Designing blended professional learning for school-based administrators:

A design-based research study

Judith Hadden, Kirk Linton, & Eric Perrault

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Background and problem statement:

As the Chief Superintendent of District A, Dr. Anna Brown is seeking to implement a division-wide professional development program for school leaders to build capacity in the effective integration of technology across the curriculum and improve learning opportunities and achievement for students in district schools through innovative student-centred (21st century) pedagogies (Trilling & Fadel, 2009). She knows that effective professional learning opportunities are content focused, build coherence, engage participants in active learning, require collective participation, and occur over a sustained period of time (Koh, 2011; Timperley , 2011). By contrast, much of the professional development (PD) offered to leaders in the school district has followed the "sit and get" workshop model with little impact on classroom practice or school effectiveness (Timperley, 2011), particularly in the area of technology integration. Alberta Education's Draft *School Leadership Standard* (2016) (SLS) has made explicit the central role of principals as instructional and visionary leaders in Alberta and Dr. Brown has seen recent research that points to instructional leadership as an "area for growth" in school leaders in her district and across Alberta (Brown, 2013). She is also aware of the recent development of the *Learning and Technology Policy Framework* (LTPF) from Alberta Education (2013) and is working to implement it in her district. Because of the nature of the district, small and rural, Dr. Brown would like to involve all principals as well as members of the district leadership team, from the outset in the Technology Leadership Initiative (TLI).

Through research, Dr. Brown has determined that as Thomas & Seely Brown (2011) present, the success of district wide PD for 21st century schools must consider a global context which requires the cohort to connect, engage, and collaborate amongst themselves and the greater educational world to co-create knowledge through shared experience. Through their

exploration of school improvement, Hubbard, Mehan & Stein (2006) note that educational reforms are socially constructed phenomena. A pillar for the PD as envisioned by Dr. Brown will stand on the context of knowledge co-creation. Considering the relevance of a greater circle for collaboration in support of educational reform, Dr. Brown is compelled to consider the use of technology as a means for collaboration given the large rural nature of her jurisdiction. As well the district geography is a challenge to create professional learning opportunities for her school-based administrators that engage them in active learning and participation over a sustained period of time. As a result, the design and development of an innovative, blended form of PD incorporating both face-to-face opportunities as well as an online platform that allows for networked, asynchronous learning will allow school leaders to experiment with new ideas in their school while feeling supported by peers as well as the personal choice to differentiate their learning based on their areas of interest or need.

Along with a blended format, Dr. Brown would like to experiment with creating *collectives* to support the learning of her leaders utilizing local and global networks through professional social network platforms. In their work, *A New Culture of Learning,* Thomas & Seely Brown define *collectives* as a community of similarly minded people who support learning and provide guidance to meet a particular set of needs of an individual or group. *Collectives* allow for a culture of belonging and an "active engagement with the process of learning" (Thomas and Seely Brown, 2011, p. 52). Dr. Brown would like to design structures for professional learning that capitalize on *collectives* generated as participants identify problems of practise. The strength of the technology infrastructure within the school district will impact the positive outcome of the intervention as McDonnell (2008) recognizes that weak infrastructure supporting the research-based development function in education is problematic.

Purpose, scope and aim:

Purpose: An innovative blended professional development program that utilizes online platforms as well as face-to-face learning to support school leaders in the implementation of the LTPF with the intention of building capacity in the SLS standards in instructional and visionary leadership will be designed and implemented.

Scope: Dr. Brown, district personnel and school leaders will collaborate with a research team of doctoral students from the University of Calgary, whose area of research is blended learning as a model for professional development, to design a professional development initiative, the Technology Leadership Initiative (TLI), to be implemented over two successive school years. Leaders from across District A will self-select for participation in the research which will utilize in-person and online methods of delivery and participation.

Aim: Using SLS standards of instructional and visionary leadership, leadership capacity will improve relative to innovation and technology integration in District A and a growth mindset amongst school leaders that enables sustainable transformative change in individual schools will be fostered.

Research question:

How can effective blended (online and in-person) professional learning environments be utilized to deliver programming that builds capacity in SLS standards of instructional and visionary leadership in technology integration and innovative student-centred pedagogies amongst school-based administrators in District A as outlined in the *Learning and Technology Policy Framework* (LTPF)? [data sources: *Analysis and Exploration Phase* - questionnaires, field notes, focus groups, demographic survey of participants, *Design and Construction Phase*: reflective blogs, field notes, design-team meeting minutes and design artefacts, and *Evaluation and Reflection*

Phase: artifacts from school leadership, analytics, interviews and document analysis]

Sub-questions:

