Evolution of Knowledge Building Teacher Professional Development Communities

by

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A thesis submitted in conformity with the requirements for the degree of Doctor of Philosophy
Curriculum, Teaching and Learning
University of Toronto

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2018

Abstract

This study explores the interplay of factors in diffusion of Knowledge Building pedagogy through a multi-level (teachers, administrators, and students) Leading Student Achievement initiative sponsored by the Ontario Ministry of Education in partnership with Ontario Principals’ Councils. Rogers’ (1995) model of diffusion of innovation was used to explore the first and broadest level of decision making by teachers and principals and included analysis of initial resources to learn about and implement Knowledge Building. Analysis included perceived attributes of Knowledge Building pedagogy and factors that influenced early adopters and sustained use. A case study of one school board provides an in-depth account of how these factors came into play; five case studies of classroom practices provide a more micro-perspective on how teachers and students implemented Knowledge Building principles. The findings confirmed that the Leading Student Achievement project is fostering successful adoption of Knowledge Building in Ontario. This study helps to inform decision making for future Knowledge Building and professional development initiatives as well as system-level support required to create a multi-level learning ecology to inform uptake and sustainability of pedagogical innovations.
Acknowledgments

First and foremost I would like to express my special appreciation and thanks to my advisor Professor Marlene Scardamalia for being a tremendous mentor. I would like to thank her for encouraging my research and for allowing me to grow as a knowledge builder. It has always been a privilege working with her. Witnessing her inexhaustible motivation, commitment, and energy to sustain Knowledge Building initiatives all around the world is inspiring. She became my role model not only with her attitudes as a professor and director, but also with her personality as a human. I would also like to offer my sincere appreciation and thanks to my committee members, Professor Clare Brett, and Professor Clare Kosnik for insightful and brilliant comments throughout, and to Professors Clive Beck and Ronald MacDonald for serving on my committee and helping me learn continuously. I am deeply appreciative for input from this very special committee. I wish also to thank Professor Carl Bereiter for sharing his wisdom, thoughts, and insights with us in IKIT research meetings. It has been priceless for my career and I always feel very special to meet him.

I would like to express my sincerest gratitude to secret heroes of this dissertation. Thanks to my dear participant teachers and principals who have generously devoted their time and energy to this work. Listening to their stories was a unique learning opportunity for me. A very special thanks to all at LSA for opening the doors of education innovation to me. Mary Cordeiro, Karen Dobbie, Elaine Hine, Denis Maika, Linda Massey, and Monica Resendes have provided fantastic opportunities for me to attend LSA events and learn from advances in Ontario.

I especially thank all brilliant IKIT friends and colleagues and Knowledge Building
collaborators around the world. All of you have been there to learn together during my Ph.D. journey. It has been a great pleasure to be a part of this incredible community.

Special thanks to Stacy Costa, Joel Wiebe, Ahmad Khanlari, and Gaoxia Zhu for being ready whenever I ask for help. I am indebted to you for your support and friendship. I am also grateful to Susana La Rosa. I appreciate her unconditional help and support since the first day I joined this team. I cannot imagine an IKIT without her.

My heartfelt thanks to Dr. Hamdi Erkunt. He is the actual one who started my Knowledge Building journey thirteen years ago. Thank you for taking courage to seed and water my growing interest in Knowledge Building over the years, it has flourished now. I am also grateful to my professors in the Educational Technology department at Bogazici University who believed in me, were always supportive, and engaged me as a colleague.

Words cannot express how grateful I am to Asuman Caliskan, Seyda Sayir, Gulseren Bulut, and Kemal Tek who have provided moral and emotional support not only in my Ph.D climb but also in my personal life.

Ebru Bag and Nefise Kahraman--no words are strong enough to describe my appreciation for your friendships. Thank you very much for sharing the fun and joy of my life in Toronto as well as the pressure and hurdles of thesis writing. Thanks for making Robarts hours bearable and encouraging me to strive towards my goal.

At the end I would like to express appreciation to my beloved friends, Alev Zeybek and Mehmet Kuru, Emre Karatas and Elvan Tayhani, Esra Basol and Orhan Ozalp, and Ozan Erdem, who helped me to build a new lovely life here in Toronto and make it home for me. And finally, last but by no means least; I would like to thank my little friends, Ipek
Kuru and Ipek Ozalp, to be my playmates.

I dedicate this dissertation to my dearest nephew, Umut Selim, with the desire for him not
to leave the path illuminated by science and intelligence.

Derya Kici

Toronto
Table of Contents

Abstract ................................................................................................................................. ii
Acknowledgments ................................................................................................................ iii
List of Tables ....................................................................................................................... ix
List of Figures ....................................................................................................................... x
List of Appendices ............................................................................................................... xii

CHAPTER 1 .......................................................................................................................... 1
1. Introduction ..................................................................................................................... 1
  1.1. Chapter Overview ...................................................................................................... 1
  1.2. Motivation for the Study .......................................................................................... 1
  1.3. Knowledge Building as a response to 21st century education challenges .............. 3
  1.4. Purpose of Study and Research Context .................................................................. 6
  1.5. Research Questions .................................................................................................. 7
  1.6. Organization of Dissertation .................................................................................... 8

CHAPTER 2 .......................................................................................................................... 9
2. Background of the Leading Student Achievement Project ......................................... 9
  2.1. Chapter Overview ...................................................................................................... 9
  2.2. Historical Overview of the Leading Student Achievement Project ....................... 9
  2.3. Leading Student Achievement Initiatives ............................................................... 13
  2.4. Addition of Knowledge Building into the Leading Student Achievement Project 15
  2.5. Leading Student Achievement Theory of Action .................................................... 16
  2.5.1. Four paths of leadership influence on student learning ........................................ 19
  2.6. Knowledge Building Theory of Action for Leading Student Achievement .......... 22
  2.7. Chapter Summary ................................................................................................... 23

CHAPTER 3 .......................................................................................................................... 24
3. Literature Review .......................................................................................................... 24
  3.1. Chapter Overview ...................................................................................................... 24
  3.2. Teacher Learning and Professional Development: The Current Challenge and Situation ................................................................................................................................. 24
  3.2.1. School-based professional learning communities ................................................ 29
  3.2.2. Partnerships with school boards and districts ....................................................... 31
  3.3. Teacher Professional Development from a Social Constructivist Perspective ........ 32
  3.3.1. Social constructivism .......................................................................................... 32
  3.3.2. Teacher learning communities .......................................................................... 34
  3.4. Knowledge Building Community: Professional Development (KBC:PD) ............ 37
  3.5. Diffusion of Knowledge Building as an Innovative Pedagogy .............................. 42
  3.5.1. Diffusion of Innovation Theory .......................................................................... 42
  3.5.2. Key Components of Innovation Decision Making .............................................. 43
  3.5.3. The five-stages model of innovation-decision process ....................................... 46
  3.6. Chapter Summary ................................................................................................... 53
List of Tables

TABLE 1. DATA COLLECTION PHASES ................................................................. 63
TABLE 2. SCHOOL-A TEACHER PROFILES ..................................................... 65
TABLE 3. SCHOOL B TEACHER PROFILES ..................................................... 70
TABLE 4. SCHOOL-C TEACHER PROFILES .................................................... 77
TABLE 5. SCHOOL PRINCIPAL PROFILES ..................................................... 79
TABLE 6. RESEARCH QUESTIONS .................................................................... 92
TABLE 7. LIST OF ANALYZED DATA ............................................................. 97
TABLE 8. LIST OF TEACHER AND PRINCIPAL PRESENTATIONS OF CLASSROOM PRACTICES IN WEBINARS ................................................................. 142
List of Figures

FIGURE 1. LSA MULTI-LEVEL LEADERSHIP APPROACH ........................................... 12

FIGURE 2. LSA THEORY OF ACTION: FOUR PATHS OF LEADERSHIP
INFLUENCE ON STUDENT LEARNING AS OF 2014........................................ 18

FIGURE 3. A KNOWLEDGE BUILDING THEORY OF ACTION FOR LSA............ 23

FIGURE 4. FOUR PATHWAYS WITH SUB-CATEGORIES FOR ONGOING
PROFESSIONAL DEVELOPMENT ...................................................................... 28

FIGURE 5. LINKING PROFESSIONAL COMMUNITY AND PROFESSIONAL
DEVELOPMENT ............................................................................................... 32

