

Knowledge Building International Project: Designs for Deep Understanding

Thérèse Laferrière, Christian Perreault, & Pier-Ann Boutin, Laval University, Quebec, Canada
tlaf@fse.ulaval.ca, christian.perreault@fse.ulaval.ca, Pier-Ann.Boutin@fse.ulaval.ca
Nancy Law & Johnny Yuen, University of Hong Kong, Hong Kong, nlaw@hku.hk, johnny.yuen@gmail.com
Mireia Montané, Col·legi de Llicenciats, Barcelona, Catalonia, Spain, mireiamontane@me.com
Oscar Hernandez Lopez, University IberioAmericana, Puebla, Mexico, oscar.hernandez@iberopuebla.edu.mx
Pere Boluda, Escola Sant Pau, Tarragona, Catalonia, Spain, pboluda@gmail.com
Marta Blancafort, Escola Projecte, Barcelona, Catalonia, Spain, marta-blancafort@gmail.com

Abstract. Deep understanding and knowledge creation are two of the three ICT competency standards for teachers identified by UNESCO (2009). In the classroom, knowledge creation bears many similarities with knowledge building, the framework put forward by Bereiter and Scardamalia (1993). We report on four knowledge building oriented university-school partnerships (Catalunya, Hong Kong, Quebec and Mexico). They had teacher professional development in mind, and their shared goal was students' understanding of sustainable development problems (Knowledge Building International Project, 2007-2011). Participants engaged in onsite/online written and verbal interaction. The dynamics of their collaboration are uncovered. With respect to one site, we report on explanation quality as evidence of movement toward deep understanding.

Background

The principle of deep understanding is central in contemporary learning sciences, and teacher educators (Putnam & Borko, 2000) have been taking notice. Knowledge creation (Bereiter, 2002) is also part of the educational conversation. UNESCO called on teachers to engage into knowledge creation and engage learners into this process in its ICT competency standards for teachers (2009). Van Aalst (2009) sums up the thinking of Paavola, Lipponen and Hakkarainen (2004) on knowledge creation by describing it “as a set of social practices that advance the state of knowledge within a community over time”, p. 260). Knowledge creation and knowledge building are terms that can be used alternatively in the classroom. Scardamalia and Bereiter (2003) refer to knowledge building as “the production and continual improvement of ideas of value to a community through collaborative inquiry” (p. 1371).

University-school partnerships have been recognized as a key strategy for innovation to occur within an education system (Holmes Group, 1990; Laferrière & collaborators, 2010). Collaborative digital platforms support and stretch such effort beyond time and space limits but adoption is slow. The Knowledge-building International Project (KBIP) provided an opportunity for teachers 1) to engage school learners into collaborative inquiries on sustainable development applying the Knowledge Forum platform; 2) to seek the emergence of classroom-based knowledge-building communities; and 3) to foster deep understanding of problems. In this paper, we present the dynamics of collaboration that unfolded and deep understanding is researched at one site through an analysis of question posing and explanation levels.

Theoretical Framework

The knowledge building perspective focuses on developing classrooms and communities for progressive problem solving and knowledge creation. Scardamalia and Bereiter's (2003) twelve knowledge building principles are the following ones: *democratizing knowledge, community knowledge/collective responsibility, real ideas/authentic problems, improvable ideas, idea diversity, epistemic agency, constructive use of authoritative sources, knowledge building discourse, rise above, symmetric knowledge advance, pervasive knowledge building, embedded, concurrent, transformative assessment*. Therefore, a class of students is meant to become a community that shares a commitment to creative work on ideas and advancement of the state of knowledge in their (networked) classroom. When students engage in collective inquiry, the process is mediated by discourse on Knowledge Forum (Scardamalia & Bereiter, 2006). Knowledge Forum includes a web-based collaborative platform for extending and deepening classroom discourse, which affords scaffolds to support written discourse, and a set of analytical measures that participants and classroom-based communities can apply to monitor their own knowledge building activity.

Deep understanding is the end goal (Bereiter, 2002). Classroom-based knowledge building communities tend to meet/exceed their mandated curricula (Scardamalia, Bereiter & Lamon, 1994; van Aalst & Chan, 2007).

Methodology

University-school partnerships have been at the basis of this innovation. In three out of four the local government also have played an important role. In Hong Kong, advances have been made in developing knowledge building pedagogy in schools. In particular, a community of knowledge building teachers (the knowledge building teacher network) has developed a model of professional development support for scaling up curriculum and assessment innovation in schools, and in establishing sustained collaborative inquiry among the international network of knowledge building classrooms. In Catalonia, the International Office of the Ministry of Education has exercised leadership in Europe regarding classroom activities that foster knowledge creation as an ongoing activity of school learners' experience. In the Americas, an increasing number of classrooms are networked through Web-based tools, thus creating new affordances for teachers and learners as they access online resources, including peers from other classrooms with whom to engage in collaborative inquiry.