- In what ways can blended learning platforms be used to support learning *collectives* and professional learning networks (PLNs)–as well as facilitate collaboration amongst school leaders in promoting social learning and an innovative "culture of learning" (Thomas & Seely Brown, 2011) in District A? [data sources: *Evaluation and Reflection Phase:* artifacts from school leadership, computer logs/analytics, interviews and document analysis, focus groups, participant reflective blogs]
- What strategies for instructional leadership can school leaders employ in their schools to build teachers' capacity in technology integration and pedagogy and what is the impact on teaching and student learning that result? [data sources: *Evaluation and Reflection Phase*: artifacts from school leadership, artifacts from TLI, analytics, interviews and document analysis]
- What strategies can be fostered to overcome identified barriers that exist when using blended learning and networks as a means of providing professional development to school leaders? [data sources: *Evaluation and Reflection Phase*: focus groups, interviews and document analysis]

Literature review:

A review of the literature to support the vision of this case study examines current research in the areas of:

1. Design research as research practice as well as a process for creating knowledge through collaboration within *collectives* and networks.
2. Entrepreneurial leadership to build capacity for school improvement through

innovative models of professional development.

3. Blended learning, innovation, and technology pertaining to 21st century learning.

McKenney and Reeves (2012) describe educational design research as "a genre of research in which the iterative development of solutions to practical and complex educational problems also provides the context for empirical investigation, which yields theoretical understanding that can inform the work of others" (p. 7). Edelson (2002), Brown (1992) and Barab & Squire (2004) set direction for the research to be useful in purpose, allow for the process to unveil contextual variables, and remain empirical in nature.

Professional development as key to transformational educational reform is emphasized by Hubbard, Mehan & Stein (2006) as well as Robinson (2006), and Timperley (2011) argue that the most important role of the school leader is to encompass leading with core attention to teaching and learning. Further, these authors argue that the leadership of teaching and learning is shared beyond the role of the principal to leaders at the district level. Engaging principals and district level leaders in a journey of shared vision has the possibility to build a greater collective experience and possibly a deeper result in overall student academic growth for the district. Learning *collectives* as addressed by Eraut (2000) allow for the all participants to engage in discourse without hierarchy, to value informal experience as "knowledge building" and to validate nuances in the school day to be elements of wonder. Jacobsen (2009); Deryakulu & Olkun (2009) and Held, McGrew, Goldblatt, Perraton (1999) speak to the insurgence of ongoing virtual professional development and the global context which becomes a greater part of the school community. Bottery (2006) argues that the role of the educational professional is becoming redefined through technology and globalization and while the intervention in this research must remain focused at the jurisdiction level in its initial design phases, the possibilities

for further iterations are exciting and have potential for global impact.

Leonard (2013) defines entrepreneurial leadership as value creation which includes intellectual, social, and economic value. He further suggests that no greater social value exists than that which is assigned to the education of our youth. In examining the school culture as an ecosystem, Lynch (2012) emphasizes the role of educational leader to create a safe culture of risk in order for teachers to allow creativity to guide pedagogy in innovation and technology. The findings of OECD (2014) clearly ascertain that teaching and administrative practices are critical to a learning environment in which innovation thrives. Supporting school leaders to navigate the loose coupling, defined by Weick (1976) which describes building an organization while understanding the autonomy that teachers have in individual classrooms may also, through this research, support district level leadership to consider the autonomy of schools on the journey to designing a district level commitment.

Technology and innovation as pillars for 21st century learning are recently reviewed and empirically measured by OECD (2014). The design research model to be explored is situated in Alberta, a province currently proposing draft standards for school administrators and teachers to include competencies in the use of technology to support teaching and learning. Garavaglia (2016) discusses the role of creativity in innovation and proposes that augmented reality, virtual reality and IoT (Internet of Things) communications are the most current innovations for uses of technology in education. The rapid and enduring pace of change influences the literature in the exploration of technology and innovation. Its constant flux will provide a challenge to the research process.

To parallel the paradigm of technology and innovation, the research study employs blended learning to facilitate formal learning through face-to-face and online communication.

Christensen (2013) as founder of the Clayton Christensen Institute for Disruptive Innovation notes that blended learning allows for flexibility over path, place, and time which is supportive to a rural school district with schools of multiple demands and populations. The participating principals will be supported to contribute while continuing to meet the demanding roles of school administrators. Blended learning offers the research participants an opportunity far beyond that of developing knowledge through professional growth. Ferdig (2014) adds that using blended learning situates the learning amongst the theories, practises, and experiences of fellow participants while developing a common culture.

The nature of design based research (DBR) calls for ongoing connection to relevant literature in support of current practices as well as connecting the practice to theoretical perspectives. The iterations of this case study situated in innovation and technology will demand currency of literature.