FIGURE 6. A MODEL OF FIVE STAGES IN THE INNOVATION-DECISION
PROCESS ........................................................................................................ 47

FIGURE 7. STUDENT LINKING CUBES ................................................................. 181

FIGURE 8. STUDENTS BUILDING DIFFERENT FIGURES WITH CUBES............ 182

FIGURE 9. GRID PAPER AND TILES FOR ‘TOOTH FAIRIES’ TREASURE BOXES’
ACTIVITY ........................................................................................................ 183

FIGURE 10. PICTURE OF A BARN DOOR ON THE CLASSROOM WALL WITH
STICKY NOTES ................................................................................................ 189

FIGURE 11. MURAL PAPERS: COMMUNITY SPACE FOR WORKING WITH THE
IDEAS ................................................................................................................ 196

FIGURE 12. IMAGES FROM KATHY’S CLASSROOM .......................................... 198

FIGURE 13. SCREEN CAPTURE OF THE LEVEL OF DIALOGUE AND
QUESTIONS ...................................................................................................... 200
FIGURE 14. SCREEN CAPTURE OF THE FIRST ELECTRICITY VIEW ON KNOWLEDGE FORUM ................................................................. 201

FIGURE 15. REMARKS SECTION IN KNOWLEDGE FORUM NOTES ........... 202

FIGURE 16. SCREEN CAPTURE OF THE SECOND AND THE FINAL ELECTRICITY VIEWS ................................................................. 203

FIGURE 17. AN EXAMPLE OF STUDENTS’ LEARNING LOGS ....................... 204

FIGURE 18. A SCREEN CAPTURE OF STUDENTS’ CONTRIBUTIONS FROM KNOWLEDGE FORUM .......................................................... 204

FIGURE 19. RUBRIC ADAPTED FROM “IMAGINE THE LEARNING” FOR KNOWLEDGE BUILDING ........................................................................... 205

FIGURE 20. BULLETIN BOARD WITH STUDENTS’ QUESTIONS AND IDEAS. 208

FIGURE 21. DISCUSSION OF STUDENTS ON THE BULLETIN BOARD (LEFT). AND SCREEN CAPTURE OF THEIR DISCUSSION ON A KNOWLEDGE FORUM VIEW (RIGHT) ................................................................. 210

FIGURE 22. THE LEARNING JOURNEY OF STUDENTS MADE VISIBLE ON A BULLETIN BOARD .............................................................................. 211

FIGURE 23. PICTURE OF THE BULLETIN BOARD WITH IDEAS ABOUT SPECIES AND LIVING THINGS (LEFT). PLANTS FOR EXPERIMENTS (RIGHT) ........................................................................................................... 211

FIGURE 24. STUDENTS’ IDEAS LINKED BY STRINGS ON THE BULLETIN BOARD .............................................................................................. 213
## List of Appendices

<table>
<thead>
<tr>
<th>Appendix</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Interview Protocol and Questions for Teacher Interviews</td>
<td>246</td>
</tr>
<tr>
<td>B</td>
<td>Interview Protocol and Questions for Principal Interviews</td>
<td>249</td>
</tr>
<tr>
<td>C</td>
<td>Ethical Approval</td>
<td>252</td>
</tr>
<tr>
<td>D</td>
<td>Consent Form for Teachers and Principals</td>
<td>253</td>
</tr>
<tr>
<td>E</td>
<td>List of LSA Events</td>
<td>255</td>
</tr>
<tr>
<td>F</td>
<td>List of LSA Virtual Learning Sessions</td>
<td>259</td>
</tr>
<tr>
<td>G</td>
<td>List of the Upper Grand District School Board Teacher and Principal Presentations and Proposals</td>
<td>260</td>
</tr>
<tr>
<td>H</td>
<td>List of Learning Exchange Students’ Panel Videos</td>
<td>261</td>
</tr>
<tr>
<td>I</td>
<td>Coding Scheme and Example Quotes</td>
<td>262</td>
</tr>
<tr>
<td>J</td>
<td>Twelve Knowledge Building Principles</td>
<td>275</td>
</tr>
</tbody>
</table>
CHAPTER 1

1. Introduction

1.1. Chapter Overview

This research is situated within a larger project investigating Ontario’s uptake of Knowledge Building through a Ministry of Education sponsored Leading Student Achievement (LSA) initiative. The LSA Networks for Learning initiative aims to improve teachers’ practices and increase students’ learning by taking advantage of principals and vice-principals’ leadership capacity. This particular study investigates how Knowledge Building pedagogy spreads within schools and across school boards, illustrates a model of professional learning for teachers, and presents examples from teachers’ implementations of this principle-based pedagogy in their classrooms. The research focuses on the interplay of factors from multiple levels (macro, meso, and micro level) of the school system to provide a detailed account of the collaborative culture among teachers and principals that has supported their engagement in Knowledge Building. This introductory chapter begins with an account of the motivation for the research followed by purpose and research questions, then an overview of the eight chapters of the thesis.

1.2. Motivation for the Study

If education is to meet needs for a knowledge society, dramatic shifts in national reform agendas, teacher education, and mindsets of administrators and teachers are required to improve professional development and student outcomes (Darling-Hammond & McLaughlin, 1995; Fullan, 2007). There have been many efforts to respond to calls for
reform; for example, Partnership for 21st century skills, En Gauge fostering 21st century competences, Assessment and Teaching of 21st Century Skills, National Educational Technology Standards, and the National Assessment of Educational Progress, as elaborated in Voogt & Roblin (2010). 21st century competencies are defined differently in different contexts, but are generally set out in terms of knowledge, skills, attitudes, values and ethic (Binkley et al., 2012; Voogt & Roblin, 2010; Soland, Hamilton, & Stecher, 2013). According to Binkley et al. (2012) 21st century skills include creativity and innovation, critical thinking, problem solving, decision making, learning to learn, metacognition as ways of thinking; communication, collaboration (teamwork) as ways of working; information literacy, ICT literacy as tools for working; and citizenship—at the local and global context, life and career, personal and social responsibility—which includes cultural awareness and competence as living in the world. In the research bulletin published by the Education Quality and Accountability Office (EQAO) in 2011, the 21st-century skills were also referred as employability skills or essential skills in six categories: numeracy; communication; critical thinking and problem solving; personal; interpersonal; and information management, technology and information systems (Hunter, 2011).

Philosophers and educators from Socrates on have argued for critical and analytical thinking and creativity; a number of scholars argue that there is nothing particularly new in these skills (see, for example, Greenstein, 2012; Fisher, 2011; Silva, 2009; Johnson & Reed, 2008). Broader challenges to be addressed: “Will educational institutions, within their present structures, be able to adapt sufficiently to meet the needs of the information age?” (Scardamalia, 2001, p.172); Will schools incorporate and support sustained work in
design mode (Scardamalia & Bereiter, 2017); “How can we ensure that we are developing graduates able to work productively in an increasingly volatile, uncertain, complex and ambiguous future?” (Bates, 2017, p.15). Overall, can schools be re-designed as more deliberate institutions for twenty-first century skill development (Binkley et al., 2012) and complex problem solving (Homer-Dixon, 2006), with all students feeling themselves part of a knowledge creating culture (Scardamalia & Bereiter, 2006)? Scardamalia (2001) argues for schools as knowledge creating organizations with knowledge creation built into the social fabric of communities and the technologies that support their work (Scardamalia, 2001; Scardamalia & Bereiter, 1996). Thus schools would operate as knowledge creating organizations of the sort described by Dunbar (1995) and Nanoka (1991) and be more responsive to changes in the economy, labor market requiring more theoretical and analytical knowledge (Griffin, Care & McGaw, 2012; Drucker, 1994). Collective and individual success in the modern economy depends not only on skills: Knowledge workers need to change their basic attitudes, values, and beliefs, to acquire a habit of continuous learning (Drucker, 1994; Tapscott, 1996). Some students are fortunate to attend highly effective schools or classes with highly skilled teachers, however effective schooling should not depend on such good fortune (Rotherham and Willingham, 2010).

1.3. Knowledge Building as a response to 21st century education challenges

Knowledge Building — the production and continual improvement of ideas of value to a community (Scardamalia & Bereiter, 2003) — is a principle-based, idea-centered pedagogy that aims to initiate students into a knowledge creating culture (Scardamalia &
Bereiter, 2006). It was identified in the Handbook of the Learning Sciences (Sawyer, 2006) as one of five foundational models in the learning science.

