CJLT RCAT
Canadian Journal of Learning and Technology
La Revue canadienne de l'apprentissage et de la technologie

Volume 47 (4) Special Issue 2021

Advancing Knowledge Creation in Education Through Tripartite Partnerships

Faire progresser la création de connaissances dans l'éducation grâce à des partenariats tripartites

***Sharon Friesen**, University of Calgary*
***Barbara Brown**, University of Calgary*

Abstract

The purpose of this paper is to highlight the work of one tripartite partnership with stakeholders to improve and strengthen novice teachers' pedagogical designs using design-based professional learning guided by the principles of knowledge building/knowledge creation. The tripartite partnership involved 450 novice teachers from an urban school division, a practitioner-research university team, and the provincial government. Using a design-based approach during and in between five professional learning sessions, this study analyzed the ways in which teachers worked in collaborative, collective, and connected ways to progressively improve pedagogical designs for collective knowledge building. The community used a digital audit trail and video cases to engage in knowledge building discourse, and to keep track of and continually reflect on progressive improvements and refinements to their pedagogical designs. Design-based professional learning, informed by the 12 principles of knowledge building/ knowledge creation, provided novice teachers with a process to: understand teaching practice as the site for progressively improving and refining pedagogical designs; accept all participants as legitimate contributors and support each other in idea improvement; make use of authoritative sources; contribute to collective knowledge advancement using artefacts and evidence from practice; and understand that teacher knowledge building/creation requires a supportive community.

Keywords: Design-based professional learning; Professional learning; Design-based research; Knowledge building; Knowledge creation; Teacher induction

Résumé

L'objectif de cet article est de mettre en évidence le travail d'un partenariat tripartite pour améliorer et renforcer les conceptions pédagogiques des enseignantes et des enseignants novices par l'intermédiaire d'un apprentissage professionnel basé sur le design et guidé par les principes de coélaboration/création de connaissances. Le partenariat tripartite impliquait 450 enseignantes et enseignants novices d'une division scolaire urbaine, une équipe universitaire de recherche-intervention, et le gouvernement provincial. En utilisant une approche basée sur le design pendant et entre cinq sessions d'apprentissage professionnel, cette étude a analysé les façons dont les enseignantes et les enseignants ont travaillé de manière connectée, collaborative et collective pour améliorer peu à peu leurs designs pédagogiques à des fins de coélaboration de connaissances collectives. La communauté a utilisé un outil de monitorage de traces numériques et des cas vidéo pour s'engager dans un discours de coélaboration de connaissances ainsi que pour suivre et réfléchir continuellement aux améliorations et aux raffinements à apporter à leurs designs pédagogiques. L'apprentissage professionnel basé sur le design, informé par les 12 principes de coélaboration/création de connaissances, a fourni aux enseignantes et aux enseignants novices un processus afin de mieux comprendre leur pratique d'enseignement en tant que lieu d'amélioration et de raffinement de leurs designs pédagogiques ; d'accepter tous les participants en tant que contributeurs légitimes qui se soutiennent mutuellement dans l'amélioration de leurs idées, utilisent des sources faisant autorité, contribuent à l'avancement des connaissances collectives en utilisant des artefacts et des appuis tirés de leurs pratiques ; et comprennent que la coélaboration/création de connaissances par des enseignantes et des enseignants passe par une communauté de soutien.

Mots clés : apprentissage professionnel basé sur le design ; apprentissage professionnel ; recherche basée sur le design ; coélaboration de connaissances ; création de connaissances ; insertion professionnelle en enseignement

Introduction and Context

The unprecedented growth in networked digital technologies and knowledge economies has given rise to knowledge societies. Knowledge creation, dissemination, and utilization are central concerns for knowledge societies (UNESCO, 2005) and schools are considered building blocks with education central to sustainable development (UNESCO, 2020). In previous times, the control of information and knowledge went hand in hand with serious inequality, exclusion, and social conflict. "Nobody should be excluded from a knowledge society, where knowledge is a public good, available to each and every individual" (UNESCO, 2005, p. 18). Older and outdated structures have allowed power and control over knowledge to be the exclusive domain of an elite few. While there are calls for a more inclusive approach to knowledge dissemination, creation, and utilization (UNESCO, 2012), there are those who contend there is little evidence that moves towards inclusion in this elite domain have gained much traction (Britz et al., 2006; Unwin, 2009).

Perhaps, now, more than ever, some of the existing inequalities and taken-for-granted assumptions regarding knowledge dissemination and utilization are being challenged. Who has access to information and knowledge, and who does not, is being brought into sharp focus. Dorothy Gordon, Chair of Intergovernmental Council for UNESCO's Information for All Programme, highlights how the current pandemic has created the need for open and free access to knowledge dissemination and utilization, stating, "In exacerbating inequalities, the pandemic has shown how control over data, information, and ultimately knowledge, should not be in the hands of a few" (Gordon, 2020, para. 3).

While the pandemic has highlighted and perhaps even challenged the ways in which control over data, information, and knowledge dissemination has limited access to all knowledge creation, one of the critical features of a knowledge society has been, and currently is, that it is a restricted domain of the elite few (Chan et al., 2020).