Theoretical framework:

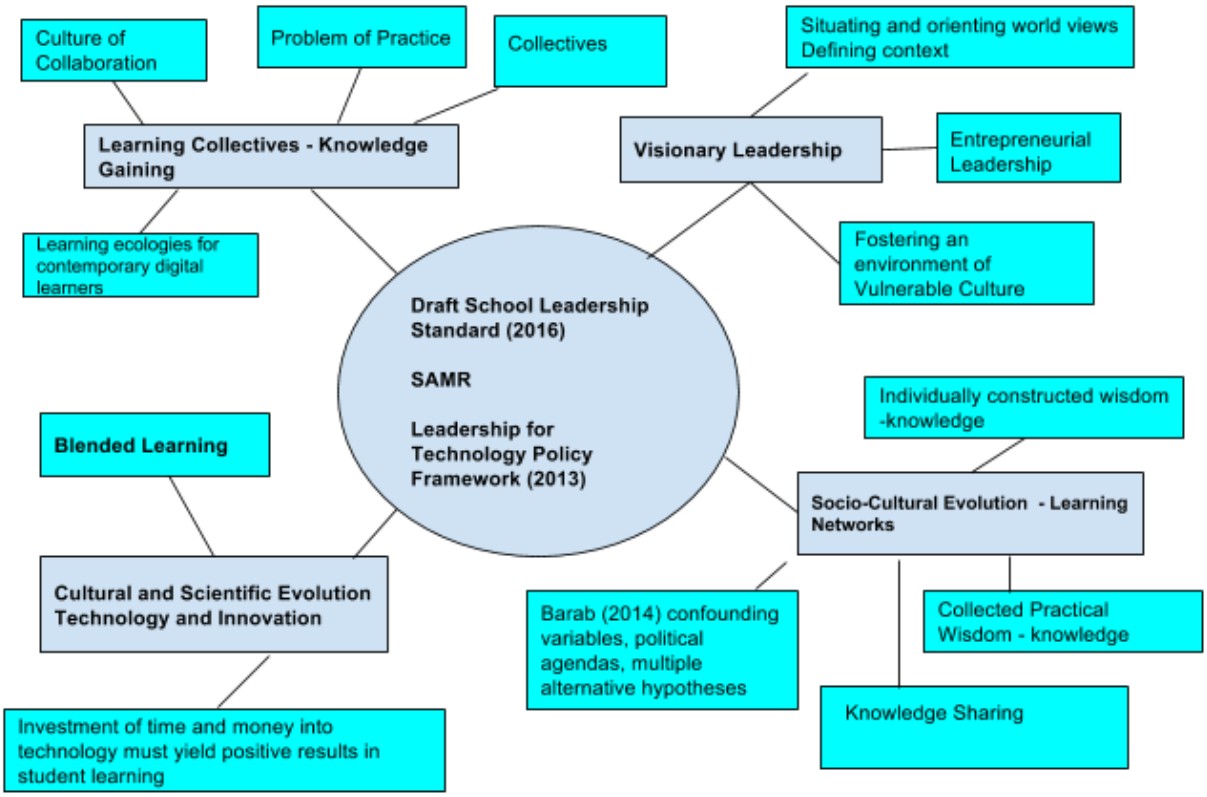
The theoretical framework of this intervention will rely on the culture of trust fostered during the initial iteration. Dweck (2008) along with Thomas & Seely Brown (2011) speak to the importance of a vulnerable culture, defined by Fletcher (2004) as a learning environment where social interaction and mutual learning can occur across difference. A safe environment where openness to learning exists regardless of positional authority and/or expertise (Fletcher, 2004). While Dweck's (2008) focus is on the freedom to experience failure as a place to freely explore new knowledge, Thomas & Seely Brown (2011) speak of play to initiate creativity. As school leaders in Dr. Brown's district embark on their journey of professional growth and development, the role that the theories of growth mindset and play impact the contributions of leaders must be considered and measured in additional iterations. Further, Fullan & Hargreaves

(2016) in their most recent call to action *Bringing the Profession Back In,* note that "strong cultures of collaborative professionalism are like strong teams. They thrive on diversity and disagreement, promote good variation of style, strengths, and overall approach, and increase individual as was well as collective talent" (p 18). They also note that strong cultures accept individuality and eccentricity without judgment. The notion of eccentricity as a component of design, and as an essential element of *collectives* emphasizes the significance of creativity to the success of DBR.

