions.

Challenges and Strategies in Creating a Collaborative Learning Environment

There are many benefits of applying web-based collaborative learning. However, the instructional designer, students and the teachers still face the challenges in adopting the online activities for the groups learning online. In this section we will identify the current and potential challenges related to pedagogy, virtual team, evaluation of the students achievement, and motivation.

Pedagogy. Brandon and Hollingshead (1999) stated that many instructors are ill-prepared to develop activities for online groups due to a lack of familiarity with learning in an online environment. The teachers may apply the technology into the online course without consideration of adopting the appropriate pedagogies. Marjanovic (1999) suggested several potential learning activities for online collaborative learning: interactive lecturing, group dictionary, collaborative problem-based learning, collaborative writing, and the collaborative exercises. To encourage and foster the collaborative attitude online, Trentin (1999) suggested that instructors: 1) stimulate discussion through open-ended questions that facilitate the creative thinking of students; 2) encourage students to find the answers by themselves from the resources instead of providing the answers; 3) help students to post the questions repeatedly to the group or to other individual students again. It would be beneficial to the instructors to witness collaborative online courses conducted effectively. Modeling an ideal environment as a starting point allows them to gain insight and develop strategies for their own learning environments. It is also important to the instructors to understand and rationalize how and why the features of the web are exploited.

Virtual team. Virtual team is an evolutionary form of a network organization enabled by advances in information and communication technology (Jarvenpaa & Leidner, 1998). The concept of working collaboratively as a virtual team promises the flexibility, responsiveness, lower costs, and improved resource utilization considering the ever-changing task requirement in the web environment (Mowshowitz, 1997). Jarvenpaa and Shaw (1998) indicated that virtual team should be "a self-managed knowledge team with distributed expertise, that forms and disbands to address a specific organizational goal."

The Internet-based technologies facilitated the development of virtual team, working collaboratively in the cyber space. Communication in an online environment can be better than the traditional face-to-face communication in terms of enhancing the flexible working condition and extending the team works. To

apply the theory of virtual team to the WBLE, we should know what is required (Aspin, 2000: 1) strict guidelines, such as, the frequency of communication, structure and openness of information exchange, providing instant feedback to other group members to help the individual feel the identity and belongings of the community; 2) common goals and commitment, regarding members' contribution to finished tasks and creation of knowledge; 3) skills of members in information management, online meeting and discussions.

Evaluation of the students' achievement. Evaluating the academic performance of students in the web-based collaborative learning environment is not an easy job for the instructors. Evaluating students learning in a collaborative environment is difficult to conduct, as individual contributions can never be identified properly. Several strategies could be employed to evaluate the students' achievement: self-evaluation as an individual, self-evaluation as a group, and a comparison between student's performance and the class objectives. How the students share the responsibility of peer-work also needs to be addressed in the process of assessment. Wiggins (1998) states, "the reason for making feedback concurrent with performing is that this is the only way students can learn to self-assess continually and then self-adjust their intellectual performance" (p.59).

Motivation. One problem of collaborative learning in WBLE is the challenge of increasing and sustaining learners' intrinsic motivation and keeping learners from dropping out from online courses (Jasinski & Thiagarajan, 2000; Reeves & Reeves, 1997). Hence, how to enhance and sustain the motivation of online learners is an important issue to be explored. Lepper and Hodell (1989) identified four primary characteristics of tasks that promote intrinsic motivation: challenge, curiosity, student control, and fantasy. These characteristics can encourage students to participate actively in the learning process. Grabowski and Curtis (1991) identified four motivational factors that influence learning especially in hypermedia environments: "(1) interest in or attention to the information and the technology; (2) perceived relevance of the information; (3) self-confidence in the ability to access and use the information; (4) resulting satisfaction from successful access to and usefulness of the information" (p.10).

Designing the online course contents by adhering to these motivational theories should be one of the challenges met by the designer. However, it is our belief that a collaborative environment, designed with strategies in alignment with the motivational theories

mentioned above will retain learner attention and interest more effectively than before.

Discussion: Future Directions And Final Thoughts

In this paper, theoretical and empirical issues related to the collaborative learning in WBLE were reviewed. As this review indicates, a research agenda is required to gain a better understanding of the social, affective, and cognitive processes involved in collaborative learning in a WBLE. The communication among a group of participants by means of network/web, for the purpose of discussing a topic of mutual interest, eventually intended to knowledge construction, can be referred to as collaborative learning activity on the web. The use of WBI/WBLE as a medium for collaborative learning has in many respects outstripped the development of theory on which to base such utilization. The following questions can be raised based on the current state of affairs in collaborative learning on the WBLE.

First, how to assess the quality of interactions and the quality of the co-learning experience in WBLE is one research question that remains unsatisfactorily answered. Thus far, many analysis models focused on measuring the quantity of messages or interactions, type of content, units of meaning, or patterns of connection (Gunawardena, Lowe, and Anderson, 1997; Henri, 1992; Hiltz, 1990). More extensive approach and the development of tools are required to assess the interactivity related to knowledge sharing and knowledge construction.

Second, measuring student and learning progress itself will always be a challenge to educators in any kind of learning environments including WBLE. There have been efforts to assess the learning outcomes of the web-based learning, but most of them have focused on the "written" assignments or tests (O Reilly & Patterson, 1998). Moreover, in web-based collaborative learning, it is more difficult to assess the individual learning outcomes and contribution to group work. Additionally strategies for peer-evaluation need to be developed. Therefore, following questions are raised: (1) how can we effectively evaluate/assess the individual learning outcomes or performance in web-based collaborative learning environment? , (2) what variables are associated with outcomes of this web-based collaborative learning? , (3) what other issues can be raised related to the peer-evaluation in the web-based collaborative learning?

Additionally, for the research and development of meaningful web-based collaborative learning environment, further questions should be addressed: (1) how do you increase and sustain the motivation of WBLE learners? How do learners pay attention to both the learning and collaborative work in the WBLE? What kind of strategies can be useful and helpful? , (2)

how do we promote meaningful collaborative learning activity in WBI/WBLE? , (3) should interface of Web-based collaborative learning environment be different from other WBLE interface? This leads to another question, how can we apply the principles of WBLE interface design to the Web-based collaborative learning environment? (4) how is the role of the teacher and the learner different from traditional environment?

In analyzing collaborative learning on the web, it is clear that we need to learn and understand more about how the learner interacts with the media and how the web affects the learner and learning outcomes. The learners and desired learning outcomes should be the ultimate focus of developing successful collaborative learning on the web. The answers to the questions raised earlier can contribute to the design and development of meaningful web-based collaborative learning environment. However, it should be noted that collaborative learning is at its developmental stage and is still being experimented, thereby identifying the need for further research in the areas of learning outcomes, learner interaction, design and delivery, and strategies.

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If you wish to follow up this paper, please contact Seungyeon Han (shan@coe.uga.edu). Address: Seungyeon Han, 604 Aderhold Hall, The University of Georgia, Athens, GA 30602; Phone number: 706-542-3810.