> While knowledge creation is critical to societal progress and collective well-being, a common belief holds that few can create new ideas. The traditional "genius" conception serves to increase existing gaps between the knowledge rich and poor, and in turn, undermine society's natural, abundant, untapped resource—the ideas of its citizens. A modern theory of knowledge creation is needed if we are to foster a vision of an inclusive knowledge society. How knowledge creation can be realized in classrooms, schools, and beyond supported by digital technologies for new educational alignments has become an urgent educational agenda. (Chan et al., 2020, p. 106)

Members of the educational community have challenged limitations on who can engage in knowledge creation. Two of these members are the Institute for Knowledge Innovation and Technology and the Galileo Educational Network. These organizations have created networks exemplifying that one of the ways the educational community is addressing the need for new alignments is through forming partnerships. Tripartite partnerships, building upon research-practice partnerships exist between schools, universities, and governments who collaboratively engage in the important work of school improvement. Tripartite partnerships ensure the linkages between the key partners in research and innovation systems are involved in designing and creating new structures, processes, and practices (Brown & Egizii, 2019; Laferrière et al., 2010). Partnerships with multiple stakeholders is considered an "imperative for designing technology-enabled crisis resilient school systems" (Chan et al., 2020, p. xxi). Chan et al. (2020) described that Thematic Working Group 13 advocated for a tripartite approach to advance the work of knowledge building and knowledge creation in the classroom, school, and beyond the school.

Research within tripartite partnerships is typically supported through a participatory approach or paradigm (Heron & Reason, 1997; Lincoln et al., 2018). A participatory approach is grounded in the "primacy of the practical" (Guba & Lincoln, 2005, p. 195). While researchers and other partners working together with practitioners in schools to support learning is not a new concept, partnerships that involve schools, universities, and government in partnership with each other with a focus on collaboratively designing and carrying out joint research initiatives meant to create sustainable innovations throughout the system, is in its infancy. Several newer research designs, such as design-based implementation research (Fishman & Penuel, 2018), draw upon the strength and diversity of teams within partnerships to design and study educational innovations while they are being put in place.

Teams from the schools and university collaboratively organize the design process, draw upon theories to guide the research and determine an intervention or solutions, and develop the capacity of those involved (Fishman & Penuel, 2018). The research question guiding this paper is: In what ways does a tripartite partnership using a design-based approach to professional learning foster knowledge building/ knowledge creation activities in the learning community with networked digital technologies?

Review of the Literature

Throughout the iterative research process, literature related to tripartite partnerships and knowledge creation/knowledge building was sought. This study is situated in the literature related to the ways university-school partnerships have broadly evolved and can support knowledge creation/knowledge building in teacher professional learning environments. It also draws on Scardamalia and Bereiter's (2003) view of knowledge building/knowledge creation environments as "any environment (virtual or otherwise) that enhances collaborative efforts to create and continually improve ideas" (p. 2).

School-University-Government Partnerships

University-school partnerships have existed for many years, most often established to support teacher education and provide opportunities for students engaged in initial teacher education programs to experience the practical aspects of teaching. Professional development schools were one form of university-school partnerships. A professional development school sought to provide field experiences for initial teacher education, provide professional development opportunities, and conduct collaborative research. Initially, however, school-university partnerships formed to create professional development schools were hard to sustain and scale (Bullough et al., 1999; Abdal-Haqq, 1998). Doolittle et al. (2008) argued that professional development schools can establish an appropriate framework for establishing school-university partnerships, noting, however, that establishing effective partnerships requires that a number of conditions are met before engaging in these partnerships. Advocating for school-university partnerships, Maheady et al. (2016) proposed partnerships as a solution for solving contemporary educational issues and bridging theory to practice.

Hargreaves and Shirley (2012) advocated a more collaborative approach to partnerships, indicating that partnerships can help to promote educational responsibility or shared responsibility for teaching and learning (Killion, 2013; Neumerski, 2012). Research-practice partnerships provide a way to envision a collaborative approach to partnerships (Coburn et al., 2013; Penuel & Gallagher, 2017). Coburn et al. (2013) defined research-practice partnerships as "long-term, mutualistic collaborations between practitioners and researchers that are intentionally organized to investigate problems of practice and solutions for improving district outcomes" (p. 2). Laferrière et al. (2010) advocated for tripartite partnerships between schools, universities, and governments that were grounded in coherent theory, pedagogy, and technology. Chan et al. (2020) advocated for international tripartite school-university-government partnerships "to support open and connected Knowledge Building communities in education" (p. 110).

Emerging research from partnerships that build on the research-practice partnership between universities and schools suggests government should be included. In a case study involving 11 tripartite partnerships in the province of Alberta, Canada, findings indicated researchers and practitioners benefitted from the partnership and funding provided by the provincial government (Brown, in press). Tripartite partnerships demonstrated a positive impact and contribution to theory and practice through participants' reports of knowledge mobilization activities; however, the participants also noted there were challenges with coordinating multiple stakeholders and adhering to government timelines and funding structures (Brown, in press).

Laferrière et al. (2010) reported the findings from two case studies of school-university-government partnerships.