Puentedura's (2013) substitution, augmentation, modification, and redefinition (SAMR) model for infusing technology into teaching and learning through a progression of student engagement provides an empirical and theoretical basis upon which interventions of leadership PD can be quantitatively validated through evidence of engagement. This leads to the utilization of networks as the external process to further learning. Castells (2010) and Wellman (1999) describe networks as having boundaries that are more permeable than groups, interacting with diverse populations at multiple leadership levels which allows for sharing of multiple perspectives and experiences and broadens the scope of understanding for conceptualizing and applying the emerging research theories of practise. Technology communication is embedded in daily life and adds a new dimension to the individual and researcher as learner. Veugelers, Wiel and O'Hair (2005) note that networking traditions in relation to research continue to progress and that factors in relation to what triggers change through networking and where stability is established are still unknown as the attributes of the networked relations are yet, unclear. A serendipitous discovery may conclude that eccentricity has more opportunity to foster creativity and make profound impact in the networked environment.

Theories of utilizing professional learning to influence change in education (DuFour, 2008; Timperley, 2011) will ground the initial framework upon which Dr. Brown, in collaboration with participants, maps the plan for improving leadership to support program delivery and results in student achievement. With a goal to improve student learning through innovation, the work of Veugelers, Wiel and O'Hair (2005) supports that networks encourage and support student-centred learning environments through the development of high standards for all students, smaller and more personalized learning environments, authentic and connected student learning, democratic leadership structures, and the use of data to support continuous improvement (p. 133) reflects the vision of Superintendent Brown.

Graphic 1- TLI Framework



Research plan overview:

This study will take place over two years and will incorporate two mesa-cycles and six micro-cycles of design, development, and revision. Following McKenney and Reeves (2012, p. 188) educational design model, this study will begin with an *Analysis and Exploration Phase* that will span several months. The *Exploration* component of the first phase will consist of site visits, professional meetings, and networking with the intention of building collaborative and democratic relationships between the research team and the participant school administrators. The *Analysis* component of the first phase will be utilized to examine the diverse contexts in which the school-based administrators operate across the school division, and to better define the problem in context by "clarifying contextual insights and exploring the boundaries of feasible change" (McKenney & Reeves 2012, p. 86) within District A. Initial inventories may identify current technology available for use in schools, current use of technology to support learning, and a staff and student inventory of possibilities for technology to impact learning. The key for the research team will remain focused on how to build a culture of innovative wisdom where networked learning and *collectives* become a part of the district culture and are activated by decentralized administrators.

The first year of *Design and Implementation* will be considered one meso-cycle and will consist of two micro-cycles - 1) *Design and Construction*, and 2) *Evaluation and Reflection*. During the *Design and Construction Phase* of research, the researchers will collaborate with a team of district leaders consisting of a Superintendent, Supervisor of Educational Technology and District Principals in creating a conceptual model of *collectives* and blended learning for professional learning opportunities with school-based administrators that are both "internally consistent and externally useful" (McKenney & Reeves 2012, p. 79) in order to carefully

mitigate the gap between theory and practice resulting in a product that is both grounded in theory and useable in context. During the *Construction Phase*, the design team will prototype a blended online learning platform and a program of professional learning that builds capacity in instructional and visionary leadership.

The *Evaluation Phase* will consist of the implementation of the TLI beginning in November 2018. As this study will consist of research through intervention, data collection will take place throughout this phase. In its first iteration, the TLI will consist of the district leadership team. The *Reflection Phase* will involve active examination and consideration of the data collected throughout the *Evaluation Phase* with the intention of utilizing the data in the redesign of the TLI for its second iteration the following school year.

The second iteration of the TLI will take place the following year (beginning in September 2019) and will follow a similar meso-cycle of *Analysis and Exploration*, *Design and Construction*, and *Evaluation and Reflection* with the intention of scaling the program up to a larger number of school-based administrators in District A. A two-year, iterative cycle will allow for formative data to be considered from the first meso-cycle, the refinement of the professional development processes and platforms designed, and the further diffusion of the intervention. Diffusion is what McKenney & Reeves refer to as the "process through which interventions are pulled into practice from within" (2012, p. 163). The shift in practice initiated by the TLI will begin a cascading effect resulting in a culture of innovation within District A and ownership of the initiative with the district. Several iterative cycles will be necessary to accomplish this.

Finally, after two meso-cycles, the research team will share findings from the project with the participants and the broader research community.

