

Toward a Multi-Level Knowledge Building Innovation Network

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Abstract: Knowledge building requires collaborative bootstrapping, with participants at all levels of the education system part of a collective effort to go beyond information exchange to innovation-producing networks that demonstrate that education can operate as a knowledge creating enterprise. Organizational theories and research are increasingly focused on multilevel perspectives for creating actionable knowledge; the challenge is to take advantage of emergence to self-organize around solutions and new means. By “innovation networks” we mean networks that go beyond sharing and discussion to the actual creation of new knowledge and innovations. Self-organization and emergence surround us, all the time and at multiple levels, whether we are aware or not. However, self-organization around idea improvement is rare and requires engaging innovative capacity at all levels, a research-intensive enterprise surrounding innovations, and an open source engineering team committed to enabling new forms of interaction, media, and analytic tools. “Multi-level” envisions inclusion of students, teachers, administrators, researchers, engineers, and policy makers in a collaborative enterprise. This session takes the form of a design think tank to advance conceptual frameworks and means for new and more powerful environments to support a multi-level knowledge building innovation network.

Introduction

According to OECD, networked communities of practice must together add up to an intertwined interconnected infrastructure at the system level (OECD, 2013). There are many networks in which teachers and sometimes administrators share experiences and practical ideas and discuss issues. However, they are not what Peter Gloor calls “innovation networks”—networks of people who not only share ideas but generate and refine new ideas through the dynamics of networked social interaction. Instead, according to Bryk, Gomez, and Grunow (2011, p. 135), education networks typically “function as free-floating idea bazaars, contexts for self-expression, and places ‘to share.’”

Gloor identifies three forms of network engagement: (1) *Collaborative Innovation Network (COIN)*—a core team of self-organized and intrinsically self-motivated people who have a collective vision; (2) *Collaborative Learning Network (CLN)* - others who join the core community to discuss, learn, and apply innovations (DiMaggio, Gloor, & Passiante, 2009; Gloor, 2006); (3) *Collaborative Interest Network (CIN)*- those on the periphery, often lurkers, who do not contribute content but seem to have shared interests. These different forms of engagement create an innovation network ecosystem with spread of innovation from the core to periphery (Gloor, 2006). Innovations must occur throughout the extended virtual network, with people at the periphery in some contexts becoming innovators in another, with inward and outward flow of ideas and network boundary crossing—what in knowledge building we have referred to as *symmetric knowledge advancement*. Gloor, Fuehrer, and Fischbach (2016) also identify repeat innovators across contexts as important for innovation networks.

More than two decades ago the knowledge building community initiated the Knowledge Society Network (KSN). Four sub-network structures were identified by Hong, Scardamalia, and Zhang (2010): intensive participant interaction, frequent idea interaction, emergent knowledge innovation, and sustained knowledge innovation. These have rough correspondence to Gloor’s sub-networks. However, instead of working through networks, many knowledge building researchers have tended to work closely with teachers to co-design improved educational practices in their particular context—a one-on-one or one to small-group approach that is necessarily limited in scale. While the network helps to spread ideas, sustained innovation is limited due to insufficient time for engagement and demands for technological innovations that exceed the capacity of a small design team. In order to support a global innovation network and enable schools to operate as effective knowledge creating enterprises, an innovation network extensible to and adapted to the work patterns and the interests of all participants is needed.

The proposed think tank session features researchers, teachers, engineers, and policy makers spanning 10 nations, all committed to creating needed social and technological innovations. Toward this end the session will begin with a 30-minute presentation of a collective design document—a best effort on the part of the organizers to define social and technological innovations that will enable engagement in each country and be extensible to a much broader community. The immediate goal is to create infrastructure to enable forms of engagement that will allow us to establish a network through which we can address issues presented below. In an additional 30-minute session an overview of specific issues by various team members will be presented so that audience members can direct issues and questions to those with most relevant experience. The final half hour will be reserved for open audience participation.