Knowledge Building involves creative work with ideas that matter to the people doing the work (Bereiter & Scardamalia, 2003, p.13). New ideas, which are the key engines of economic growth, drivers of market productivity, and sources of cohesion for all nations, are essential for the development of human capital (Goldman & Scardamalia, 2013).

Knowledge building is a term used interchangeably with knowledge creation as known in contexts beyond school; it addresses issues of innovation, intellectual property, intellectual capital, and knowledge work. The focus of knowledge building is “generation of new knowledge and the improvement of ideas that have a public life and that are of value to others” (Scardamalia, 2003, p.169). Based on Scardamalia’s (2003) definition, knowledge builders do more than learning while constructing a life for ideas beyond their minds and personal notebooks. As Bereiter & Scardamalia (1996) explain, it is different from learning. Learning is activity directed toward improving personal knowledge, the aim of knowledge building is to improve community knowledge. Knowledge builders consider the strengths, weaknesses, applications, limitations, and potential of community ideas for further development. Through reflective processes required for continual idea creation, development, and improvement and assuming collective responsibility for knowledge advances knowledge builders naturally learn while knowledge creation becomes the cultural norm (Scardamalia & Bereiter, 2003; Scardamalia, 2003)

Knowledge building is not limited to formal education; instead it goes on throughout a knowledge society. The Knowledge Society Network (KSN) was established to be “open to members of the broad international community engaged in knowledge building
research and development including also professionals such as scholars, teachers, engineers, and so on” (Hong, Scardamalia, & Zhang, 2010, p.2).

Knowledge Building pedagogy aims to initiate students from the earliest school years into a knowledge creating culture of the sort demanded in working lives beyond school boundaries (Hong, Scardamalia, & Zhang, 2010). In the act of transforming schools teachers need themselves to be knowledge creators. Little is known regarding how teacher communities can be sustained in Knowledge Building to create the pedagogical advances associated with it (Teo, 2012).

Bereiter and Scardamalia (2008) have elaborated the teacher shift in terms of three teacher models: Teacher A is basically a manager of activities; Teacher B sets learning objectives and works to ensure that all students achieve them; Teacher C additionally works to enable students themselves to take over the high level functions now considered the exclusive responsibility of teachers. The Teacher C approach is also distinguished by being principles-based rather than procedures-based, with the result that Knowledge Building principles themselves, as well as means of applying them, become objects of inquiry, invention, and continual improvement (Chan & Song, 2010; Chan, Ma, & Law, 2007; Zhang, Hong, Scardamalia, Teo, & Morley, 2011). Knowledge Building engages participants in technology-mediated work to sustain community interactions and formation of collaborative networks—a community of communities committed to sustained idea improvement. Overall, Knowledge Building requires a shift from traditional schooling to schools operating as real-world knowledge creating enterprises using modern technology that supports sustained creative work with ideas.
Kooy (2009) argues that teachers must immerse themselves in practices and experiences they create for their students. Bielaczyc and Collins (1999) emphasize the need for teachers and students to “develop ways to assess their own progress and work with others to assess the community’s progress” (p. 272). Chai and Tan (2009) add the requirement that teacher-researcher teams co-construct new knowledge and teaching practices to develop 21st century competencies.

According to the McKinsey report (Mourshed, Chijioke, & Barber, 2010), Ontario is among the top five education systems in the world. The report labels these systems as “sustained improvers,” which means that they have seen “five years or more of consistent rises in student performance spanning multiple data points and subjects” (p. 11). “Sustained improvers,” according to this report, have successfully moved past a centralized system to a distributed model where schools, teachers and administrators take more responsibility for developing and implementing effective instructional practice grounded in innovation, collaboration and peer-to-peer learning (p. 20). This trajectory of system improvement, as described in the report, “is all about turning schools into learning organizations” (p. 111).

1.4. Purpose of Study and Research Context

This research takes advantage of the Ontario Ministry of Education and three principals’ councils efforts to explore the potential of Knowledge Building in Ontario schools. Through their LSA initiative the principals’ councils place leadership capacity of principals and vice-principals at the center of their work, assuming principals’ leadership can affect student success through enabling teachers to incorporate increasingly effective
teaching and learning approaches (Leithwood & Miller, 2012). LSA was initiated in 2005. In the 2013-2014 school year, Knowledge Building was adopted by the LSA project.

Diffusion of Knowledge Building at multiple levels of the school system is explored to better understand spread and transformation of educational practice. Ontario’s uptake of Knowledge Building provides a particularly rich context for studying Knowledge Building professional development (PD). I pay particular attention to movement toward a Teacher C model and ways in which schools, teachers, and administrators take responsibility for developing and implementing effective practice grounded in Knowledge Building pedagogy.

1.5. Research Questions

This thesis aims to provide a detailed account of implementation of Knowledge Building, with a focus on the Ontario LSA initiative and the Knowledge Building “Teacher C” model elaborated above. These goals are embedded in three research questions:

**Research question 1:** What factors have affected diffusion of Knowledge Building as an innovative pedagogy within and across schools in Ontario? Does Everett Rogers’ five-stage model of diffusion of innovation help explain how and why Knowledge Building has spread in Ontario?

**Research question 2:** In what ways do principal learning teams (PLTs) support teachers in implementing effective Knowledge Building practice?
**Research question 3:** What do teacher practices convey regarding engagement of students in principle-based Knowledge Building Communities?

1.6. **Organization of Dissertation**

This dissertation is organized into eight chapters. In Chapter 2, I present the background of the LSA project to provide an overview of the research setting and context. In Chapter 3 I review research relevant to teacher learning and Knowledge Building Communities as professional learning communities and discuss teacher professional development from a social constructivist perspective with focus on the present research situation and challenges. Subsequently I present literature relevant to research on diffusion of innovation and its relevance to the current research. The literature review is followed by an overview of methodology in Chapter 4 that focuses on the qualitative research design and case study approach used, with discussion of participants, research setting, and general framework for data analysis. After that, I consider issues regarding needed validation of research findings and ethical considerations. The methodology chapter is followed by three chapters presenting results: Chapter 5, diffusion of innovation in five stages; Chapter 6, the Upper Grand District School Board (UGDSB) case study to provide a model of professional learning within and across schools; Chapter 7, cases from teachers’ classroom practices with Knowledge Building that provide a micro-level analysis of use of twelve Knowledge Building principals. In the last chapter I present a general discussion of results including implications, limitations, and conclusions.
CHAPTER 2

2. Background of the Leading Student Achievement Project

2.1. Chapter Overview

This chapter provides an overview of the Leading Student Achievement (LSA) project. I start by describing the general structure and objectives of the LSA project, historical background, and growth and evolution over time leading to LSA’s focus on Knowledge Building. LSA has developed an infrastructure for schools and leaders including *Principal Learning Teams, Professional Learning Communities, and Collaborative Inquiry Process*, as elaborated in Section 2.3, leading to the addition of Knowledge Building as described in section 2.4. In Section 2.5, the discussion shifts to describing LSA Theory of Action and four paths of leadership (rational path, emotions path, organizational path, and family path) that influence student learning. Finally, I conclude with an LSA Knowledge Building Theory of Action.

