PROJECT-BASED LEARNING USING WIKIS

Sim Kim Lau, School of Information Systems and Technology, University of Wollongong, Wollongong, NSW 2522, Australia, +61242214132, simlau@uow.edu.au

ABSTRACT

This paper describes a case study of project-based learning using authentic tasks to improve student learning through group collaboration. The assessment designed in this study follows constructivism approach which gives students opportunity for concrete, contextually meaningful experience through which they can construct their own models. Learning is also achieved through personal reflection on ideas and negotiating with each team member to lead to deeper understanding. The process of negotiation of meaning is achieved by combining group and individual activities of analyzing, designing and developing an information system. Results from the study indicate that wiki can be used to enhance collaborative learning.

INTRODUCTION

The ability to work collaboratively is one the foundational knowledge and skills expected from graduates. Research indicates that the success of online learning groups depend on curriculum that facilitates negotiation of meaning and co-construction of knowledge [6]. Constructivism enables learning through construction of knowledge from experience [10]. A collaborative team-based learning environment enables learners to construct their own mental and learning model and it encourages individual learning experience.

In a collaborative team-based learning environment students share what they already know with each other. They negotiate, clarify and explore each other's differences and negotiate new meanings of knowledge. During the process they reflect, elaborate, negotiate, co-construct and internalise knowledge as knowledge evolves which leads to deeper learning. Web 2.0 has the potential to support team work and project-based learning. The purpose of this paper is to discuss the use of Web 2.0 tools such as wiki and blog to support the process of negotiation of meaning and co-construction of knowledge in project-based team work.

LITERATURE REVIEW

According to the constructivist perspective, individuals construct knowledge by working to solve realistic problems [1] [5]. Under this perspective, learning is the process whereby individuals construct new ideas or concepts based on prior knowledge and experience. According to Gupta and Bostrom [5] learning method that manifests team feedback has greater effectiveness in learning outcomes. The interaction and collaboration between team members can be described using a five-stage model consisting: sharing and comparing of information, discovery and exploration of inconsistency among ideas or concepts, negotiation of meaning and co-construction of knowledge; testing and modification of proposed synthesis or co-construction, and agreement statement with application of newly constructed meaning [4] [6]. In stage one of the models, team members share and compare information, observation or opinion. They define, describe and identify problem. They ask and answer questions to clarify statements or observations. In stage two, team members identify and state areas of disagreement, they

ask and answer questions to clarify source and extent of disagreement and they may restate their positions by references or through data collection. In stage three, team members negotiate or clarify meaning of terms, further identifying areas of agreement or disagreement, propose and negotiate new statements and co-construct knowledge. In stage four, team members test the new statement against formal model, personal experience and conduct formal data collection to validate new knowledge. In stage five, team members summarise the agreements, co-construct and apply new knowledge. As the team moves through successive stages, their collaborative skills draw upon higher mental functions.

Wiki is a tool that enables a group of individuals to develop community online. They can discuss an issue of interest using wiki. Wiki can also be used in collaborative learning environment to support a group of students to work together towards collective intelligence in learning environment. Shared editing is a common feature in wiki software. Other common features in wiki include email, announcements and notifications. According to Zhang et al. [12] a good collaborative tool such as wiki should that has the capabilities to support ownership with single user login and identity persistence, easy information access by having features that facilitate search and retrieval, multiple perspectives by facilitating integration and synthesis of data, and emergence by facilitating expert flag and notification can affect the team's collaborative processes and thus improving on team performance. Koh and Lim [8] propose a three-level wiki framework to describe wiki system. A level-one wiki includes basic features that facilitate asynchronous information exchange such as shared editing, tracking functions and page permission. A level-two wiki includes features in level 1 and additional features that improve spontaneous communication such as group chats. A level-three wiki includes features in levels one and two, and be able to integrate with the enterprise information systems to enable data integration. Wiki can influence learning outcomes. A wiki that does not provide enhanced features such as group chat and discussion board may result in team members focus on contributing individual blocks of text and editing the wiki without critical discussion on the rational, thinking process and the validity of ideas. A learning task that utilises a level-three wiki to facilitate socio-emotional activity may enhance learning outcomes by reducing student isolation and an increasing sense of community.