Issues to be discussed

Inclusivity

The typical education network, like many online networks, consists of a relatively small number of active contributors plus a large number of “lurkers,” who follow discussions but do not take active part in them. In innovation networks, as Gloor’s research indicates, there is movement between innovation and lurker status. A truly inclusive network will need to afford intermediate possibilities that encourage full active participation without undue anxiety or need for assertiveness. It will also need to support coherent discourse across media and input, and opportunities for the most minimal of contributions to grow.

Sustainability

Sustainability is a major challenge and a critical feature in networks of all kinds (Sorensen, 2009). In some cases the problem is how to sustain a network after start-up funding ends, but in the case of a Knowledge Building innovation network, the more basic challenge is to sustain involvement and innovativeness. Achieving both of

these depends on developing in the network a dynamic process that yields sufficient intrinsic rewards to participants to keep the network thriving. An issue that bears on both inclusivity and sustainability is that of funding necessary to provide central functions of technological and administrative support. Fees sustain some well-known initiatives, for example New Pedagogies for Deep Learning (<http://npdl.global>), but fees are not in the spirit of opportunistic, inclusive, scalable knowledge-creating enterprises.

Continual improvement

Given Knowledge Building's heavy emphasis on "collective cognitive responsibility for idea improvement" (Scardamalia, 2002), a Knowledge Building network is necessarily an "improvement network," as advocated by the Carnegie Foundation for the Advancement of Teaching (Bryk, Gomez, & Grunow, 2011). Ever since the pioneering work of Deming (1986) on continuous improvement, the importance of data and data-based goals has been recognized. A Knowledge Building innovation network needs cross-site data that enables participants to evaluate "how we are doing" with respect to shared goals and that also serves as a repository of rich qualitative information that can be mined for ideas and potential educational models. Such a database raises problems of comparability across sites and curricula, ethical approval, access rights, and language differences, besides the complex problem of anonymization. The potential of such a repository is enormous, however; it offers the prospect of doing for idea-centered education what the CHILDES *Child Language Data Exchange System*, (<http://childes.psy.cmu.edu>), has done for the study of language development. A fundamental issue that is more serious in an education network than in networks more oriented toward a "bottom line" is the relation between indicators and criteria. There are many well-recognized indicators of how well an educational innovation is doing, but there is also a high risk (as appeared in the NCLB drive toward continual improvement in a few kinds of test scores) that the indicator becomes a criterion, so that increasing standing on the indicators becomes the goal, displacing the actual educational goals that gave rise to the indicators.

Research-based innovation

Innovations in educational practice can come about through disciplined design-based research and also through teachers' efforts to solve educational problems or find a better way. A number of people in the Knowledge Building community are seeking a third approach that has researchers, practitioners, and engineers working together to produce innovations that combine the top-down character of theory-into-practice with the bottom-up character of innovations that originate in practice. A looked-for result is what Bereiter (2014) discussed as "principled practical knowledge"—knowledge that meets both criteria of practicality and criteria of explanatory coherence. The basic iterative mechanism of design-based research characterizes this knowledge-building process, but there is in addition investment in coherent justification and making generalizable sense of the emerging innovation. Beyond shared stories and research reports, the innovation networks must produce shared data to inform design iterations and test the effectiveness of Knowledge Building practices both in terms of knowledge building principles and in terms of generally recognized objectives of literacy, numeracy and what are popularly known as 21st century skills. Data should be helpful and convincing for the public and policy makers, as well as administrators and practitioners. Research-based advances must span elementary to tertiary sites, all subject areas, a broad range of socio-economic levels and sectors and include great cultural and linguistic diversity. Besides meeting these requirements, the data banks described previously should support graduate student research at all levels and enable match-making between practitioners and researchers to extend collaborative opportunities. The data repository should be the world's most valuable resource for studying knowledge creation in education, positioning the Knowledge Building design community to produce not only exportable "know-how" but to contribute significantly to knowledge of what students are capable of as junior members of a knowledge society. The data should provide a basis for models not only for education systems concerned about boosting basic skills but also for systems looking beyond test scores and '21st century skills' to what could increase cultural capacity to innovate, advance knowledge, and solve societal problems