2.2. Historical Overview of the Leading Student Achievement Project

The premise of the LSA project is that investment in leadership capacity of principals and vice-principals is essential for developing their own professional learning and student achievement. Blase and Blase (1999) explored the question of how principal leadership affects teachers’ professional learning. Results point to teacher dialogue to promote reflection and opportunities for professional growth. For example, principals promote teachers’ learning by applying principles of adult learning, growth, and development to all phases of staff development; supporting collaboration and coaching relationships; emphasizing the study of teaching and learning; encouraging redesign of programs and
action research to inform instructional decision making. Teachers define effective leadership in terms of opportunities to critically reflect on their learning and professional practice through dialogue that includes suggestions, feedback, modeling, inquiry, soliciting advice and opinions, and giving praise; they expect professional growth to result in promotion (Blase & Blase, 1999). Buttram and Farley-Ripple (2016) identified ways in which principals shape the adoption and implementation of professional learning communities. They conclude: “Of particular importance were how the principal saw the state mandate as well as the steps that the principal took to set expectations, enhance teacher knowledge and skills, and provide resources to support teacher collaboration” (p.211). Research by Zheng, Yin, Liu, and Ke (2016) investigated the relationship between leadership practices and professional learning communities with attention to the mediating role of trust. Positive effects of leadership practices include shared sense of purpose, collaboration, collective focus on student learning, deprivatized practice, and reflective dialog. Leithwood (in press) reviews literature on principal leadership and the importance of trust relations among teachers, parents, and students for enhancing teacher professional development through factors such as listening to needs for assistance, buffering teachers from distractions and excessive demands, and modeling leadership. Overall, effective principal leadership helps teachers find creative ways to improve instruction, explore innovative teaching, and set high learning standards for students. This ultimately increases students’ achievement. Specifically, when principals work within principal learning teams and develop essential skills to support teachers, teachers are more likely to incorporate effective teaching and learning strategies into their classroom practice and improve student achievement (Miller, 2016).
The LSA project was established with a multi-level approach in 2005, originally titled LSA: Our Principal Purpose (Leithwood & Miller, 2012) and has evolved through several iterations over the last decade. As it is seen in the Figure 1, this multi-level structure had three planes; school, district, and province. At the provincial level, the LSA Steering Team, formed by the representatives from three Ontario principals’ associations, the Literacy and Numeracy Secretariat (LNS), and Curriculum Services Canada is in charge of leading the project. To accomplish goals they organize provincial symposia, provide support to principals and system leaders, and prepare and deliver resources. The LSA Steering Team also takes responsibility for collaborative projects with partners. At the district level, principals and vice-principals are encouraged to work within the principal learning teams for professional learning and networking. At the school level, principals and vice-principals are responsible to support the teachers in their schools to create professional learning communities that embrace innovative and collaborative approaches (Miller, 2016).

I present a brief overview of the evolution of the project through reference to a document published by Leithwood and Miller (2012) and Miller (2016). The project started in 2005 with professional learning initiatives-- expert presentations focused on topics such as emotional intelligence, action research, appropriate assessment and instructional strategies, and leading schools in a data-rich world. In 2007, by the end of the school year, the focus of the project shifted toward understanding the key conditions for evidence-based direct effects on student learning and achievement (Leithwood, 2007). (See Section 2.2 below for a review of key conditions).
The next advance started in the 2007-2008 school year with focus on following the development of principals’ and vice principals’ capacities to improve key learning conditions in their schools. They were encouraged to share effective practices in their schools and districts with other principals. The project progressed through the development of the LSA professional network, integration of web-based technologies, and adoption of collaborative inquiry, known more specifically as the Teaching-Learning Critical Pathway (TLCP). At this stage, Curriculum Services Canada supported LSA with a variety of web-based materials and a number of web-conferences (Leithwood & Miller, 2012). The implementation of Teaching-Learning Critical Pathway model was supported by provincial symposia twice a year through participation of principals and district leaders accompanied by teacher leaders who were employed to initiate the Collaborative Inquiry Process in their schools. Collaborative Inquiry Process is one of the LSA initiatives that may take different forms such as the Teaching-Learning Critical Pathway
and Professional Learning Cycles. The aim of this initiative is to create “an effort by groups of staff to improve the design of lessons, analyze student work and create meaningful ways of diagnosing and monitoring student learning” (Miller, 2016, p.7). The process was promoted by the Ministry of Education Literacy and Numeracy Secretariat with a pilot project in the secondary school context: in the 2009-2010 school year the number of schools joining the project increased.

As of 2016, in its eleventh year the LSA Project included 63 districts, approximately 3200 principals and vice principals, and 123 system leaders. System leaders contact school principals to invite them to join the LSA project. This increase in number of participants led to the formation of hubs and networks of principals and schools, and the project were renamed LSA: Networks for Learning (Miller, 2016).

2.3. Leading Student Achievement Initiatives

The LSA Steering Team was created to provide guidance and resources to the project and to help organize provincial symposia. The LSA project has developed an impressive infrastructure of schools and leaders along with a wide variety of initiatives (Leithwood, 2010). I provide a summary of these initiatives below:

*Principal Learning Teams (PLTs) and Professional Learning Communities (PLCs).* At district level, principals and vice-principals who participated in the project were organized into principal learning teams and at the school level they were asked to create professional learning communities. In the first five years of the project, mostly school administrators participated in the project and met at regular events to learn together and share their experiences. The main purpose of this initiative was to improve their
leadership capabilities. The teachers and school leaders came together in the professional learning communities to improve their own instruction (Leithwood, 2010; Leithwood & Miller, 2012).

Collaborative Inquiry Process. The collaborative inquiry process is the approach to the work that takes place in professional learning communities. For instance, the Teaching-Learning Critical Pathway aims to engage school leaders in improvement of classroom-based practices and equip them with skills needed to support teachers (Leithwood, 2010). Professional Learning Cycles consist of four segments; (1) Plan - examine data to determine the students need, select a learning focus, determine educator learning, plan with the goal in mind, (2) Act - implement instruction and engage in professional learning, (3) Observe - monitor student learning share/examine evidence of student learning, share instructional practice, and (4) Reflect - examine, analyze and evaluate results (Miller, 2015). All of the forms of collaborative inquiry processes “include an effort by a group of staff to improve the design of lessons, analyze student work and create meaningful ways of diagnosing and monitoring student learning” (Leithwood & Miller, 2012, p.9).

Key Learning Conditions. These are the conditions experienced by the students that have both direct and indirect effects on the learning. In LSA projects, these conditions have been improved over time. The key conditions as specified in the LSA Theory of Action are as follows: Academic emphasis, disciplinary climate, teacher collective efficacy, relational trust between teachers, parents, and students, time for instruction, focused instruction, and family educational culture (Leithwood & Miller, 2012).
**LSA’s Web-based Interactive Technologies.** The number of web-based resources and supports has been increasing with expanding access by the participants of the project every year. These technologies are provided and supported by Curriculum Services Canada (Leithwood, 2010; Leithwood & Miller, 2012).

**The Ontario Leadership Framework.** This framework, which was developed by the Leadership Development Branch of the Ministry of Education, describes the successful leadership practices around five dimensions: setting directions, building relationship and developing competencies, developing the organization, improving the instructional program, and assuring accountability (Leithwood & Miller, 2012). Leithwood (2010) stated “LSA’s theory of action assumes that as principal’s capacities in each of these five categories increase, they will be increasingly successful at improving the status of key conditions on each of the four paths” (p.3).

The other two LSA initiatives —Knowledge Building and LSA’s Theory of Action— are explained in Section 2.4 in greater detail.

### 2.4. Addition of Knowledge Building into the Leading Student Achievement Project

Knowledge Building was introduced into the LSA project in August 2013 when the steering team began conversations with Dr. Marlene Scardamalia, Professor, OISE/UT, and Dr. Carl Bereiter, Professor Emeritus, OISE/UT, the co-developers of Knowledge Building theory and pedagogy. Throughout the 2013-2014 school year, Knowledge Building pedagogy was introduced to LSA participants in two symposia, several regional sessions, and also a series of virtual learning sessions (aka webinars). As some LSA
participants became more familiar with the approach, they began sharing their own experiences, questions, and challenges about getting started with Knowledge Building. At this initial stage, Knowledge Building was positioned within the LSA Theory of Action (see Figure 2) as one aspect under the Rational Path. In 2014-2015 school year, Knowledge Building was repositioned as a frame that could encompass all four paths (see Figure 3). Over the course of this year, more teachers and administrators began sharing their experiences and presenting their work with Knowledge Building in webinars and workshops.

2.5. Leading Student Achievement Theory of Action

The LSA project is framed as a theory of action (Leithwood, 2010) that perceives human behavior as action constituted by the meanings and intentions of agents. During the action process, agents monitor the effectiveness of action as well as the suitability of their construction of the environment (Argyis, Putnam, & McLain Smith, 1985). Theory of action informs the agents whether any action achieves intended consequences or not, and whether any change must simultaneously focus on changing individuals and the culture of the system they work within (Fullan, 2006).

Drawing on standards-based district-wide reform initiatives, professional learning communities, and ‘qualifications’ frameworks focused on development and the retention of quality leaders, Fullan (2006) identifies seven premises of a theory of action for school improvements; “focus on motivation, capacity building with a focus on results, learning in context, changing context, a bias for reflective action, a tri-level engagement, and
persistence and flexibility in staying the course” (p.8). These premises are elaborated briefly below.