> These school-university-government partnerships worked like living organisms, each part helping out the other through the process. University researchers worked onsite and online, and conducted teaching and research activities. Their role depended very much on a particular school's goals, and master of the Knowledge Building principles and Knowledge Forum suite of tools. Governments were highly instrumental in providing orientation and resources. (p. 15).

Tripartite partnerships hold promise for connecting multiple stakeholders and impacting scholarly and professional communities in a knowledge society (Brown, in press; Chan et al., 2020; Laferrière et al., 2010; UNESCO, 2020).

Knowledge Building/Knowledge Creation

Bereiter and Scardamalia (2014) contended that knowledge building and knowledge creation represent the same core idea, in that the activity of creating or building knowledge is the "product of purposeful acts of creation" (p. 35). They argued that knowledge creation and knowledge building have different origins with knowledge creation arising from the organizational sciences literature and knowledge building from the learning sciences literature. Drucker (2015) argued that within successful organizations knowledge creation leads to innovation which must be "part-and-parcel of the ordinary, if not routine" (p. 185). According to Scardamalia and Bereiter (2014), knowledge building is a knowledge creating activity based on 12 principles that contribute to the advancement of the overall community through processes of idea improvement (Bereiter & Scardamalia, 2014; Chan et al., 2020; Chen & Hong, 2016).

Similarly, Chen and Hong (2016) contended that knowledge building/knowledge creation are not dependent upon a digital environment, noting that "humans have been engaged in knowledge building/ knowledge creation since the beginning of time" (p. 273). Several technologies can be utilized to support knowledge building/knowledge creation; however, it is unlikely that they will be successful without principles-based guidance, such as the 12 principles developed by Scardamalia and Bereiter (Chen & Hong, 2016). These 12 principles are: (a) real ideas, authentic problems; (b) improvable ideas; (c) idea diversity; (d) rise above; (e) epistemic agency (mobilize personal strengths to set forth their ideas and insights, negotiating a fit with the ideas of others and using contrasts to spark and sustain knowledge advancement); (f) community knowledge; (g) democratizing knowledge; (h) symmetric

knowledge advancement (interleaved communities provide successively more demanding contexts); (i) pervasive knowledge building; (j) constructive uses of authoritative sources; (k) knowledge building discourse; and (l) concurrent, embedded, and transformative assessment (Scardamalia & Bereiter, 2014).

Fishman et al. (2004) argued that knowledge building/knowledge creation is a cognitively-oriented technology innovation "designed to foster deep thinking and learning" (p. 43). When knowledge building/knowledge creation are tightly coupled with the 12 principles of knowledge building, progressive improvements and continual change are realized (Chan et al., 2020). Further, when networked digital technologies are utilized to foster collaboration while engaging in the knowledge building processes, then innovations that contribute to the overall advancement of the community are possible.

Methodology

A design-based research methodological approach (McKenney & Reeves, 2018) was used to study a year-long design-based professional learning intervention with novice teachers enacted within a tripartite partnership. This tripartite partnership involved teacher leaders and district administrators from a large urban school district, the government, researchers, and professional learning facilitators from the University of Calgary. The school division approached the researchers and professional learning facilitators at the university to partner with them to co-design, facilitate, and study the implementation of a professional learning initiative involving 450 beginning teachers. Throughout the year-long initiative, the school-university-government partnership worked collaboratively and collectively, with each part supporting the other parts. University researchers and professional development consultants worked onsite and online, conducted teaching and research activities, collaborated with school division leaders in the design of each of the professional learning sessions, and collaborated with the government in knowledge dissemination and mobilization activities.

The school division and the university researchers collaboratively designed the research proposal for the initiative and submitted it to the government. The government selected the proposal as one of their network initiatives. The design-based professional learning series drew on promising results from other studies using this type of intervention (Brandon et al., 2020; Brandon et al., 2014; Brandon, Saar, & Friesen, 2016; Brandon, Saar, Friesen, Brown, & Yee, 2016; Brown et al., 2020; Chu et al., 2020; Friesen & Jacobsen, 2015). In this study, the intervention was designed to support novice teachers to adapt their teaching to meet the Alberta Teaching Quality Standard (Alberta Education, 2018). The partners agreed that continuing professional learning was desirable, as teachers at the beginning of their careers needed to experience continuing professional learning and understand their practice as the site of professional improvement (Timperley, 2015). Design-based professional learning is an approach to continuing professional learning which promotes collaborative professionalism (Hargreaves & O'Connor 2018a, 2018b). Drawing upon principles of knowledge building/knowledge creation as articulated by Bereiter and Scardamalia (2014) and Scardamalia and Bereiter (2003, 2010, 2014), the design-based professional learning series aimed firstly to assist teachers to draw upon their practice as

the site of idea improvement, secondly to contribute to the overall advancement of the learning community, and thirdly to support individual learning and development of teaching competencies.