Technology innovation, analytic tools and open source community

Collective goal: develop an educational software environment that mirrors conditions of the surrounding open, innovation-driven, knowledge society and that is maximally conducive to knowledge creation. The environment should

- make it possible for all citizens to be productively engaged in a knowledge building community
- incorporate analytic tools that provide support for sustained engagement leading to advances in knowledge and practice.
- support quality of group life rather than focus exclusively on individual achievement
- incorporate interface designs that make knowledge building activity transparent and adjustable as work proceeds.
- support "on the fly" visualizations that allow users to view their discourse from multiple perspectives, as part of the knowledge building process.
- support sustained creative work with ideas
- provide a scalable, cross-sector architecture to “rise above” idea fragments and clutter to powerful ideas
- include assessment to enable instant individual and group feedback to boost knowledge building and help users advance in basics, 21st century competencies and new competencies in parallel
- integrate face-to-face and online discourse into coherent knowledge-building/knowledge-creating dialogues

Open innovation

In “The Era of Open Innovation” Chesbrough (2003) states “the logic that supports an internally oriented, centralized approach to research and development (R&D) has become obsolete. Useful knowledge has become widespread and ideas must be used with alacrity. Such factors create a new logic of open innovation that embraces external ideas and knowledge in conjunction with internal R&D. This change offers novel ways to create value. ...” As suggested in this quotation, successful enterprises are undergoing a fundamental shift from “closed innovation” to “open innovation” that takes advantage of an abundant resource—ideas—and communities able to move from promising ideas to useful innovations. Open innovation, as put into play by organizations ranging from technology companies to the U.S. Office of Education, requires two things not normally found in innovation networks: (1) openness to input from anywhere in the world rather than input limited by network participants, and (2) a central authority that defines problems to be put out for open innovation and evaluates and coordinates inputs from that process. The multi-level challenge of networking for educational innovation is therefore to exploit the strengths of three quite different forms of knowledge-creating interaction: local, small group collaboration in problem solving and design development; larger scale innovation networks; and still larger scale open innovation, where there are no restriction on where productive ideas and problem solutions come from.

Clearly not all these issues can be covered in the time available. The moderator will focus discussion on issues rising to prominence through ideas common to the presenters’ contributions and the audience response to them.

Significance of the symposium for the CSCL community and the CSCL 2017 theme

An important part of CSCL 2017’s “equity and access” theme is work that seeks “ways to broaden the CSCL pipeline.” Including the voices of teachers and other practitioners is a first-order requirement of such broadening. Many, perhaps most CSCL design researchers already include practitioners as active agents in the design process. This has certainly been true of Knowledge Building researchers for decades. However, giving practitioners a voice is not enough. Teachers and other practitioners represent a resource for innovation and invention that has proved difficult to integrate fully into design and engineering processes. Because Knowledge Building is a principles-based rather than a procedures-based approach (Hong & Sullivan, 2009), teachers’ creative input needs to extend beyond devising activities and implementation strategies. It needs to advance ways of improving the overall functioning of a classroom or other group as a knowledge-creating community. In order to do this within the large framework of Knowledge Building principles, practitioners themselves, along with researchers, engineers, administrators, and policymakers, need to function as a knowledge-creating community. Because the participants in this “think tank” symposium have pursued this objective in various ways over a number of years, they have the potential to produce design advances that will help the CSCL community as a whole in their pursuit of “equity and access.”