Graphic 2: Design Macro-cycle

Analysis and Exploration Phase	Design and construction	Evaluation and Reflection		Analysis and exploration	Design and construction	Evaluation and reflection		Conclusions and Sharing
Initial (micro-cycle 1)	**First (micro-cycle 2)**	**Alpha (micro-cycle 3)**		**Revisited (micro-cycle 4)**	**Second (micro-cycle 5)**	**Beta (micro-cycle 6)**		
								
• Problem definition (seek input from stakeholders)	• Initial design of TLP as blended learning environment for school leaders • Online as well as face-to-face learning opportunities developed. • Establish collectives (groupings of school leaders based on school demographics) and networks (internal through our established platform and external through social media)	• Delivery of blended PD to a small group of self-selected administrators • Data collection • Reflection		• Revisit problem definition • Use of feedback/data collection from Year 1 • Planning for next cycle • Plan for scalability	• Redesign/enhance blended learning environment to better develop collectives and social learning • Scaling of design solution to include a larger number of participants.	• Delivery of PD • Data collection • Reflection		• Reporting of results • Article submitted to peer-reviewed journal • Conference presentation
Data Collection: • Questionnaires • Field notes from site visits, professional meetings, and networking. • Focus groups • Demographic survey of participants • Inventories	• Field notes • Design team meeting minutes • Participant reflective blogs	Formative feedback: • Focus Groups • Document analysis • Computer log information/ analytics • Artifact production • Participant reflective blogs		• Questionnaires • Field notes from site visits, professional meetings, and networking. • Focus groups	• Field notes • Design team meeting minutes • Participant reflective blogs	Formative feedback: • Focus Groups • Document analysis • Computer log information/ analytics • Artefact production		
Meso Cycle (Year 1)				Meso Cycle (Year 2)				

Contingency:

The research team views regular communication with stakeholders as key to the effective implementation of the program. As the primary model, the research team will initiate regular communication with the participants to ensure the viability of the project over the long term. The research team acknowledges that contingencies may be necessary as personnel, budgets, and political environments shift and are committed to developing a model of professional learning that can be applied across various contexts and districts. The online platform that is developed for the blended learning model will be proprietary to the research team and the University. As such, should circumstances arise, the research team will be able to continue developing the professional development initiative outside of District A.

Design principles:

The research team's understanding of design has been strongly shaped by the field of instructional design, and in particular the work of Bransford, Brown & Cocking (2000). In their seminal book, *How people learn: Brain, mind, experience, and school,* they posit that classroom environments should be: a) learner-centred (recognizing the diverse knowledge, skills, and attributes that the learner brings to the classroom), b) knowledge-centred (where attention must be given to what is taught, why it is taught, and what competency or mastery looks like), c) assessment-centred (where ongoing assessments make thinking visible), and d) community-centred (where learning is influenced in fundamental ways by the context in which it takes place, norms are consciously developed, and connections to the outside world support core learning values). This supports the researcher's assertion that effective professional learning should a) take the learner into account and build on their individual knowledge, skills, and attributes (in this case those of school-based administrators), b) focus on developing competency or mastery in a specific curricular area (in this case instructional and visionary leadership), c) be measurable (utilizing formative assessment tools such as reflective blogs and the SLS rubric), and d) take place in the context of a community of learners (in this case, the development of *collectives* of administrators).

Significance and implications

In DBR there is a commitment to developing both a practical solution that is developed in the naturalistic world with participant craft knowledge and a theoretical innovation or insight that grounds the solution (Brown, 1992; Barab & Squire, 2004; Bannan-Ritland & Baek, 2008; McKenney and Reeves, 2012). In this inquiry, the real world problem is building the capacity of school principals to lead the integration and implementation of technology to facilitate

instruction utilizing blended methods of professional learning. This study extends understanding in the areas of professional learning through *collectives* and the use of contemporary digital media to create the *collectives;* two commingled pioneering solutions to contemporary leadership problems.

Within DBR there is posited the concept of "outcome theories" (Edelson, 2002, p. 113). Edelson describes an outcome theory as a "natural outgrowth from a problem analysis, because problem analysis must characterize not just the challenges but also the the outcomes of implementing the design, desired outcomes" (p.113). Similarly, McKenney and Reeves describe "local theory" (Mckenney & Reeves, 2012, p. 35) as an output of the research that informs iterations and outcomes at a smaller horizon line. In the case of this inquiry the output or local theory would pertain to the the development of localized leadership and change theories within the context of School District A that could be used to design and inform professional learning *collectives* in other domains to build craft knowledge and wisdom that adds to the creation of a vulnerable culture of innovation and pioneering learning in School District A.

Role of researchers:

DBR, as a participatory style of research, necessitates that "meaningful cooperation between researchers and practitioners" (McKenney & Reeves, 2012, p. 17). There are different forms of cooperation and roles within DBR that are influenced by a multitude of factors, from personality to the sociopolitical culture of the site for the the research. This sophisticated interplay constrains and defines the different roles of the researcher, with the primary role being that of researcher, which is to maintain an overview of the macro vision while supporting the unfolding of problems of practise. Denzin and Lincoln (2011) indicate that the key role of the researcher is in designing effective endeavours to be responsible for integrating methodology and

substance to create a clear and relevant purpose for the research. This purpose allows them to support the unfolding problems of practise, particularly as the iterative cycles of DBR result in design and redesign of the intervention. Within DBR the researcher is considered part of the world that that they are researching (Cohen et al., 2011) which creates an ethical imperative for the researcher to preserve the integrity and dignity of the context, particularly with the view that in DBR researchers are co-participants. The DBR researcher is intimately and directly involved in the conceptualization, design, implementation, and research of an intervention (Barab & Squire, 2004). In this study, these roles will be negotiated between the team with each taking different key roles based upon expertise and interest.