Methods

The design-based professional learning (DBPL) series involved 450 novice teachers and five iterative professional learning cycles. Data were gathered during each of the five cycles. To encourage participants to base their reflective conversations on student evidence of learning, they were asked to bring in artefacts from their students to each of the sessions. Initially, participants were inclined to bring only examples from their practice that were indicative of a highly successful instructional sequence or featured students who had no difficulty grasping concepts. After the second session we asked participants to bring three examples to each session that included work from one student who experienced challenges grasping the concept being taught. The researchers were responsible for data analysis that occurred during the interval between each of the sessions. Using the agendas, working documents, and researcher field notes from the five DBPL cycles, we analyzed the ways in which the structures and processes put in place throughout the sessions supported knowledge creation. Scardamalia and Bereiter's (2010, 2014) 12 principles were used as a lens to analyze the five sessions and the applied learning that occurred between sessions. The analysis drew upon a number of approaches including thematic coding and content analysis to understand the ways in which teachers engaged with the DBPL. To begin this process, the various structures and processes were mapped to the knowledge building/creation principles (Table 1).

Table 1

Technology-Enabled Activities Mapped to Knowledge Building/Knowledge Creation Principles

DBPL Cycles 1-5	Technology-Enabled Structures and Processes	Connection to Knowledge Building / Knowledge Creation Principles
Structures to Support Knowledge Creation during Sessions	In triads, participants engaged in the advancement of community knowledge using a collaborative word document to create audit trail.	Real ideas; improvable ideas; idea diversity; rise above; epistemic agency; community knowledge; and knowledge building discourse
	Research-informed literature and multimedia cases provided participants with exemplars and authoritative sources for building knowledge and idea improvement. Some of these cases were developed with participants for critical examination treating all participants as legitimate contributors.	Democratizing knowledge; symmetric knowledge advancement; and constructive use of authoritative sources

DBPL Cycles 1-5	Technology-Enabled Structures and Processes	Connection to Knowledge Building / Knowledge Creation Principles
Structures and Processes to Support Knowledge Creation Between Sessions	Applied learning between sessions built on each of the sessions using the principle of idea improvement within participants' own classroom practice. Participants drew upon the interconnected digital and physical communities/spaces (DBPL in-person community, online artefacts/audit trail, with school community)	Pervasive knowledge building; and concurrent, embedded, and transformative assessment

Findings

We discuss how four findings from the tripartite study with novice teachers fostered knowledge building/knowledge creation. In presenting the four findings from this analysis, we specifically note the ways that the tripartite partnership using a DBPL approach to professional learning fostered knowledge building/knowledge creation activities in the learning community with networked digital technologies over the year. The four findings are: (a) understanding teaching practice as the site for idea improvement; (b) accepting all participants as legitimate contributors identifying and working on problems of practice and supporting each other in idea improvement and knowledge advancement; (c) making use of authoritative sources and contributing to collective knowledge advancement using artefacts and evidence from practice; and (d) understanding that teacher knowledge building/creation requires a supportive community of colleagues, district and school leaders, and university-based researchers. More specific details about the DBL intervention that was used, along with findings from pre- and post-survey data have been reported elsewhere (Brown et al., 2020; Chu et al., 2020).

Teaching Practice as the Site of Improvement

Findings demonstrated that novice teachers were positioned as designers of learning and teacher learning involved reflective practice with colleagues (Brown et al., 2020). According to the descriptions of the five cycles and field notes maintained by the researchers, each DBPL cycle included dedicated time during the sessions for participants to engage in processes to progressively improve their instructional practices using various artefacts they brought to the sessions from their classrooms as real-world examples of their teaching improvements and their learning (e.g., samples of work from three students including videos of students work, digital images of student work, formative assessment tasks, instructional sequences). Working with the principle of idea improvement and epistemic agency, participants used a triad protocol to guide the process of sharing their artefacts with their peers.

Within their triad, each participant would describe and explain the design decisions that gave rise to the artefact. As the first participant (presenter) in the triad described their pedagogical design to make their design choices and their learning visible to this small group, another member recorded key questions, insights, and highlights in an electronic questionnaire (Google Form, One Drive) to document the explanation, and the third member listened and helped facilitate the discussion. As with all

generative forms of dialogue, the listener also asked questions to support the knowledge building process, such as, “Can you explain...”, “I need to understand…”, “Another idea might be….”, or “Have you thought about…”. The dialogue was aimed to deepen thinking about the design and the artefacts, engage in the work of idea improvement, and to mobilize personal strengths and support the triad as they negotiated a fit between personal ideas and ideas of others. The discourse:

a) served to identify shared problems of practice and gaps in understanding as members of the group asked questions;
b) offered feedback as the group engaged in its own assessment of the artefacts; and
c) prompted critical contrasts and complementarity to create a rich environment for teaching improvements, to spark and sustain knowledge building, and to evolve into new and more refined forms.

The dialogue that emerged was often referred to as “fierce dialogue” by the participants, as the dialogue was not merely relegated to participants sharing ideas with each other. Rather, participants were engaged in the processes of improving the ideas that underpinned their teaching improvements through the work of addressing real problems of practice. The process was repeated until each member had a turn sharing their artefacts from their classroom that represented their teaching improvements and learning. The triad dialogue took approximately 45 minutes. Once groups finished, participants could view all the entries in a collated spreadsheet as an audit trail of learning (Google Sheet) which was available to all members of the community to build on, ask questions of, or use to spur new ideas. Members of the research team, the professional learning facilitators, and the participants themselves analyzed this audit trail and made observations and shared their critical analysis.