Design Research

The knowledge building international project (KBIP) is an outgrowth of the Knowledge Society Network (KSN, <http://www.ikit.org/ksn.html>). The idea was born during the Knowledge Building Summer Institute 2007, the annual face-to-face meeting of the KSN members. The summer institutes that followed were critical for renewing the commitment toward the project, identify gains, make adjustments, and plan next iterations. Changes were made to the local/international socio-technical designs on the basis of emerging results. They primarily regarded the teaching of the knowledge building principles (timing, and feedback to teachers), the matching of classrooms, and the management of databases.

Participants

Participation may be considered an early result of design research. Over the past five years, here is an overview of the distribution of participants.

Table 1: KBIP participants.

Sites	Students	Teachers	School principals	Ministry personnel	Graduate students	University researchers
Catalonia	525	22	11	3	1	2
Hong Kong	350	13	2	1	4	3
Quebec	350	20	4	1	4	3
Puebla	150	5	2	-	-	2

Intervention

Socio-technical designs at each site were context-based but the three following features characterized each site:

- **Principle-based innovation.** The 12 knowledge building principles guided the design of the classroom-based knowledge building communities. University-based teacher educators and researchers were instrumental in acquainting teachers with knowledge building and scaffolding their understanding of this approach (Chan, Law, Hui, Fung, & KBTN Team, forthcoming; Laferriere & Breuleux, forthcoming).
- **Computer-supported innovation.** Knowledge forum supported written discourse for all participants. At first, teachers and learners worked on their own server. Next, they were to access their partner classroom's database. In complement, a web-based videoconferencing system (VIA) provided support for audio-visual exchanges. Classrooms prepared Powerpoint presentations in a pdf format and, in best cases, they showcased what they had written on their Knowledge Forum database.
- **Team-mediated innovation.** Each partnership designated a coordination team. Coordinators were teacher educators, teachers, seconded teachers, and graduate students. At the substantive level, it was a matter of reaching consensus regarding the "umbrella theme" to be inquired into each school year, and matching classrooms with similar inquiry questions. At the organizational level, it meant numerous written and verbal interactions to establish a calendar, provide access to and guidance into databases, schedule and facilitate synchronous meetings.

Research

Meso and micro dimensions were explored. At the meso level, ethnographic notes of videoconference meetings were analyzed by two researchers using complexity adaptive system theory (e.g., Lemky & Sabelli, 2008) for the identification of emerging dynamics of collaboration. At the micro level, the proximal conditions that led to productive online discourse were studied using ethnographic notes and the Knowledge Forum analytical tools.

Moreover, the online discourse of 25 classrooms was analyzed to explore the depth of understanding students reached at one site. The scheme was an adaptation of Lee, Chan, & van Aalst's (2006) scheme and of Hakkarainen's (2003) scheme. 251 K-6 students (289 with control group) were part of this specific study, and pre- and post-activity interviews were conducted.

Results

Meso-level Results

The dynamics of collaboration that stood out regard partnerships, teacher participation, and coordination.

Partnerships were the Drivers of Innovation

Within each partnership, teacher agency and knowledge was critical for engaging students in collaborative inquiry within and beyond the classroom. School principals were key regarding informing and getting permission from parents, and coordinating activity between schools from the same school district and beyond. Some Catalonia and Hong Kong' school principals modeled collaborative inquiries with students. Local experts (e.g., ecologists) also played an important role in moving collaborative inquiries beyond clichés and laypersons' concerns regarding the environment. University researchers' attention to teachers' concerns and analyses regarding how the knowledge building perspective was part of the school learner's experience was also critical. In Catalonia, the International Office of the Department of Education was the key agent in the partnership fostering knowledge building in a local network of thirteen schools and the participation of six of them within KBIP. The government created opportunities for innovation: teacher professional development workshops, access to curriculum experts to help teachers see links between KBIP and the curriculum (<http://www.xtec.cat/ofinternacional/COMconeixer/cat/index.html>). An association of teachers is now assuring the sustainability of the effort (<http://kbinaction.com>). In Quebec (<http://kbip.fse.ulaval.ca>) and Hong Kong (<http://kbtn.cite.hku.hk/kbip.php>) governmental agents were well-aware of the knowledge building perspective adopted, and consented extensive financial resources over a number of years. In Mexico the government was not a partner but the head of the Universidad Iberoamericana Puebla (<http://www.iberopuebla.edu.mx>) was the leading agent and financial resource. In the fifth year, a new generation of university-school partnership was the result of presentations made at a main teacher educator conference.