Methodology and method:

The paradigm that guides the methodology for this inquiry is pragmatic, with a focus on the solution of real world practical problems of practice (Barab & Squire, 2004; Creswell, 2014; Cohen, Manion, & Morrison, 2011). The researchers' pragmatic world view is guided by the question, 'Will this intervention improve learning?' (Onwuegbuzie & Johnson, 2009). This stance leads researchers to mixed methods, to best represent the realities of the school environment. The study is situated within the mixed, messy naturalistic world of school leadership and professional learning, and invites the researchers and designers "to examine situations through the eyes of the participants rather than the researcher" (Cohen et al, 2011, p. 17). The "craft wisdom and creative experience" (Mckenney & Reeves, 2012, p. 13) of participants and researchers will guide the design and methods of data collection for this inquiry to address the development of leadership competencies. The purpose of this study is to create a shared iterative experience to co-create new knowledge through the creation of *collectives* as an intervention for PD of principals as instructional and visionary leaders to bring innovative

student centered pedagogies into practice. This is a design study of professional learning interventions, *collectives,* created through blended learning including digital social media to increase professional practice competencies. This study follows an iterative design process based upon a model of educational design research developed by McKenney and Reeves (2012). The research questions and the context of the research, guide the decision for using a mixed methods approach to collect and analyze the data to address and inform the research (McKenney & Reeves, 2012; Bannan-Ritland & Baek, 2003; Cohen et al 2011). Historically, mixed methods has been prevalent in DBR. Brown (1992) describes a mixing of quantitative and qualitative data "in order to describe the phenomena" (p.156). Mixed methods is described as a "useful strategy to have a more complete and better understanding for, and impact of, an intervention program through collecting both quantitative and qualitative data over time" (Creswell, 2013, p. 267). Through multiple phases of the DBR process, mixed methods will be implemented and used to capture evidence that addresses the research questions (Bannan-Ritland & Baek, 2008).

Research site and context:

This research is located in-situ; in the naturalized setting of a large rural school district. The design and intervention "occurs in the buzzing, blooming confusion of a real-life setting where most learning occurs" (Barab, Baek, Schatz, Scheckler, & Moore, 2015, p. 320). It involves a flexible and iterative design process focused on the development and implementation of an intervention, the TLI, to build the leadership capacities of principals (primary participants) in relation to the SLS, particularly in the areas of visionary and instructional leadership as related to technology integration.

Participants:

The participants for this inquiry will be drawn from leadership roles within School

District A, including superintendents, district supervisors, and principals in the development of the intervention and data collection methods. The primary users of the intervention, the TLI, are principals in the school district with a particular focus on a mix of veteran and new principals with a preponderance of participants being new principals. The participants are expected to participate in developing the intervention and capitalizing on the work that is currently being done through the district expectation that principals submit/keep a portfolio on the SLS. The selection process for participation is through professional invitation from the research team. The research team from the University will be considered co-participants in this methodology.. The roles of participants and researchers in this inquiry are structured to invite and involve different expertise into creating, enacting, and analyzing the TLI design (Barab, et al., 2015).

Data collection and interpretation:

Data collection will follow a MMR pattern of concurrent data collection and interpretation. The quantitative (confirmatory) and qualitative (exploratory) data (Onwuegbuzie & Leech, 2005 in Cohen et al., 2011) will be collected and reviewed at each of the following phases, 1) *Analysis and Evaluation*, 2) *Design and Construction*, and 3) *Evaluation and Reflection*. This method will also guide data collection in each of the two meso-cycles using a concurrent model where the two forms of data are integrated into the design analysis (Creswell, 2013). Timing of data collection is concurrent in each cycle and sequential in each phase. In this real world inquiry there is the complex task of data selection from all of the available data. Data selection is a "non-trivial issue" (Brown, 1992, p. 162). It will be a key task of all participants to establish "grain size" (p. 154) of the data to represent their experiences with the TLI intervention. For this inquiry, a combination of methods derived from McKenney and Reeves (2012), six common and specific methods for data collection can be implemented in the