All Members Are Legitimate Contributors Identifying and Working on Problems of Practice and Supporting Each Other

Another key feature of the DBPL cycles was the work that occurred during and between sessions. The risk which involved novice teachers opening their practice to each other and to members of the university at an early stage in their career cannot be underestimated. The school leaders and university researchers and professional development consultants discussed ways to create an environment where nontenured and novice teachers might consider bringing real problems of practice and trusting their colleagues to help them improve their practice. Our decision to move to triads and make all documents from the triads available to all the members from the session through digital audit trails, and all 450 participants, was an important step in this direction. In addition, creating time for self-reflection, using artefacts and evidence from their classroom requesting participants to bring in artefacts from three of their students, and scaffolds to support the idea improvement dialogue were also necessary. At the beginning of the third session, participants relaxed into the process. They brought, not just their best work, but the real work of the classroom and the real problems that confounded, perplexed, or confused them along with evidence-based teaching improvements. The dialogue with each other, in the presence of the work of students from their own classrooms as indicative of evidence-based teaching improvements, helped them not only address problems but also identify some new problems and challenge some taken-for-granted assumptions.

Contributing to Collective Knowledge Advancement Using Artefacts and Evidence from Practice

The five DBPL cycles included video case studies of various participants' instructional practices as part of teaching improvements. During the sessions, the team from the university listened in on the dialogue of the triads. Frequently, problems of practice surfaced, with accompanying artefacts from the classroom, that held possibility for advancing the knowledge for the entire community, not only the participants in the session, but all 450 participants. The team from the university committed, with approval from the teacher and school and district leaders, to capture and produce the videos of the teachers and their students in the classroom. Videos were reviewed by the teachers to ensure they accurately portrayed their instructional practices. They were then reviewed by the school-university team prior to the DBPL session. Video cases were used as authoritative sources, along with other authoritative sources such as peer-reviewed research literature, during the sessions to create a dynamic environment for instructional and idea improvement and refinement by and with colleagues (Brown et al., 2020). In addition, the video cases helped participants create a defensible theory of professionalism as their own work stood alongside peer-reviewed research literature during the sessions.

A Supportive Tripartite Community

This finding showed that teacher learning with a focus on improving instructional practice involved collaboration and a supportive network (Brown et al., 2020). Participants committed to attend the DBPL series and engage in the applied learning tasks between sessions. The applied learning component provided an opportunity to interconnect the digital collections from the sessions (audit trails and video cases) and share these sources during the sessions and with the broader school community. Novice teachers could access and review the audit trails and could utilize the video cases when working with their colleagues in their respective schools between sessions. Novice teachers who were supported within their school communities (e.g., worked closely with learning leaders in the school) reported how they connected with supportive colleagues in their school. The school district leaders used the video cases during a similar DBPL series with principals, assistant principals, and teacher leaders; thereby, creating a dynamic community where every member of the teaching community, principals to novice teachers alike, were engaged in the collective work of improving practice.

The participants in this study came to acknowledge and understand that they alone cannot solve the problems of practice within the profession. Everyone who has a place in the chain of influence, from the government policy makers to those in district offices, to school administrators, and to teachers, were engaged in the processes of improvement and knowledge building on behalf of the youngest members of our society. The vibrancy of the school-university partnership evolved through the iterative cycles of the design-based research, which itself was focused on designing the DBPL series, gathering feedback from the sessions and reviewing the analysis from the data, engaging in idea improvement between each of the sessions, and designing the next DPBL session. The government was involved in disseminating and mobilizing the knowledge to a larger network of government-university-school partnerships that operated through the province.

Discussion

The DBPL mirrored the knowledge building/knowledge creation processes; thus, teachers worked in collaborative, collective, and connected ways to progressively improve pedagogical designs for collective knowledge building (Chan et al., 2020). The initiative built collective efficacy as educators worked to advance their state of knowledge and improvable practices. Educators took collective cognitive responsibility (Bereiter, 2002; Scardamalia & Bereiter, 2014) to improve professional practices of their colleagues as well as their own, as participants engaged with problems of practice from the classroom and worked collaboratively and collectively to address these authentic problems. Technology enhanced, extended, and enabled the knowledge building processes during and between the DBPL cycles.

Networked digital technologies were used for collectively capturing the knowledge building/ knowledge creation dialogue and the classroom artefacts, which provided the evidence base for ongoing teaching improvements, and for the discursive practices developed through the triad activity. This process helped to maintain, not only a record of the problems of practice using networked digital technologies in the form of an audit trail, but also allowed for continual analysis, the progressive improvement of teaching improvements and refinements, and the questions from the community to build on each other's ever deepening understanding of the ways in which teaching improvements addressed problems of practice. Novice teachers engaged in making their practice visible and public so it could become the site of improvement. Participants took active roles in contributing to idea diversity. During the sessions, the triad protocol provided participants with a structured format to give and receive feedback, to engage in the processes and question scaffolds that treated teachers' classroom practices as improvable, and the audit trail allowed all members of the session and the 450 participants to contribute to addressing the problems of practice and engage in teaching improvements. Arguably, the triad activity, sharing artefacts of students learning, and use of networked digital technologies to maintain an audit trail supported knowledge building/knowledge creation during the DBPL sessions.