The main focus of a theory of action should be on capacity building to increase the collective effectiveness of a group (e.g. closing the gap of student learning; Fullan, 2006). For the capacity building internal accountability is crucial more than external accountability. External accountability by itself produces negative pressure. Capacity building requires positive pressure that motivates, along with access to needed resources (Fullan, 2006). Motivation and engagement are fundamental for the remaining six premises. If a strategy does not increase motivation over time, it will not be successful (Fullan, 2006). Moreover, a theory of action is expected to change the larger infrastructure. The success of a theory of action also depends on the changing context. For instance, changes in larger infrastructure establish lateral school and district capacity building. According to Fullan (2006) schools and districts can learn from each other through two forces, knowledge (best idea flow) and motivation (feeling part of a larger system). Tri-level engagement among the school and community, district, and state has a pivotal role. Fullan (2006) asserts, “if enough leaders across the same system engage in permeable connectivity, they change the system itself” (p.11).

Reflective action is another important premise of a theory action. As Dewey asserts, people learn by purposeful thinking about what they are doing rather than merely doing (cited in Fullan, 2006). One of the most important premises is persistence and flexibility in staying the course. Knowing the concrete strategies is important for change knowledge; we also need to think deeply. Fullan (2006) states, “If you do understand the thinking you spontaneously get the strategies right, and self-correct as you experience
them unfolding” (p.11). In order to build on theory of action, one should be flexible, apply self-correction and refinement rather than getting stuck on inevitable barriers by insisting on the same strategies (Fullan, 2006).

Throughout the LSA project life, Dr. Kenneth Leithwood, Professor Emeritus, OISE/UT, has provided significant contributions as the researcher and evaluator of the project. The Theory of Action of LSA was introduced in 2010 by Leithwood and was adopted by the project in the same year. This framework has been refined over the years as data has been gathered and the project has progressed (Leithwood & Miller, 2012). As Leithwood and Miller (2012) state, “This theory describes the assumptions the LSA project makes about how their initiatives will eventually accomplish the single project goal of improving student achievement” (p.10). As of 2014 LSA Theory of Action (2014) is shown in Figure 2 below.

![Figure 2. LSA Theory of Action: Four Paths of Leadership Influence on Student Learning as of 2014. Retrieved from http://www.curriculum.org/LSA/about.shtml](http://www.curriculum.org/LSA/about.shtml)

In the Figure 2, it is clearly illustrated that the ultimate aim of the project is improved student learning and well being. The framework also indicates that engagement of
principals with a wide variety of initiatives increases their capacities and impacts the status of key conditions in their school communities (Leithwood, 2010). These key conditions are underpinned by the four “paths” – the Rational path, Emotions path, the Organization path, and Family path. Leithwood, Anderson, Mascall, and Strauss (2010) describe “these four distinct paths along which the influence on the successful leadership practices flow in order to improve students learning” (p.13) drawing on two fundamental assumptions about leadership; (1) “such leadership is about the exercise of influence” and (2) “the effects of such influence on students learning are mostly indirect” (p.13).

Each of these paths consists of different sets of conditions and variables (e.g. variables relating to school cultures, teachers’ practices and emotional states, and parents’ attitudes), which have direct impact on the students’ experiences at different levels (Leithwood, 2010; Leithwood et al., 2010). Principals are expected to deal with challenges facing their schools by selecting the most promising variables to improve status (Leithwood, 2010). The quality of students’ experience and learning are enriched when each variable is improved by the influence of principals and other sources (Leithwood et al., 2010). Leithwood (2010) emphasizes that the results of exercising leadership that influence only a single path do not provide sufficient gains for students. A major challenge for principals is alignment across the four paths as elaborated in Leithwood et al. (2010).

2.5.1. Four paths of leadership influence on student learning

According to the LSA Theory of Action, key conditions for learning follow four paths, as elaborated below.
2.5.1.1. **The rational path.**

In the rational path, the variables are the knowledge and skills of school staff about curriculum, teaching, and learning. The school leaders need to improve their knowledge about the “technical core” as well as problem solving capacities and their knowledge of leadership practices for exercising more effective influence on these variables, (Leithwood, 2010; Leithwood et al., 2010). These variables include school level variables such as academic press and disciplinary climate as well as classroom level variables such as the management of the classroom and the general quality of teaching.

2.5.1.2. **The Emotions Path.**

Leithwood (2010) asserts that the connection between Rational and Emotions path are very tight. Examples cited by Leithwood (2010) show that “emotions direct cognition: they structure perception, direct attention, give preferential access to certain memories and bias judgment in ways that help individuals respond productively to their environments (Oatley, Keltner & Jenkins, 2006)” (p.5). Teachers’ emotions such as individual and collective teacher efficacy, job satisfaction, and trust in colleagues, parents, and students have significant effects on teaching and learning. (Leithwood, 2010; Leithwood et al., 2010). The empirical studies clearly recommend that the school leaders should focus and exercise influence on emotional path variables (teachers’ efficacy and trust) to improve student achievement and learning (Leithwood, 2006). These two variables are negatively affected by excessive workload (e.g. managing extracurricular activities and other beyond-classroom duties expected of teachers), unreasonable constraints (e.g. inflexible rules, hierarchical administrative structures) and
lack of administrative and social support. With this in mind, Leithwood (2006) recommends that school leaders should consider improvements in teachers’ working conditions, which have a significant effect on “teachers’ thoughts and feelings — their sense of individual professional efficacy, of collective professional efficacy, of job satisfaction; their organizational commitment, levels of stress and burnout, morale, engagement in the school or profession; and their pedagogical content knowledge” (p.88).

2.5.1.3. The Organizational Path

Variables on the Organizational Path are rooted in the structures, culture, policies, and standard operation procedures of the organization. These variables, which establish the schools infrastructure and constitute teachers working conditions, have strong effects on teachers’ emotion (Leithwood et al., 2010). The school structure should be modified to sustain gains and magnify capacities. Organizational Path modifications are essential “to reflect what individual members learn” and to create “the potential for that learning to shape the behavior of many others in the organization” (Leithwood, 2010, p.8).

2.5.1.4. The Family Path

Although improving instruction is essential and obligatory, improving learning requires more than improving instruction (Leithwood et al., 2010). The variables located under this path, as well as Emotional and Organizational path variables, constitute other factors that influence students’ achievement across schools (Leithwood, 2010). Leithwood (2010) cited variables that influence learning — family work habits, academic guidance, support provided to students, physical settings in the home conducive to academic work,
health and nutritional conditions, parent involvement in schools, time spent watching television, etc.

2.6. Knowledge Building Theory of Action for Leading Student Achievement

In 2015, Leithwood formed A Knowledge Building Theory of Action for LSA (see Figure 3). In this theory of action, the four paths allow for two distinct outcomes. One is gains in student achievement, namely development of 21st century skills, deeper content knowledge, and performance to mastery learning orientation. Another outcome is equity, which aims for a greater proportion of students to be engaged in academically meaningful work at schools. Achievement and equity also influence each other.

The Knowledge Building Theory of Action for LSA shares the same four pathways with the LSA Theory of Action. However, the dimensions of the paths are slightly different. Under the Rational path, there are two dimensions: academic emphasis and disciplinary climate. The Emotions path includes student efficacy and student trust. The third one, Organizational path includes time on tasks and academically engaged time. Under the last path, the Family Path, the dimension is communication between parents and children—family educational culture in this model.
2.7. Chapter Summary

This chapter began with a description of the LSA project in which this research is situated. I provided a detailed explanation of the LSA project—historical background and growth over twelve years. I then explained the LSA key initiatives such as Key Learning Condition, LSA’s Web-based Interactive Technologies, The Ontario Leadership Framework. I elaborated on the uptake of Knowledge Building within the LSA project and the LSA Theory of Action, with the four paths of leadership—rational, emotional, organizational, and family—and the influence of this perspective on student learning and intended outcomes. I concluded with a discussion of the LSA Knowledge Building Theory of Action.
CHAPTER 3

3. Literature Review

3.1. Chapter Overview

This chapter begins with a review of teacher learning and professional development literature, with focus on critical strategies and professional development approaches relevant to the current research. In particular, two critical components of ongoing professional development are discussed--a multi-level systemic approach and partnerships with school boards, districts, and school-based professional learning communities. I then situate teacher professional development within a social constructivist perspective, followed by in-depth discussion of teacher learning communities and Knowledge Building Communities for professional development. I present a detailed review of the existing research relevant to Knowledge Building Communities of teachers to improve their Knowledge Building practice.