Gunawardena et al. [3] proposed a six-phase social networking spiral model consisting of the following phases: context, discourse, action, reflection, reorganisation and socially mediated meta-cognition. The spiral nature of the model indicates the phases are iterative and can progress in multiple iterations. In the context phase, a wiki is used to define context of the wiki and context of team members using the wiki. In the discourse phase, individual members contribute to the wiki based on their life experience, knowledge and insights. In this phase, negotiation of meaning is reinforced by the strength of the interaction as individual members are motivated to contribute [3]. In the action phase, individual members identify a learning goal and with the use of wiki they connect with each other to share that goal. Through wiki, individuals contribute knowledge and discuss their findings. In the reflection phase, individual members review and discuss relevant postings in wiki based on their experience and/or prior knowledge. The reflection is characterized by interaction of personal experience and group thinking. Members discuss viewpoints and integrate new knowledge which may result in changing of understanding and co-construction of knowledge at the individual and group levels. The history page and tracking function of wiki facilitate the reflection. In the reorganisation phase individual members bring new insights and are moving toward the shared goals. They adjust their understanding of the knowledge, learn from reflection stage and realign and reorganise their understanding to move toward the shared goal. Collaborative learning is emerging in this phase and individual members may begin a second iteration of action, reflection and reorganisation with new tasks and learning. In the socially mediated meta-cognition phase, individual members critique each other work, offer viewpoint and suggestion to one another to achieve shared understanding by mutually reflecting on own reasoning and

developmental process a group. Thus wiki provides a shared space for this purpose. The history page of wiki facilitates this process and enables the tracking function of the development process of shared understanding. Blog within wiki can also be used for this purpose. The level-one wiki framework proposed by Koh and Lim [8] contains features that are appropriate for the first three phases of the social networking spiral model and level-two wiki includes features that support the last three phases of the model.

Wheeler [11] proposed a five-stage wiki activities model to encourage a progression of engagement from individual inquiry to group collaboration. The five-stage model consists of five modes: exploration, exhibition, explanation, elaboration and evaluation. In the exploration mode, team members are getting to know each other; for example they post information about themselves to the wiki. In the exhibition mode, team members share their ideas, post useful links related to their project. In the explanation mode, team members begin their posting, describe their views or knowledge they wish to share with the group and may explain the basis of their knowledge or viewpoint. This is followed by the elaboration mode in which team members elaborate their views, justify their decisions and contribute more collaborative postings and may conduct complex editing in the form of critique and feedback. Finally the evaluation mode assesses values, accuracy and significance of the content. The complexity of activities increases as the mode progresses from exploration to evaluation mode.

Relationship between team members can illuminate different ideas that in turn can be discussed, communicated, negotiated, adapted, reformulated and co-constructed to increase the knowledge beyond the individual viewpoint. Within a learning activity this process can be repeated over several iterations until a shared understanding is achieved. In the online collaborative learning environment Web 2.0 tool such as wiki can provide a platform to communicate, share and collaborate. Different team members can post their findings, ideas and comments to the wiki and communicate with their team members in order to facilitate negotiation of meanings and co-construction of knowledge. Research indicates that the learning process is improved by combining collaborative activities with individual reflection [11]. Figure 1 shows the Wheeler model of negotiation of meaning through shared space. In this model wiki and blog are used to develop the intersecting space between the personal and community space in which meaning is negotiated. Combining the use of a blog as the reflective space and the wiki as the collaborative space facilitates negotiation of meaning. The interaction of reflective and collaborative space is the region in which the learners clarify ideas and negotiate meaning which leads to co-construction of knowledge.