In between the sessions, the researcher-practitioners also reviewed and analyzed the audit trail. This required the collective group to work together and in partnership to advance understanding beyond the level of the individual. The audit trail supported collective teacher agency. Novice teachers took both personal and collective responsibility to negotiate ideas individually during the triad sessions, and collectively when analyzing the complete audit trail in between and after the sessions. Making teaching the site of improvement through collecting and presenting artefacts from the classroom anchored the foundational work that occurred during the DBPL sessions with a clear connection to the applied learning and work that occurred in between the DBPL sessions. In addition to the supportive tripartite partnership that supported the participants, we speculate that the continuity and connections from one session to the next also helped form a strong network of support and helped novice teachers take collective responsibility for the growth of their peers.

Video viewing of teacher activity, peer activity, or one's own professional practice has been shown in the literature to benefit teachers' knowledge-based reasoning (Gaudin & Chaliès, 2015). Video

case studies were used in this study to contribute to knowledge advancement alongside peer-reviewed literature. In this way, teachers new to the profession were recognized as legitimate creators of and contributors to knowledge. Through the video case studies, novice teachers came to understand that it was not sufficient to know how to engage in improvement but also to know why. They also came to understand that their practice required a defensible theory of professionalism, connecting research to practice and practice to research. Video cases used during the DBPL sessions provided a way to guide reflection and engage all participants in providing successive and more demanding contexts in which to take up their problems of practice. Lastly, the video cases helped connect their teaching practice with the professional competencies for teachers in Alberta (Alberta Education, 2018), and five principles in the teaching effectiveness framework (Friesen, 2009). Further research could be conducted to better understand how video viewing (videos of self, videos of peers, videos of unknown actors) can be used during and between DBPL sessions for knowledge building/knowledge creation and the effects of video viewing for professional learning with novice teachers.

The tripartite partnership supported the participants in this research study to engage in the process of knowledge building/knowledge creation. At the government level, a provincial network was created to support tripartite partnerships across the province, as well as provide a platform to disseminate and mobilize the knowledge from this study (Brown et al., 2020). Like the tripartite relationships noted by Laferrière et al. (2010), “the school-university-government partnership worked like a living organism, each part helping out the other through the process” (p. 15). School leaders and the university team collaboratively designed the five sessions in the DBPL series by meeting before each of the five sessions, collaboratively designing each session, and collaboratively reviewing the findings through each of the design-based research cycles. The university team worked onsite and online with the participants, conducting teaching and research activities. They also worked onsite and online with school leaders and members from the government. Teachers found they were able to make strong connections between their evidence-based teaching improvements and the government mandated Teaching Quality Standard (Alberta Education, 2018), and the teaching effectiveness framework used throughout the school division as a guiding frame for designing learning (Friesen, 2009). Teachers came to understand how a principle-based and continuing professional learning approach enabled them to create powerful evidence-based teaching improvements with a supportive community of colleagues, district and school leaders, and university-based researchers.

Conclusion

The architectural foundation of the DBPL cycles is comprised of the design of each session and the work conducted between sessions, all interconnected with the 12 principles of knowledge building/ knowledge creation. The knowledge building principles helped us understand the nuances and the relationships among the participants and researcher-practitioners within a supportive network of tripartite partners. Novice teachers were supported by peers and a learning community during the sessions and supported by their colleagues and leaders outside of the sessions (Brown et al., 2020) and more broadly by the district, university, and ministry through their support for the research partnership.

Digital technologies supported a professional learning environment that enabled and enhanced collaboration among the partners, engagement in continuous knowledge building processes for designing learning during and between sessions, and a strengthened a professional learning network. DBPL informed by the 12 principles of knowledge building provided novice teachers with a process to work collectively as a community, progressively improving and refining their pedagogical designs, and engaging in knowledge advancement using artefacts from their practice within a supportive learning community and tripartite partnership.

References

Abdal-Haqq, I. (1998). *Professional development schools: Weighing the evidence*. Corwin (Sage).

Abodeeb-Gentile, T., Pedro, J., & Tapper, J. (2016). Translational research in education: The benefits of a partnership that examines the impact of professional development on early-literacy outcomes. *Delta Kappa Gamma Bulletin, 82*(3), 1-15.

Aguerrondo, I. (2009). *Complex knowledge and education competencies*. UNESCO. http://www.ibe.unesco.org/sites/default/files/resources/wpci-08-knowledge_compet_eng_0.pdf

Alberta Education (2018). *Teaching Quality Standard.* https://education.alberta.ca/media/3739620/standardsdoc-tqs-_fa-web-2018-01-17.pdf

Bereiter, C. (2002). *Education and mind in the knowledge age.* Lawrence Erlbaum Associates.

Bereiter, C., & Scardamalia, M. (2014). Knowledge building and knowledge creation: One concept two hills to climb. In S. C. Tan, H. J. So, & J. Yeo (Eds.), *Knowledge creation in education* (pp. 35-52). Springer.

Brandon, J., Friesen, S., & Saar, C. (2020). Conceptualizing and enacting overall instructional leadership in the Alberta context. In S. Friesen, J. Brandon, & M. Jacobsen (Eds.), *Selected proceedings of the IDEAS conference: Transforming pedagogies* (pp. 57-76). Werklund School of Education, University of Calgary.