International panel and areas of expertise

Brazil

Cesar Nunes has implemented and evaluated large scale transformations on education including knowledge building communities involving teachers, policy makers and researchers and on subjects as diverse as moral development, creativity, and science. He is a researcher of the Moral Development Group at the University of Campinas, Brazil and consultant for OECD and Ayrton Senna Institute on programs for development and assessment of creativity and critical thinking.

Telma Vinha is professor at the Faculty of Education, University of Campinas –Unicamp-, Brazil. She leads the Moral Development Studies and Research Group and has been coordinating programs involving public and private schools around Brazil with the use of Knowledge Forum to connect Knowledge Building Principles and the development of student autonomy.

Canada

Marlene Scardamalia invented CSILE, the first networked collaborative learning environment and is active in all aspects of research on Knowledge Building and Knowledge Building technology. As holder of the Presidents' Chair in Education and Knowledge Technology at the University of Toronto, she has led an international network of researchers and innovators in education devoted to extending the limits of the possible in students' functioning as knowledge-creating communities.

Carl Bereiter is one of the originators of Knowledge Building as an educational approach and has been active in research related to it and to supportive technology design. His particular interest has been in the epistemological aspects of knowledge production (Bereiter, 2002, 2014, 2016).

Thérèse Laferrière, Chair, Centre of Research and Intervention for Student and School Success (CRI-SAS/CRIRES), Université Laval, a multi-university research center on successful schooling, is conducting a number of design research projects, including ones related to the Networked Remote School initiative, network-enabled communities of practice, and knowledge building communities. She is the lead researcher of a large network on school attendance and academic achievement named PERISCOPE, and funded by the Quebec main research funding agency (FRQ_SC).

Alexander (Sandy) McAuley is an Associate Professor at the Faculty of Education at the University of Prince Edward Island where he is the academic lead for the MEd cohort on 21st Century Teaching and Learning. He has been working with Knowledge Building in cross-cultural contexts, specifically in northern Canadian contexts, since the early 1990s and is particularly interested in its role in redressing the imbalances of power between marginalized and dominant groups in education.

Richard Reeve has worked in various capacities (teacher, teacher/researcher & faculty member) all oriented toward developing, sustaining and researching knowledge building communities in schools. As the original IKIT (Institute for Knowledge Innovation and Technology) teacher/researcher he became deeply interested in the role design plays in the implementation and development of innovative classroom practices. With his colleague Vanessa Svihla he has examined teacher discourse that supports this type of *designerly* work.

China

Shaoming Chai is an Associate Professor and Vice-Dean of the International Business School, South China Normal University, China. His research interests include computer-assisted language learning, online education, computer-supported collaborative learning, learning studies and technology, and international education.

Carol K.K. Chan (University of Hong Kong) has conducted research on knowledge building and has expertise in assessment in collaborative learning settings. Her work was recognized with the outstanding paper award at CSCL 2005. She is associate editor of the *International Journal of Computer-supported Collaborative Learning*.

Jan van Aalst is Associate Dean (Research), and Associate Professor at the Faculty of Education, The University

of Hong Kong. His areas of expertise include: Knowledge building, formative assessment, inquiry-based learning. He is Associate Editor for the Journal of the Learning Sciences.

Colombia

Fernando Díaz del Castillo is Director of Innovation and Development at Gimnasio La Montaña, in Bogotá, Colombia. He leads the implementation of educational technology to scaffold innovation, and improve the quality of teaching, learning, assessment, as well as projects ranging from infrastructure renovations to international student exchanges and collaborations.

Finland

Kai Hakkarainen, Ph.D. (www.helsinki.academia.edu/KaiHakkarainen) is the professor of education at the Institute of Behavioral Sciences, University of Helsinki. With his colleagues, Hakkarainen has, for 20 years, investigated personal and collaborative learning processes at all levels, from elementary to higher education. From a strong theoretical basis he has addressed how learning and human intellectual resources can be expanded using collaborative technologies and personal and collective learning processes taking place in knowledge-intensive organizations, including innovative private corporations and academic research communities.