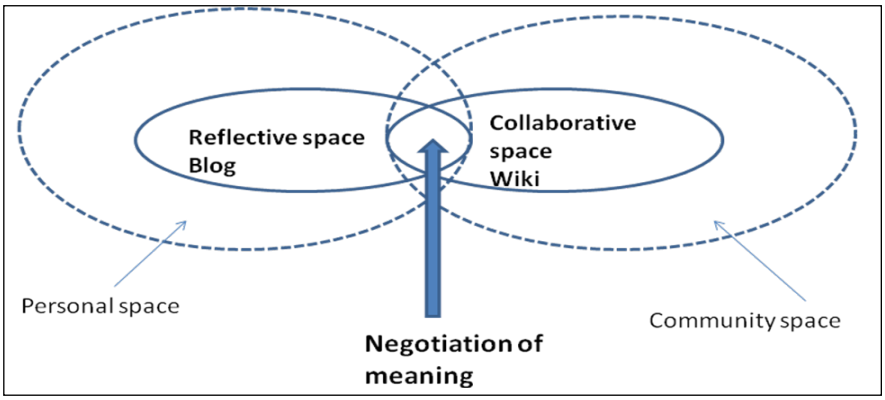

Figure 1: Wheeler's model of negotiation of meaning through shared spaces
[11, p. 111]

The use of a reflective journal can increase the learning that results from the experiences undertaken [9]. Through facilitating the documentation and reflection on ideas developed during the learning experience, journals enable students to record the development of their ideas. Reflection enables students to think about, internally examine and meta-cognitively reflect on the issue triggered via a learning experience. By combining team based activity with individual reflection, collaborative learning can be enhanced. A learning task that encourages team members to reflect on their actions during the team based learning activity has the potential to increase both student satisfaction and learning outcomes.

THE CASE STUDY

The Wheeler's model is applied to a project-based learning using a wiki system called *Wikispaces* (www.wikispaces.com). *Wikispaces* enables groups to be organized by allocating team members to individual groups which have its own pages, files and permissions. *Wikispaces* can be categorised a level-two wiki system using the classification proposed by Koh and Lim [8].

The assessment designed in this study follows constructivism approach which gives students opportunity for concrete, contextually meaningful experience through which they can construct their own models. It encourages students to take ownership of ideas and engage in learning activity and reflection. Authentic learning tasks were designed to enable students to take the role of system developer within a system development team. Learning outcome of the subject is for students to be able to assess the needs of different systems development projects and select an appropriate system development methodology. Authentic learning principle is integrated into assessment to enable students to immerse in the complexities of system development tasks and involves authentic activities that mirror real-world activities.

Students enrolled in this subject are international students from diverse cultural background. The group is formed based on self-selection method. Davies [2] explains that culture has some influence on behaviour of groups, in particular cultural and linguistic background can influence the way students respond to group work. Self-selection group formation has the advantage that students have the freedom to choose who they want to work with and giving ownership and responsibility of team formation to the students. However the disadvantage is students tend to form group with their friends or similar ethnic background which may result in inequity in skills and team formation [2] [7].

There are twenty-one students enrolled in the subject and five groups were formed. Each group is asked to develop a web-based information system for a company which recruits temporary positions for local businesses. The requirements of the system include enabling local businesses to submit requests online to fill temporary positions; enabling potential applicants to submit curriculum vitae online; matching of available temporaries with requests submitted by the business; preparing and sending contract online to the business and applicant after the position is filled. User requirements for the case are intentionally vague and ill-defined to reflect the authentic context of real world situation. There is no constraint on the choice of software or programming language that the group can use to develop the system. Each student is required to submit a weekly learning reflective journal using the wiki with the aim to reflect student's learning on the project.

Wheeler's five-stage wiki activity model is adopted in student learning [11]. The exploration mode includes activities for orientation and making contact. This is achieved by students posting their background and curriculum vitae to the group wiki space. The exhibition mode is achieved by students

sharing ideas about the project with each other, finding useful links related to the project and may also include project planning and allocation activities. The explanation mode is achieved when students post their contributions to the report and deliverable to the wiki. They describe their results and inform the progress. To encourage the elaboration mode which involves complex editing, collaborative posting and dialogues, students are required to do the following. One week before the report is due for submission, all team members are required to review and critique work completed by another team member and to revise the work if necessary. Each team is asked to take a "snapshot" of the work prior to the review process (for example by saving the file as a pdf document or save the file using a different filename). The *comment* feature within the editor in the Wikispaces can be used for this purpose to enable students to post their comment, suggestion or critique. Students can also use the discussion forum for this purpose. Each student must select a portion of the work completed by another team member to perform this task. Finally the evaluation mode is achieved by students complete the review process, revise the report to ensure accuracy and submit the final report for assessment.