Teacher Participation Exhibited Both Flux and Sustainability

Teacher participation was in a state of flux given teacher mobility within their school system, and the growing attraction of the network. The network found coherence through 1) reference to the same twelve knowledge building principles, 2) the use of the Knowledge Forum® software, and 3) the use of the multi-user web-based videoconferencing system (VIA) for oral synchronous discourse supported by digital artefacts. Participants' core included 10-12 teachers. Some of them had their classrooms collaborate with one another while others worked with incoming teachers who for the first time engaged their classrooms in collaborative inquiries.

Coordination Required Diligence

For collaboration to occur within and across sites, time scheduling of synchronous events, time management, and administrative support for accessing another classroom's database were ongoing activities. For elementary teachers it was easier to schedule inquiry time than for secondary school teachers. A few did it for an hour on a daily basis over a certain period of time, some devoted a few intensive weeks, and others gave students minimal amounts of time. Secondary school teachers from Hong Kong tended to have students work after class. Both elementary and secondary teachers from Catalonia had their students stay after school to allow for synchronous verbal conversations (videoconferences) with North American students. At the international level hundreds of email messages were exchanged and Google docs developed to coordinate classrooms' online meetings.

Micro-level Results

The proximal conditions that led to productive online discourse pertained to student engagement and knowledge building practice. Deep understanding was the ultimate goal, and we provide partial results (one site only).

Student Engagement was Grounded in Authentic Questioning

The dominant theme, sustainable development, provided plenty of possibilities for emerging knowledge building communities to focus on specific questions of collective interest. Question posing and explanation are pivotal to collaborative intellectual inquiry. Although much progress has been given to examining questioning and explanation in computer-based discourse (Hakkarainen & Sintonen, 2002), relatively less is known about how children collectively pose productive questions and how they sustain inquiry and advance knowledge creation in diverse and distant communities. Videoconferences among distant communities led to question posing that

prompted interactions and explanations, thus providing scaffolds for children to build on others' ideas. Early results showed that teachers and students engaged in authentic question posing, and demonstrated *epistemic agency, idea improvement* and *embedded assessment* (Laferrière, Law & Montané, 2010).

Knowledge Building Practice Reflected a Critical Mass of Innovative Pedagogies

Teachers engaged in curricular and pedagogical design in a way as to demonstrate collective knowledge building among their own local/international communities. However, the release of collective agency to students for knowledge creation purposes may take many forms. The same is true regarding the scaffolding of collective cognitive responsibility in asking questions and formulating explanations. A critical mass of knowledge building practices, including translated documentation, was created onsite/online. There are now materials to showcase design research in computer-supported collaborative learning involving field-based educators and/or strong university-school partnerships.

Deep Understanding

Cognitive and conversational analyses conducted by Turcotte, Hamel and Laferrière (2011) revealed that students who wrote better explanations on the Knowledge Forum scored higher on post-activity interviews even when they scored lower on the pre-activity interviews. Active use (1 hour a day) produced the greatest improvement of student explanation skills, and that confirmed teachers' impression and field observations.

Discussion

The relevance of an international network grounded in university-school partnerships and devoted to an innovative theoretical framework and related pedagogies that take advantage of web-based tools is confirmed. The literature on partnerships emphasizes the importance of converging visions and strategies (Legters, Balfanz & McPartland, 2002; Bringle & Hatcher, 2002). We suggest that a partnership's solid foundation depends on a big idea, one capable of driving the agency of participants in a converging manner. Knowledge building is such an idea.

A growing number of teachers manifest interest in knowledge building/knowledge creation. Their participation in KBIP may remain peripheral for some time but it affords them an opportunity to design their own classroom as a knowledge building community. The KBIP community also provides support, be it technological or pedagogical.

Such a project requires extensive coordination. The use of different databases added to the complexity of coordination in the first four iterations of the project. For the next iteration, participants seem to be willing to access the same database. This will offer new affordances but will bring its share of design issues.