The review then shifts to E. M. Rogers (1995) diffusion on innovation model used in the current research to explore macro-level spread of Knowledge Building as an innovative pedagogy within and across school boards. Five stages of Rogers’ innovation-decision process that influence adoption are discussed.

3.2. Teacher Learning and Professional Development: The Current Challenge and Situation

Teachers play a critical role in actualizing change (Desimone, 2009; Dunleavy & Milton, 2009; Edwards, 2012). Darling-Hammond and McLaughlin (1995) claim that ‘‘The vision of practice that underlies the nation’s reform agenda requires most teachers to
rethink their own practice, to construct new classroom roles and expectations about student outcomes, and to teach in ways they have never taught before’’ (p.642). In order to help teachers rethink their practice, the authors suggest professional development programs to address teachers’ dual capacities of teaching and learning and to help them develop new visions of what, when, and how they should learn.

To meet standards-based improvement, teachers must be in position to engage students in new programs and practices to achieve higher-order competencies (Birman, Desimone, Porter, & Garet, 2000; Darling-Hammond & Richardson, 2009; Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009) and implement contemporary pedagogical practices effective for teaching their subject (Blank & de las Alas, 2009). To transform knowledge into practice, traditional program delivery mindsets and practices must change: no longer “typically, an “expert” delivers new content and information” (Kiggins, 2002, p.3; Kiggins, Cambourne, & Ferry, 2005). Under “expert-delivery” conditions teachers are positioned as passive learners who need to be “fixed” through delivery of “packaged” knowledge in traditional forms of professional development activities and one-shot workshops that feature lectures and tutorials (Kooy, 2009). Kooy suggests that if teachers are to abandon conventional practices and adopt new concepts of teaching they must immerse themselves in “extensive learning opportunities that actively engage them in the practices and experiences they create for their students” (p.8). There is growing understanding of limitations of traditional professional development activities (Beach, 2012; Borko, 2004; Darling-Hammond & Richardson, 2009; Dede, Ketelhut, Whitehouse, Breit, & McCloskey, 2008), and the need for novel forms with teachers as
change agents and decision makers (Kooy & Colarusso, 2014, 2012; van Veen & Kooy, 2012) both for their own and students’ learning.

The shift from traditional forms of professional development to innovative teaching practices requires an institution-based change in a broad sense. Hargreaves (1999) argues that in knowledge-creating schools, the school system already engages in educational knowledge creation.

Although teacher professional development is a significant element in school improvement, most programs – even those claiming to be based on modern pedagogy and support for teachers – retain traditional forms (Bolam, 2008; Lieberman & Mace, 2008; Lock, 2006). These forms are mostly based on disconnected lectures/courses, one-shot workshops, seminars and conferences in which teachers are out of their work place (off-site) and positioned as passive listeners; activities and content are irrelevant to the real problems and issues of daily classroom practice (van Veen, Zwart, & Meirink, 2012). “More typically, teachers experience professional development as episodic, superficial and disconnected from their own teaching interests or recurring problems of practice” (Little, 2012, p. 22). In most traditional forms, the transmission model of learning is dominant (Barnes, 1995, van Veen, et al., 2012). The decision of what and how teachers should learn is made by an expert trainer with the focus of fixing what is wrong and correcting teachers’ skills, content knowledge, and attitudes (Beck & Kosnik, 2014; Clark & Floroio-Ruane, 2001). Moreover, teachers have a variety of attitudes and professional development needs according to the school level, subject, and teaching experience (MacDonald, 2009). Thus, a one-size fits all approach fails to address complex needs of different teachers.
According to van Veen, et al., “innovative forms” comprise “all those interventions in which teachers do play an active role, and the issues in their own teaching practice determine the content” (p.3). Professional learning communities are defined as communities “with the capacity to promote and sustain the learning of all professionals in the school community with the collective purpose of enhancing student learning” (Bolam, McMahon, Stoll, Thomas, & Wallace, 2005, p. 145). Action research and working in professional learning communities —initiatives that encourage teacher responsibility not only for student learning but also teaching insights (Little, 2006)—represent several examples of innovative forms of professional development. Ingvarson, Meiers, and Beavis (2005) mention the need for strategies to become much more complex, long term and job-embedded as oppose to insufficient traditional courses in the recent past. Stokes (2001) asserts that no single approach encompasses all of the work of teacher learning and instructional improvement. Beck and Kosnik (2014) describe a constellation of activities in four pathways with sub-categories within each: (i) informal learning opportunities, (ii) formal learning opportunities, (iii) teacher inquiry as professional learning, (iv) school-based professional learning (see Figure 4).

Ingvarson et al. (2005) add online learning and participation in formal award programs, conferences, and seminars as professional development activities utilized in other professional development programs. Teachers’ learning and professional development are integrated into practice (Allaire & Laferriere, 2005, p.800). They learn a great deal from their students—their interests, needs, and behaviors in their classrooms (Beck & Kosnik, 2014). Moreover, teachers are exposed to another type of informal learning, which comes from experimentation with a variety of content, methods, and materials.
While they are using different types of resources and implementing new pedagogical strategies they gain insights about what works and current efforts shape next steps. They also learn about classroom organization and community building through classroom-based experiences. In efficient ongoing professional development, inquiry regarding teaching and learning (Allaire & Laferriere, 2005) can be facilitated by data collection. This kind of professional development is defined by Ingvarson et al. (2005) as workplace learning through action research, mentoring, and coaching and institutional learning to facilitate understanding of research findings and best practice. Teacher inquiry and research is essential because it helps teachers “to understand how to enhance their inquiry” and “encourage academics to connect academic and practitioner inquiry” (Beck & Kosnik, 2014, p.150). Improving practice in the classroom results from implementing design experiments with iterative designs and action research.

![Figure 4. Four pathways with sub-categories for ongoing professional development (Beck & Kosnik, 2014).](image-url)
3.2.1. School-based professional learning communities

Teachers are also encouraged to conduct research in collaboration with other teachers in their school or other schools (Beck & Kosnik, 2014). The best form of teacher professional learning occurs in the school as a whole community; in specific school sites teacher groups collaborate, professional learning communities provide fertile ground for building a school culture based on shared practice with the support of school principal and other formal school leaders (Kooy, 2009). A number of research reports (i.e., Borko, 2004; Little, 2012; McLaughin & Talbert, 2006) identify the importance of teacher professional learning in changing school cultures and student learning experiences (p.11). Little (2012) explains the microcosm design of professional development as following:

Consistent with the principle of organizing professional development in and from practice, then, a school organized for teacher learning would promote systematic attention to teaching and learning in multiple ways. School leaders would support teachers in acquiring a deep understanding of what it means for children to learn core concepts and skills in particular subject domains. School staff would develop the habit of collectively examining evidence of student learning and investigating the sources of students’ progress or difficulties. Teachers would be helped to locate and participate in the best of external professional development opportunities and helped to parlay what they learn into collective capacity in the school. (p.29)

In collaborative school cultures, learning communities provide a chance for both individual transformation and the transformation of the social settings (Grossman, Wineburg, & Woolworth, 2001). The school needs to transform itself to a learning organization in order to facilitate teachers’ individual and collective efforts to foster inquiry into student achievement and to provide meaningful supports for all students (Little, 2012, p.31).
Schools are not designed for teacher learning but rather prioritize student learning (van Veen & Kooy, 2012; van Veen et al., 2012). To address this imbalance van Veen et al., (2012) suggest a different way of thinking: “taking the structural and cultural possibilities and constraints for teacher learning in the entire organization into consideration” (p.16). Creating and sustaining robust professional learning in a school culture requires cultivating a strong professional community, which includes a sense of collective responsibility (Little, 2012) for student learning and giving attention to teaching practice at multiple levels and locations in the school (Stokes, 2001). Little (2012) cites terms from Stokes (2001, p. 150–151) in order to define specific structural and cultural possibilities, namely: normative capacity and technical capacity of the school. Normative capacity refers to “the staff’s collective embrace and enactment of values that support self-study as an important kind of learning” and technical capacity means “the structures, processes, knowledge, and activities by which the school staff does the actual work of inquiring into their practices” (p.38). In turn, a participating teacher learning depends on consistent and coherent organization of the school as a whole, orchestrated leadership work on the part of both principals and teachers, and professional learning capacity of the schools (Little, 2012; van Veen et al., 2012). Size of the community affects success (MacDonald, 2009). He suggests building local communities around one particular school or common educational initiative with small numbers of teachers who might represent the same subject area or grade level, with local communities establishing relationships with other school communities regardless of distance. Online interaction is recommended as another way of connecting these learning communities “to facilitate the distribution of cognition and the generation of new knowledge” (p.334).
3.2.2. Partnerships with school boards and districts