Brandon, J., Saar, C., & Friesen, S. (2016). NEIL leading and learning cycles. In M. Takeuchi, A.P. Preciado Babb, & J. Lock (Eds.), *IDEAS 2016: Designing for innovation selected proceedings* (pp. 141-151). Werklund School of Education, University of Calgary. http://dx.doi.org/10.11575/PRISM/5260

Brandon, J., Saar, C., Friesen, S., Babb, P., & Alonso, G. (2014). Supporting pedagogical leadership in Area III. In P. Preciado Babb (Ed.), *Proceedings of the IDEAS: Rising to challenge conference* (pp. 15-24). Werklund School of Education, University of Calgary.

Brandon, J., Saar, C., Friesen, S., Brown, B., & Yee, D. (2016). Pedagogical leadership teams: Magnifying and spreading impact. In M. Takeuchi, A.P. Preciado Babb, & J. Lock (Eds.), *IDEAS 2016: Designing for innovation selected proceedings* (pp. 152-161). Werklund School of Education, University of Calgary. http://dx.doi.org/10.11575/PRISM/5260

Britz, J., Lor, P., Coetzee, E., & Bester, B. (2006). Africa as a knowledge society: A reality check. *International Information and Library Review, 38*, 25-40.

Brown, B. (in press). Research-practice partnerships in education: Benefits for researchers and practitioners. *Alberta Journal of Educational Research*.

Brown, B., & Egizii, R. (2019). Research-practice partnerships in Alberta: Research brief. Werklund School of Education, University of Calgary. http://dx.doi.org/10.11575/PRISM/36830

Brown, B., Friesen, S., Beck, J., & Roberts, V. (2020). Supporting new teachers as designers of learning. *Educational Sciences, 10*(8), 207. https://doi.org/10.3390/educsci10080207

Bullough, R., Birrell, J., Young, J., Cecil Clark, D., Erickson, L., Earle, R., Campbell, J., Hansen, L., & Wiston Egan, M. (1999). Paradise unrealized: Teacher educators and the costs and benefits of school/university partnerships. *Journal of Teacher Education, 50*(5), 381-390.

Chan, C., Lai. K-W., Bielzczyc, K., Tan, S-C., Ma, L., Scardamalia, M., Bereiter, C., Friesen, S., Massey, L., McAuley, A., Millwood, R., Philip, D., & Reeve, R. (2020). Knowledge building/ knowledge creation in the school, classroom, and beyond. In P. Fisser & M. Phillips (Eds.), *Learners and learning contexts: New alignments for the digital age* (pp. 101-108). https://edusummit2019.fse.ulaval.ca/files/edusummit2019_ebook.pdf

Chen, B., & Hong, H-Y. (2016). Schools as knowledge building organizations: Thirty years of design research. *Educational Psychologist, 51*(2), 266-288. https://doi.org/10.1080/00461520.2016.1175306

Chu, M-W., Brown, B., & Friesen, S. (2020). Psychometric properties of the design-based professional learning for teachers survey. *Professional Development in Education.* https://doi.org/10.1080/19415257.2019.1709219

Coburn, C., Penuel, W., & Geil, K. (2013). *Research-practice partnerships: A strategy for leveraging research for educational improvement in school districts.* William T. Grant Foundation. https://wtgrantfoundation.org/library/uploads/2015/10/Research-Practice-Partnerships-at-the-District-Level.pdf

Doolittle, G., Sudeck, M., & Rattigan, P. (2008). Creating professional learning communities: The work of professional development schools. *Theory into Practice, 47*(4), 303-310. https://doi.org/10.1080/00405840802329276

Donohoo, J., & Velasco, M. (2016). *The transformative power of collaborative inquiry: Realizing change in schools and classrooms.* Corwin (Sage).

Drucker, P. (2015). *Innovation and entrepreneurship: Practices and principles.* Routledge.

Fishman, B., Marx, R., Blumenfeld, P., & Krajcik, J. (2004). Creating a framework for research on systemic technology innovations. *The Journal of the Learning Sciences, 13*(1), 43-76. https://doi.org/10.1207/s15327809jls1301_3

Fishman, B., & Penuel, W. (2018). Design-based implementation research. In F. Fischer, Hmelo-Silver, C., Golsman, S., & Reimann, P. (Eds.), *International handbook of the learning sciences* (pp. 393-400). Routledge.

Friesen, S. (2009). *Teaching effectiveness framework: A framework and rubric.* Toronto, CA: Canadian Education Association. https://www.edcan.ca/wp-content/uploads/cea-2009-wdydist-teaching.pdf

Friesen, S., & Jacobsen, M. (2015). *A design-based approach to teachers' professional learning.* EdCan Network. https://www.edcan.ca/articles/a-design-based-approach-to-teachers-professional-learning/

Gaudin, C., & Chaliès, S. (2015). Video viewing in teacher education and professional development: A literature review. *Educational Research Review, 16*, 41-67. https://doi.org/10.1016/j.edurev.2015.06.001

Gordon, D. (2020). WSIS 2020 high level dialogue on open educational resources as a tool to combat inequalities in times of crisis. https://en.unesco.org/news/wsis-2020-high-level-dialogue-open-educational-resources-tool-combat-inequalities-times-crisis

Guba, E. G., & Lincoln, Y. S. (2005). Paradigmatic controversies, contradictions, and emerging confluences. In N. K. Denzin & Y. S. Lincoln (Eds.), *The Sage handbook of qualitative research* (pp. 191-215). Sage.