References

- Bereiter, C. (2002). *Education and mind in the knowledge age*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Bereiter, C., & Scardamalia, M. (1993). *Surpassing ourselves: An inquiry into the nature and implications of expertise*. Chicago, IL: Open Court.
- Breuleux A., Erickson, G., Laferrière, T., & Lamon, M. (2002). Teacher education and ICTs for improving instruction in network-enabled communities. *Revue des sciences de l'éducation*, 28(2), 411-434.
- Bringle, R. G., & Hatcher, J. A. (2002). University-community partnerships: The terms of engagement. *Journal of Social Issues*, 58, 503-516.
- Chan, C., Law, N., Hui, D., Fung, Y. H., & KBTN Team. (forthcoming). *Knowledge Building Teacher Network in Hong Kong: Sustaining and Scaling Knowledge Building through Principle-Based Innovation*. Paper presented at the 9th International Conference on Computer-Supported Collaborative Learning.
- Chan, C.K.K., & van Aalst, J. (2006). Teacher development through computer-supported knowledge building: Experience from Hong Kong and Canadian teachers. *Teaching Education*, 17(1), 7-26.
- Collins, A., Joseph, D., Bielaczyc, K. (2004). Design research: Theoretical and methodological issues. *The Journal of Learning Sciences*, 13(1), 15-42.
- Engeström, Y. (1987). *Learning by expanding. An activity-theoretical approach to developmental research*. Helsinki: Orienta-Konsultit.
- Hakkarainen, K. (2003). Progressive inquiry in a computer-supported biology class. *Journal of Research in Science Teaching*, 40(10), 1072-1088.
- Hakkarainen, K., & Sintonen, M. (2002). Interrogative Model of Inquiry and Computer-Supported Collaborative Learning. *Science & Education*, 11(1), 25-43.
- Holmes Group (1990). *Tomorrow's schools: A report of the Holmes Group*. East Lansing (MI): (501 Erickson Hall, East Lansing 48824-1034).
- Laferrière, T., & Breuleux, A. (forthcoming). *Collaborative Design (CODE) as a Teacher Professional Development Model in Francophone and Anglophone Quebec*. Paper presented at the 9th International Conference on Computer-Supported Collaborative Learning.

- Laferrière, T., Montané, M., Gros, B., Alvarez, I., Bernaus, M., Breuleux, A., Allaire, A., Hamel, C., & Lamon, M. (2010). Partnerships for Knowledge Building: An Emerging Model. *Canadian Journal of Learning Technologies*, 36(1). Available: <http://www.cjlt.ca/index.php/cjlt/article/viewFile/578/280>
- Laferrière, T., Law, N., & Montané, M. (2010). An international Knowledge Building Network For Sustainable Curriculum And Pedagogical Innovation. Paper presented at the annual meeting of the American Educational Research Association (AERA), Denver.
- Lee, E. Y., Chan, C., & van Aalst J. (2006). Students assessing their own knowledge advances in a knowledge building environment. *International Journal for Computer-Supported Collaborative Learning*, 1, 277-307.
- Legters, N. E., Balfanz, R., Jordan, W. J., & McPartland, J. M. (2002). *Comprehensive Reform for Urban High Schools: A Talent Development Approach*. New York: Teachers College Press.
- Lemke, J. L., & Sabelli, N. H. (2008). Complex systems and educational change: Towards a new research agenda. *Educational Philosophy and Theory*, 40(1), 118-129.
- Paavola, S., Lipponen, L., & Hakkarainen, K. (2004). Models of innovative knowledge communities and three metaphors of learning. *Review of Educational Research*, 74, 557-576.
- Putman, R., & Borko, H. (2000). What do new views of knowledge and thinking have to say about research on teacher learning? *Educational Researcher* 29(1), 4-15.
- Scardamalia, M., Bereiter, C., & Lamon, M. (1994). The CSILE project: Trying to bring the classroom into World 3. In K. McGilley (Eds.), *Classroom lessons: Integrating cognitive theory and classroom practice* (pp. 201-228). Cambridge, MA: MIT Press.
- Scardamalia, M., & Bereiter, C. (2003). Knowledge Building. In *Encyclopedia of Education Second Edition*. New York: Macmillan Reference.
- Scardamalia, M., & Bereiter, C. (2006). Knowledge building: Theory, pedagogy and technology. In R.K. Sawyer (Ed.), *The Cambridge Handbook of Learning Sciences* (pp. 97-115). New York: Cambridge University Press.
- van Aalst, J., & Chan, C.K.K. (2007). Student-directed assessment of knowledge building using electronic portfolios. *The Journal of the Learning Sciences*, 16 (2), 175-220.
- van Aalst, J. (2009). Distinguishing knowledge-sharing, knowledge-construction, and knowledge-creation discourses. *Computer-Supported Collaborative Learning*, 4(3), 259-287
- Turcotte, S., Hamel, C., & Laferrière, T. (2011, January). Investigating the Use of the Knowledge Forum to Improve Student Explanation Skills: The Case of the Remote Networked Schools. Paper presented at the Fourth World Universities Forum, The Hong Kong Institute of Education, Hong Kong, China.