Little (2012) underlines the importance of understanding the internal resources and external connections and relationships that determine the capacity and ability of the schools to support teachers for professional learning. Schools are not isolated from the outer world, but are embedded in school districts, professional associations, reform organizations, etc. that impact work and professional development. Valuable professional development is ongoing and based within a multi-level school, university, district, and provincial system of support (Beck & Kosnik, 2014; Laferriere & Law, 2010). Little (2012) specifically emphasizes, “The strongest and most generative professional communities appear to benefit from ties to external sources of ideas, material and assistance” (p. 38). In a multi-level system, schools and school staff can receive intellectual push from other colleagues, organizations and groups outside the school (e.g. teacher-to-teacher networks, university–school partnerships, school networks and special projects) and have a chance to “consider possibilities beyond those a school would come up with independently” (Little, 2012, p. 38). However, at each level of this multi-level system, the balance should be provided between input from teachers and other sources (Beck & Kosnik, 2014; Laferriere & Law, 2010). Figure 5 presents an overview of the link between “school-based professional learning communities focused on problems of classroom teaching and learning at the center of a larger constellation of learning opportunities” (Little, 2006, p.14).
3.3. Teacher Professional Development from a Social Constructivist Perspective

3.3.1. Social constructivism

Social constructivism is based on the idea that individuals reconstruct new information and experiences in alignment with their personal experience and their current framework for giving meaning to that information and experience (Wells, 2002). Knowledge is gained and continually modified through experience (Dewey, 1938), constructed and progressively regenerated through social interaction (Bakhtin, 1986; Vygotsky, 1992). Individuals learn in a dialogic culture (Stahl, 2000) through use of signs, tools, collaborative discourse, and self-reflection (Schlager & Fusco, 2004). Diverse influences affect comprehension and ways of thinking at the point of intersection of culture and personal understanding (Stahl, 2000).
Beck and Kosnik (2006) define social constructivism in the context of professional development as an approach that “encourages all members of a learning community to present their ideas strongly, while remaining open to the ideas of others” (p. 8). This definition is congruent with Bakhtin’s (1986) dialogical theory. This theory proposes “thinking and learning depend on multiple voices, each stemming from the voices that came from and blending with the voices already in place” (Kooy, 2009, p. 9). From this perspective, professional development should attend to the social environment that influences thinking and creation of meaning. Teachers should be encouraged to construct meaning from their experiences and interpret the world through dialogue and conversation (Liu, Carr, & Strobel, 2009; Lock, 2006). The social constructivist approach to professional development allows teachers to develop and work from an inquiry stance and in collaborative inquiry groups (Weinbaum, Allen, Blythe, Simon, Seidel, & Rubin, 2004) where they can articulate their understandings and interpretations of problems, hear different ideas from multiple contexts and viewpoints (Murphy & Laferriere, 2003), explore new ideas and classroom practices (Vescio, Ross & Adams, 2008, p. 89) and have venues for intellectual growth and renewal as a teacher (Weinbaum et al., 2004). Collegial dialogue for collective inquiry in job-embedded teacher learning is valuable (Kooy, 2015). Drawing on Dewey, “the dialogue points to difference and tensions leading to meaningful reflection, re-negotiation and critical thinking” (p. 189); a state of perplexity in a problematic situation, not completely understood, can ignite the learning process. As Kooy (2009) indicates, in dialogic teacher communities, teachers shift from learning from others to learning with others, exploring conflict and discrepancy.
Collaborative dialogue fosters teachers’ rethinking teaching and awareness of how their understating of the concept of teaching evolves (Kooy, 2006). Little (2012) describes highly collegial and improvement-oriented schools as schools with teachers in dialogue about their teaching, considering ways of improving it.

3.3.2. Teacher learning communities

With social constructivist theories in mind, research points to the potential efficiency of collegial communities (Kooy & Colarusso, 2012; Little, 2012, 2002). Developing professional learning communities is perceived as a promising way for teachers’ progressive improvement (Stoll, Bolam, McMahon, Wallace, & Thomas, 2006).

Vescio, Ross and Adams (2008) state that learning communities are defined based on two assumptions: (1) teachers learn best through critical reflection with others who share similar experiences, which they gain in daily classroom teaching (Buysse, Sparkman, & Wesley, 2003); and (2) teachers can improve their professional knowledge and enhance student learning by actively engaging in professional learning communities.

Researches identify the following critical features of professional learning communities (DuFour, 2004; Grodsky & Gamoran, 2003; Kruse, Louis, & Bryk, 1995; Little, 2012; Louis & Kruse, 1995; McLaughin & Talbert, 2001; Newmann et al., 1996; Secada & Adajian, 1997):

- shared norms and values that represent the group’s collective perspective about students, students’ abilities to learn, school priorities for the use of time and space, and the defined roles of parents, teachers, and administrators.
• shared vision and purposes as well as shared orientations to the teaching of
particular subjects, developed in dialogue with community members.

• collective learning through collaboration and supportive practices such as
observation, problem solving, mutual support and advice giving,

• reflective, open dialogue: “extensive and continuing conversations among
teachers about curriculum, instruction, and student development” (Newmann et
al., 1996, p. 182).

• consistent focus on student learning and well being; shifting focus from teaching
to improving learning (DuFour, 2004);

• authentic learning communities in which members explore disagreement,
acknowledge differences, and tolerate conflict (Little, 2012, p. 35).

• safe environment for “disclosing their teaching dilemmas, discussing them in
depth and helping one another craft solutions to problems of teaching practice and
student learning” (Little, 2012, p. 35).

The term community proliferates educational contexts to characterize new forms of
social/cultural learning. For example, communities of practice (CoP; Wenger, 2011) are
groups of individuals who have a common goal and motivation and who interact with
each other to accomplish and improve something. This characterizes domain-based
professional practice groups. In an effort to understand different forms of social
distinguish communities designed to support learning under three distinct categories;
task-based, practice-based, and knowledge-based learning communities. In task-based
learning communities, the members of the community are assigned to complete a task or
produce an object in a specified period of time. The members do not have a strong notion of community and responsibility for group learning; instead they focus on creating a finished product. The learning process may be considered later, but not necessarily revised by others. Unlike task-based communities, the members of practice-based learning communities work and learn together in a strong sense of community. They share a responsibility to learn from and learn for the community. Practice-based learning communities arise around a profession to leverage the learning power of the community (e.g. CoP; Lave & Wenger, 1991) on the basis of voluntary participation (Riel & Polin, 2004).

In the center of knowledge-based learning communities, the main activity is searching to advance community knowledge as a collective effort. In doing so, it aims to support the individual growth of the members of the community. Considering Knowledge Building Communities under this stream, Riel and Polin (2004) distinguish it from a task-based community with respect to completion of product. In Knowledge Building Communities ideas are continually generated, refined, and further built upon by others (Chen, Zhang, & Lee, 2013), leading to increasingly advanced ideas. A distinct characteristic of Knowledge Building Communities relates to intentionality. While practice is developed over time, as with all practice-based communities, knowledge builders seek intentionally to evolve their ideas and practices.

While there are overlapping characteristics of various types of communities (Hewitt (2004), Knowledge Building Communities are characterized by intention to create new knowledge (Riel & Polin, 2004); sharing and interactive participation are necessary but not sufficient.
3.4. Knowledge Building Community: Professional Development (KBC:PD)

Knowledge Building Communities are not limited to local communities; they are often linked through knowledge building innovation networks. For example, the Knowledge Building International Project represents a constellation of Knowledge Building Communities connected in a broad international network. The Knowledge Society Network engages Knowledge Building International members in cross-community, cross-sector research and development, including scholars, teachers, engineers, administrators, and so on (Hong, Scardamalia, & Zhang, 2010). Within LSA, school-based Knowledge Building teacher communities are linked to each other through district facilitators who, in turn, connect them through the LSA network of school boards.