Hargreaves, A., & O'Connor, M. (2018a). Leading collaborative professionalism: Seminar series 274. Centre for Strategic Education. http://www.andyhargreaves.com/uploads/5/2/9/2/5292616/seminar_series_274-april2018.pdf

Hargreaves, A., & O'Connor, M. (2018b). *Leading collaborative professionalism*. Corwin (Sage).

Hargreaves, A., & Shirley, D. (2012). *The global fourth way: The quest for educational excellence.* Corwin (Sage).

Heron, J., & Reason, P. (1997). A participatory inquiry paradigm. *Qualitative Inquiry, 3*(3), 274-294. https://doi.org/10.1177/107780049700300302

Killion, J. (2013). *Meet the promise of content standards: The role of third-party providers.* Learning Forward. https://learningforward.org/wp-content/uploads/2020/01/the-role-of-third-party-providers.pdf

Laferrière, T., Montane, M., Gros, B., Alvarez, I., Bernaus, M., Breuleux, A., & Lamon, M. (2010). Partnerships for knowledge building: An emerging model. *Canadian Journal of Learning Technologies, 36*(1), 1-20. https://doi.org/10.21432/T2R59Z

Lincoln, Y., Lynham, S., & Guba, E. (2018). Paradigmatic controversies, contradictions, and emerging confluences, revisited. In N. K. Denzin & Y. S. Lincoln (Eds.), *The Sage handbook of qualitative research* (pp. 108-150). Sage.

Maheady, L., Magiera, K., & Simmons, R. (2016). Building and sustaining school university partnerships in rural settings: One approach for improving special education service delivery. *Rural Special Education Quarterly, 35*(2), 33-40. https://doi.org/10.1177/875687051603500205

McKenney. S., & Reeves, T. C. (2018). *Conducting educational research.* Routledge.

Neumerski, C. (2012). Rethinking instructional leadership, a review: What do we know about principal, teacher, and coach instructional leadership, and where should we go from here? *Educational Administration Quarterly, 49*(2), 310-347. https://doi.org/10.1177/0013161x12456700

Organization for Economic Co-operation and Development (OECD). (2008). 21st century learning: Research, innovation and policy. https://www.oecd.org/site/educeri21st/40554299.pdf

Penuel, W., & Gallagher, D. (2017). *Creating research-practice partnerships in education.* Harvard University Press.

Scardamalia, M. (2003). Knowledge building environments: Extending the limits of the possible in education and knowledge work. In In A. DiStefano, K.E. Rudestam, & R. Silverman (Eds.), *Encyclopedia of distributed learning* (pp. 269-272). Sage.

Scardamalia, M., & Bereiter, C. (2010). A brief history of knowledge building. *Canadian Journal of Learning and Technology, 36*(1), 1-16. https://doi.org/10.21432/T2859M

Scardamalia, M., & Bereiter, C. (2014). Knowledge building and knowledge creation: Theory, pedagogy, and technology. In R. K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (2nd ed., pp. 397-417). Cambridge University Press.

Timperley, H. (2015). Continuing professional development. Continuing professional development. In J.D. Wright (Ed.) *International Encyclopedia of the Social & Behavioral Sciences* (2nd ed., pp. 796-802). https://doi.org/10.1016/B978-0-08-097086-8.92134-2

UNESCO (2005). *Towards knowledge societies: UNESCO world report.* https://unesdoc.unesco.org/ark:/48223/pf0000141843_eng

UNESCO (2011). *UNESCO ICT competency framework for teachers.* https://unesdoc.unesco.org/ark:/48223/pf0000265721

UNESCO (2012). Inclusive knowledge societies for sustainable development. https://www.un.org/en/development/desa/policy/untaskteam_undf/groupb_unesco_knowledge_societies.pdf

UNESCO (2020). *The digital transformation of education: Connecting schools, empowering learners.* https://unesdoc.unesco.org/ark:/48223/pf0000374309

Unwin, T. (2009). Development agenda and the place of ICTs. In T. Unwin (Ed.), *ICT4D information and communication technology for development* (pp. 7-38). Cambridge University Press.

Authors

Sharon Friesen, PhD, is a professor in the Werklund School of Education at the University of Calgary, Alberta, Canada. Her research interests include the ways in which K-12 educational structures, leadership, curriculum, and learning need to be reinvented for a knowledge/learning society. She co-founded and led the work of the Galileo Educational Network for the past 25 years. Email: sfriesen@ucalgary.ca

Barbara Brown, PhD, is an associate professor and Associate Dean, Teaching and Learning in the Werklund School of Education at the University of Calgary, Alberta, Canada. Her research interests include research-practice partnerships, professional learning, and collaborative instructional design in technology-enhanced learning environments.