Evaluation

A questionnaire was developed to evaluate students' learning experience. The majority of students have indicated that they think their team members have contributed to the team project by sharing basic understanding and description of problems, and they in turn have also contributed to the team project by collaboratively developed ideas with others, undertook complex editing and discussion. Students felt that their skills of team work were improved as a result of the project and most students think that by using wiki they have contributed to the group project through the elaboration mode of the Wheeler's model. This result can be explained by students were given the task to review and critique other team members work before the submission. However they have thought that other team members have contributed in the explanation mode.

CONCLUSION

Project-based learning described in this paper has shown wiki has the potential to support team work, authentic assessment and project-based learning. The assessment designed in this study follows constructivism approach which gives students opportunity for concrete, contextually meaningful experience through which they can construct their own models. This paper reaffirms Wheeler's view that synthesis of knowledge arising from negotiation of meaning is a powerful way to co-construct knowledge. Learning is also achieved through personal reflection on ideas and negotiating with each other to lead to deeper understanding and meaning. The process of negotiation of meaning is achieved by combining group and individual activities of analysing, designing and developing a system. This results in co-construction of knowledge throughout the team project.

REFERENCES

[1] Conole, G., Dyke, M., Loliver, M. and Seale, J. 2004. "Mapping Pedagogy and Tools for Effective Learning Design". *Computers and Education,* 43, 17-33.

[2] Davies, W. M. 2009. "Groupwork As a Form of Assessment: Common Problems and Recommended Solutions," *HIGH EDUC,* 58, 563-584.

[3] Gunawardena, C.N., Hermans, M.B., Sanchez, D., Richmond, C., Bohley, M. and Tuttle, R. 2009. "A Theoretical Framework for Building Online Communities of Practice with Social Networking Tools," *Educational Media International,* 46, 3-16.

[4] Gunawardena, C.N., Lowe, C.A. and Anderson, T. 1997. "Analysis of a Global Online Debate and The Development of an Interaction Analysis Model for Examining Social Construction of Knowledge in Computer Conferencing," *Journal Of Educational Computing Research,* 17, 397-431.

[5] Gupta, S. and Bostrom, R.P. 2009. "Technology-Mediated Learning: A Comprehensive Theoretical Model," *Journal Of The Association For Information Systems,* 10, 686-714.

[6] Hull, D.M. and Saxon, T.F. 2009. "Negotiation of Meaning and Co-Construction of Knowledge: An Experimental Analysis of Asynchronous Online Instruction," *Computers and Education,* 52, 624-639.

[7] Kriflik, L. and Mullan, J. 2007. "Strategies to Improve Student Reaction to Group Work," *University Teaching & Learning Practice,* 4, Article 3.

[8] Koh, E. and Lim, J. 2011. "Effectiveness of Wikis for Team Projects in Education," *Pacific Asia Journal of the Association for Information Systems,* 3, Article 2.

[9] Moon, J. 2003. *Learning Journals and Logs, Reflective Diaries.* Centre for Teaching and Learning, University College Dublin.

[10] Vygotsky, L.S., Cole, M., John-Shteiner, V., Scribner, S. and Souberman, N. 1978. *Mind in Society: The Development of Higher Psychological Processes*.

[11] Wheeler, S. 2010. "Open Content, Open Learning 2.0: Using Wikis and Blogs in Higher Education," *in:* Ehlers, U. and. Schneckenberg, D. (Ed.) *Changing Cultures in Higher Education,* 103-114.

[12] Zhang, X., Venkatesh, V. and Brown, S.A. 2011. "Designing Collaborative Systems to Enhance Team Performance," *Journal Of the Association for Information Systems,* 12, 556-584.