different phases and cycles of DBR: a) interviews, b) focus groups, c) observations/field notes, d) questionnaires/checklists, e) logs/journals/reflective blogs, and f) document analysis. Focus groups will be used at the beginning and end of each meso-cycle to create and maintain participation and fidelity to the implementation of shared understanding of the TLI and to capture ideas from participants for design revisions, changes in perceptions and experiences with the *collective* throughout all iterations, and changes in practice that impact principal leadership. Participant and researcher observations will be gathered from random and selected face-to-face meetings to capture participant behaviours/actions in the use of the intervention and will be coded as basic, developing, or integrated (Timperley, 2011) to facilitate analysis of participation and implementation of the TLI intervention. Surveys will be used to corroborate and inform other methods of data to rate experiences and attitudes at different micro-cycles with the TLI and can be used to confirm attributes of the intervention that are both desirable and undesirable (McKenney & Reeves 2012). Computer generated data logs will be used to track participant use and frequency of use of online *collectives* as a professional learning medium. Human generated blogs/logbooks/journals will be used as participation and reflective tools on process and progress in the TLI. These journals and logs will be sources of evidence and artifacts of the use of the intervention. There will be researcher and participant analysis of this data to inform the next cycle and iteration. The guided reflections can be derived from analysis of questionnaire/surveys and focus group evaluation. Opportunities for guided reflections, as well as independent reflections in journals/reflective blogs on each of the micro-cycles, will also use the basic, developing or integrated descriptors for document and use analysis. Triangulating data will be based upon extraction of samples and analytics from digital use of online *collectives* to provide sampling of participant use and types of use within the TLI digital platform. The data methods

and analysis is intended to discern evidence of engagement and enactment in the early phases leading to design adjustments that capture and reflect "emergent features" (Cohen et al., 2011, p. 331) of the context and situation to inform refinements/re-design in each iteration, concluding with an evaluation of the TLI in real-life settings with practitioners to address research questions.

Data interpretation:

In mixed method data collection there is a linking of data analysis to the pragmatic paradigm (Denzin & Lincoln 2011; Onwuegbuzie, Johnson & Collins, 2009). In this inquiry, the researchers have a "pragmatist of the middle stance… a practical outcome oriented method of inquiry and data analysis based on action and leads, iteratively, to further actions" (Onwuegbuzie, Johnson & Collins, 2009, p. 20).

The analysis and interpretation of the data will be a multi-staged analysis with concurrent analysis in early phases and cycles, and a mixed analysis, with an intentional and purposeful switching between qualitative and quantitative lenses to seek answers from the data in the *Evaluation Phase* (Cohen et al., 2011; Creswell, 2011; Onwuegbuzie, Johnson & Collins, 2009). Data interpretation and analysis techniques will be in concordance with and to support MMR, such as content analysis and coding (Denzin & Lincoln, 2011). Table 1 lists method analyses that will repeat in each of the phases and cycles to capture data sets.

Table 1: Data Method and Analysis Summary

Method	**Analysis**
Interview	Coding and scoring analysis, pattern
Focus Groups	Coding: patterns/themes/metaphors, experience sampling and grouping
Survey	Classification/factor analysis, percentage, frequencies, cross-tabulations
Questionnaires	Data reduction and coding percentages, frequencies
Journals/Reflective Blogs	Coding/content analysis, experience sampling and grouping
Document Analysis	Coding/content analysis, grouping, analytics
TLI artifact production	Computer use logs/frequency. elementary linkage analysis for types of users,

(Cohen et al., 2011; Creswell, 2013)

Limitations:

Inherent limitations exist within the pragmatic paradigm and DBR methodology. There are no control groups or controls on variables that are present within the natural setting. There are, as in other experimental designs, no failure criteria for the intervention, leading to the necessity of an end point rather than an endless cycle of design and redesign (Creswell, 2013; Cohen et al, 2011). The iterative and multivariable nature of a DBR study creates extensive qualitative and quantitative data for collection and analysis. Researchers must understand both qualitative and quantitative methods to extract nuanced and serendipitous data from the collection. This limitation can be further extended by the amount of time required to complete the iterative cycles which may limit the availability and willingness of participants to engage with and enact the intervention (Creswell, 2013; McKenney & Reeves, 2012).

Other limitations will exist in the ecology and setting of the inquiry. Political and social vagaries may influence data as well as the capacities of the participants to engage with design and enactment of the intervention. The participants have expressed a reluctance to use social media, this may be an effect of time required to learn the use of social media, as well as limitations of governance and policy issues with the use of social media in schools. At the *Analysis and Exploration Phase*, a policy synthesis will be conducted to ensure safe and appropriate standards of technology use. Individual participants, while regulated to abide by provincial and district standards, will have the opportunity to determine levels of engagement and commitment to the inquiry. The mobility of school leadership, due to population fluctuation and fiscal constraints, may also lead to attrition as an inherent limitation to this method in a complex ecology.