Pirita Seitamaa-Hakkarainen is Professor of Craft Science at the University of Helsinki, Department of Teacher Education. She has published studies in design and craft processes and practitioners' expertise in these areas. Moreover, she has had lead research projects for studying learning through collaborative designing and developed associated models and methods. Her investigations focus on creative processes involved in collaborative design activities as well as expert and teacher scaffolding of the process.

Japan

Yoshiaki Matsuzawa received his PhD in Media and Governance in 2008 from Keio University, Japan. He is an associate professor in the School of Social Informatics at Aoyama Gakuin University. Research interests include information systems design, computers as meta-media, and software development enabling change of learning. He is the initiating engineer for the current version of Knowledge Forum.

Jun Oshima has been involved in knowledge building research for more than twenty years, working in classroom at various levels in Japanese and advancing research on representing the state of collective knowledge advancement. In collaboration with engineering researchers, he developed Knowledge Building Discourse Explorer (KBDeX) for analyzing collaborative discourse in face-to-face and online communication.

Hajime Shirouzu is a director of Consortium for Renovating Education of the Future (<http://coref.u-tokyo.ac.jp/en>), which late Naomi Miyake founded nine years ago. Hajime and Naomi have collaborated with 2,000 teachers per year to introduce collaborative learning into ordinary classrooms in Japan.

The Netherlands

Frank de Jong has implemented knowledge building pedagogy in university education, business professional development, and currently in a two-year part-time MEd-program of Learning and Innovation of Aeres University of Applied sciences, Wageningen, the Netherlands. His current research is focused on responsive learning, the semiotic character of knowledge building conversations, and the development of semantic learning analytics.

Singapore

Seng Chee Tan is a deputy director of the Centre for Research and Development in Learning (CRADLE@NTU) at the Nanyang Technological University, Singapore. He has been working on knowledge building communities in Singaporean schools since 2002 and has edited the book "Knowledge Creation in Education" published by Springer in 2014.

Chew Lee Teo, is the Lead Specialist, Singapore Ministry of Education, working closely with teachers, heads of departments, and school leaders in principled adaptation of knowledge building. She connects teachers across Singapore in network knowledge building communities to establish idea-centered classrooms. She currently heads a group of specialists and teacher-researchers in exploring educational technology for active learning with technology in English Language, Chinese Language, Sciences, and the Humanities.

Spain

Mireia Montané is currently President of the World Federation of Associations for Teacher Education (WFATE) and director of the International Education Programs at the Col·legi de Doctors i Llicenciats in Catalonia, Spain. She is developing European Educational networks involving many European countries, and she is coordinator in Europe for the worldwide network KBIP (Knowledge Building International Network), using knowledge building theories between students, teachers and researches.

USA

Katerine Bielaczyc is the Director of the Hiatt Center for Urban Education at Clark University. Dr. Bielaczyc's research involves collaborating with students, teachers, and school communities to investigate new approaches to teaching and learning. Her work focuses on developing both technological and social infrastructures to support participants in working together as a knowledge building community to create knowledge regarding personal, pedagogical, and systemic transformation.

Bodong Chen is an Assistant Professor in learning technologies at the University of Minnesota. His primary interests include the design of new tools, analytics, and pedagogical supports to support higher-order competencies in knowledge building.

Mei-Hwa Chen, Mei-Hwa Chen is an Associate Professor at the Computer Science Department, University at Albany, State University of New York, USA. Her research interests include software architecture, software testing and reliability engineering. Dr. Chen leads the software engineering team that develops and maintains large-scale software applications in the education and the healthcare domains

Jianwei Zhang is an associate professor at the University at Albany. His research explores a principle-based, emergent structuration approach to supporting sustained knowledge building practices across classrooms. This approach is supported by the Idea Thread Mapper, a software tool designed to trace collective progress in extended online discourse, feedback on emergent structures, and connect idea threads across communities.

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