Communication plan:

The research team will take an active role in communicating regularly with stakeholders by way of monthly team meetings to ensure the success of the TLI and will meet several times with Superintendent Brown prior to the start of the project to ensure the alignment of goals and expectations. The initial invitation for the TLI will be communicated by the research team and will initiate the *Exploration and Analysis Phase* of the research through a needs assessment by way of questionnaires, site visits, and focus groups. To mitigate her role as supervisor and evaluator, the research team will support Superintendent Brown as the hub of communication for the project within the district. Her modelling of collaboration is critical to the success of the TLI. Communication in regards to the research itself will come from the research team. The research team will outline the purpose, scope, aim, and ethical considerations for all potential participants prior to beginning the TLI in order to ensure transparency. Because of the nature of the project, it may be necessary for the research team to visit a district leadership team meeting

early in the school year in order to elicit interest in the project and outline expectations. It will be important for the research team to clearly link student learning and success to the initiative. The research team will exhibit the attributes of *collectives* by maintaining regular contact with all stakeholders through email, established digital platforms, and social media. Communication, collaboration, and participation are critical elements of the project. The design of the blended networking environment will be determined collaboratively between researchers and participants (Cohen et al., 2011). In addition to online and networked communication, there will be four in-person workshop days where participants will meet and share their ongoing work as they progress through the iterations.

The research team will ensure the dissemination of findings to the participants of the TLI through a report at the end of each phase. Debriefing meetings and presentations at the end of the research will provide participants the opportunity to review the analysis of the data and contribute to the final evaluation before it is disseminated to a wider audience.

Ethical considerations:

The socially situated nature of this inquiry and the use of MMR for data gathering and analysis leads to ethical considerations in three main areas: a) consent, b) privacy and confidentiality, and c) fairness and equity (Cohen et al, 2011; Creswell, 2013). One of the subtle but complicating areas of consent is linked to the first challenge, that being the researchers' invitation into the setting by Dr. Brown. This implies an acceptance and access into the setting that will still require a careful and comprehensive negotiation and explicit delineation of roles and responsibilities of the setting, School District A, and the researchers. This will include determining/specifying who owns the data and analysis, any artifacts, the TLI, and who will have access to the data, both for analysis and evaluation.

The researchers in cooperation with the School District will need to explicate informed consent and extend an invitation that will not only be fair but also protect the confidentiality and privacy of both participants and non-participants of the principal group who are participating in the intervention. Although participation in the research will be voluntary, the actual participation in TLI may be a professional role. This creates a complicated circumstance that the researchers and district can mitigate through collaboratively creating a safe, trusting and welcoming ecology for all members of the community beyond the research participants. The creation of confidentiality and privacy of participants facilitates a culture of equity where participants are not privileged over non participants. To further protect the anonymity of participants, all data will be provided a code that does not identify the participant except to the researchers. A complicating factor to this will be the need to include internet ethics in the discourse to maintain privacy, confidentiality, and equity for participants and nonparticipants. To address these ethical circumstances prior to commencing any research, the researchers will have to establish with the district and participants, a set of ethical principles (Cohen, et al., 2011) that will delineate the responsibilities of the researchers and responsibilities of participants.

Appendix A: Definitions

- Design-based research - "a methodology designed by and for educators that seeks to increase the impact, transfer, and translation of education research into improved practice" (Anderson & Shattuck, 2012, p. 16).
- Professional development - professional learning activities completed by teachers or school-based leaders that are initiated or "required by their school, district, or larger education system" (Campbell et al., 2016, p. 7).
- Professional learning - learning undertaken by a professional teacher or school leader that impacts student learning. The processes undertaken to improve a school-based leader or teachers' "efficacy, knowledge, and practices in order to support students' efficacy, engagement, learning, and equity of outcomes" (Campbell et al., 2016, p. 6).
- Blended learning - an approach to learning that combines both face-to-face as well as online learning in order to support the creation of a personal learning environment (see personal learning environment below).
- Collectives - social learning communities enabled by digital technology and sustained through the active participation and interaction of peers organized around an area of passion or interest where participants "belong in order to learn" (Thomas & Seely Brown, 2011, p. 52).
- Networks - communication through networked digital media such as social media, email, collaborative work spaces, video conferencing, or chat rooms (Collins & Halverson, 2009). For the purpose of this study, networks will include both internal (private to the organization), as well as external (public) networks.
- Personal learning environment - The use of technology to create a learning environment

where students or professional learners can “access, navigate, disseminate, and synthesize large quantities of information for the purpose of constructing knowledge” (Drexler, 2014, p. 455).

- Personal or Professional Learning Networks (PLN) - personally managed networks where educators transition “between the physical and virtual networks to communicate, collaborate, acquire resources, elicit feedback, get support, and share ideas, data, strategies, and information” (Sheninger, 2014, p. 119).

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