Alignment of schools to knowledge society goals and challenges represents a dramatic shift in the traditional mind-set of teachers and the culture associated with teaching practice; this shift in mind-set is a knowledge-age imperative (Fullan, 2007; Kiggins, 2002). Most importantly, participants are engaged in “productive work that advances the frontiers of knowledge as these are perceived by a community” (Bereiter & Scardamalia, 2003, p. 1370). Knowledge creation requires problem redefinition at increasingly high levels (Scardamalia & Bereiter, 1999; Hewitt, Brett, Scardamalia, Frecker, & Webb, 1995). My research aims to explore how Knowledge Building Communities can support teacher professional development. I refer to these communities as KBC: PD communities: communities engaged in principle-based, continual improvement of practices, creating new knowledge of teaching practice to support continual increases in student capacity to generate new knowledge.
Drawing on Bereiter and Scardamalia’s early work (1987) regarding Teachers A-B-C, introduced briefly in the introduction of this thesis, teachers need to shift from an ‘exercise model’ (p.12), which focuses on assigned work, tasks, and activities (e.g. seatwork or computer work) to one that engages students in high level responsibility (Bereiter & Scardamalia, 2008; Chan, Ma, & Law, 2007). Turning over social and cognitive responsibility to students is an essential characteristic that distinguishes Teacher C from Teachers A and B—variations on traditional teacher models. Teacher C holds a different epistemological stance from Teacher A (supporting student exercise of routines and procedures) and Teacher B (engaging students in pedagogical strategies, tasks and activities). Teacher C conceives his or her challenge as helping students take charge at the highest socio-cognitive levels of the enterprise (e.g., planning, monitoring, assessment), with practice and principles themselves objects of inquiry, and in line with innovation-driven society requirements (OECD, 2010). This necessitates theoretically grounded principle-based understanding for continual improvement of teaching practices (Chan, Ma, & Law, 2007).

Chan and Song (2010) underline the transition from Teacher B to Teacher C model as a major challenge. For knowledge advancement and sustained classroom innovation, teachers need to focus on principle-based innovation rather than procedure-based implementation (Scardamalia & Bereiter, 2008; Zhang et al., 2011). When the tasks and activities become central in the classroom without deep understanding of key-principles, the risk is what Brown and Campione (1996) have termed “lethal mutations”—procedures that seem in line with a pedagogical model but actually go against principles.
This can lead to degeneration of the reform based approach and shallow constructivism (Zhang, 2010; Chan & Song, 2010).

Knowledge Building is not a familiar pedagogical model for teachers and students in teacher education, as their own school experience was different. A number of researchers (Chai, Wong, & Bopry, 2009; Chang & Hong, 2010; Hong, Chai, & Lin, 2009; Hong, Chen, Chai, & Chan, 2011; Hong & Lin, 2010) point out the need for teachers to be engaged themselves in a collaborative Knowledge Building Community to support teachers’ transformative pedagogical and epistemological views about teaching and learning. Results available at present indicate that immersing teacher-education students in Knowledge Building Communities enhances collaboration, reflection, and constructivist-oriented epistemological and pedagogical beliefs (Chai & Tan, 2009; Hong, Chai, & Lin, 2009; Hong & Lin, 2010). The result of Laferriere and Breuleux’s (2005) research, grounded in an ‘emancipatory’ professional development approach and reflective practitioner model, indicates that teachers’ beliefs evolve toward a more positive image of teaching and more active learning with Knowledge Building practices.

The teachers and teacher candidates who participated in different Knowledge Building Communities with the purpose of professional learning acknowledged the efficacy (Chai, Tan, & Hung, 2003) and appreciated the value of Knowledge Building for both individual success and collaborative knowledge work (Chan & Song, 2010; Hong & Lin, 2010). Drawing on the study of Resta, Cristal, Ferneding, and Puthoff (1999) with nine teachers and Chai and Merry’s (2006) research with three teachers, a picture emerges of Knowledge Building Communities supporting a shift from traditional didactic teaching toward a more constructivist approach. When teachers have experienced and
experimented with Knowledge Building by being exposed to it, they are more inclined to perceive their students as knowledge constructors (Chai & Merry, 2006; Chai, Tan, & Hung, 2003).

Moving to Teacher C requires teacher transference of high level socio-cognitive responsibility to students so that a Knowledge Building classroom functions as an expert teacher-student team in which all team members are aware of team goals and contributing to the team in distinctive ways (Scardamalia, 2002). To assume collective responsibility each team member must bring individual talents to the collective enterprise to help the group succeed as a whole (Chuy, Zhang, Resendes, Scardamalia, & Bereiter, 2011; Scardamalia & Bereiter, 2010), requiring more than reciprocal teaching (Palinscar & Brown, 1984) and learning in a group (Brown & Campione, 1994; Scardamalia & Bereiter, 2007). The collective enterprise in Knowledge Building is more akin to group creativity (Sawyer, 2014), swarm creativity (Gloor, 2005), or collaborative innovation networks (COINs; Gloor, Paasivaara, Schoder, & Willems, 2008) where opportunistic and emergent collaboration contributes to collective knowledge goals. Knowledge Building results show impressive advances in individual learning as a by-product of engagement in the collective enterprise. Chen et al. (2015) and Resendes et al. (2015) provide examples of turning increasingly high-level agency over to students resulting in significant advances in subject matter understanding as well as a broad range of 21st century skills. Scardamalia and Bereiter (2016) make the case for supports and assessment built directly into technology environments to open new possibilities for exceeding, not simply meeting curriculum expectations. The results of their endeavors convey significant advances (e.g., Caswell & Bielaczyc, 2002; Chan, Burtis, & Bereiter,
1997; Chen, Ma, Matsuzawa, & Scardamalia, 2015; Chuy et al., 2010; Gan, Scardamalia, Hong, & Zhang, 2010; Moss & Beatty, 2006; Resendes & Chuy, 2010; Zhang et al., 2007), with teacher learning involving both subject-matter learning and means to implement principle-based innovation (Zhang et al., 2011).

How might KBC: PD support a shift in teacher communities? The actualization of educational change requires recognition of “the teacher as professional and informed decision maker” (van Veen & Kooy, 2012, p.255) and revaluing of teachers’ positions as change agents (Cook-Sather, 2007) with their voices pivotal in planning and implementation of both professional development programs and improvement actions for students (Kooy & Colarusso, 2012).

Change agents typically assume a skeptical stance regarding mainstream political and social trends and consider moral issues as fundamental for professional activities. Kanu and Glor (2006) assert that teachers, as private and public intellectuals in a complex and fast changing knowledge society, must learn to teach in ways they were not taught, commit to continuous learning and reflection, and work and learn both alone and in professional teams where they can raise moral questions about practice and access knowledge from the collective intelligence of team members.

Developing students as knowledge creators requires that teachers be engaged in a knowledge creating culture where they operate as change agents, gaining deeper conceptual understanding of teaching as a Knowledge Building process (Hargreaves, 1999; Hong & Sullivan, 2009). Knowledge Building Communities empower--“teachers to commit to the task of continuous experimentation, investigation, inquiry, and study.
(...) to growing and learning for an entire lifetime in the classroom” (Ayers, 2010, p.861). A Knowledge Building Community provides a space for teachers to identify and solve problems, ponder theoretical and practical considerations, storytelling, and critical reflection.

3.5. Diffusion of Knowledge Building as an Innovative Pedagogy

To examine the spread of Knowledge Building within and across the schools and school boards in Ontario, I focused on LSA’s efforts to create Knowledge Building professional development communities. To address the first research question in Chapter 5 I present Rogers’ five-stage model of the innovation-decision process to identify factors in adoption of Knowledge Building by principals and teachers. The subsequent sections provide a literature review for the diffusion of innovation theory.

3.5.1. Diffusion of Innovation Theory

Diffusion of Innovation theory proposed by Rogers (1962) describes the process and the speed of dissemination of a new idea or technology, as well as the factors that influence the spread of an innovative idea. Diffusion of innovation is a process in which a decision-making unit (either an individual or an institution) aims to reduce uncertainty about the consequences of an innovation (Rogers, 1995). Rogers’ model is one of the best known theories for studying adoption of novel ideas and technologies and for understanding how innovations spread within and across communities (Zhang, Yu, Yan, & Spil, 2015).

Initial research on diffusion originated in sociology and anthropology in the 1940s and significant research from different scientific disciplines has been published over the last
40-50 years (see Rogers, 1995, p.42-43; Rogers & Shoemaker, 1971, p.50-51). Rogers published one of the most popular diffusion of innovation models in his book in 1983. According to Dearing (2009) “the robustness of this theory derives from the many disciplines and fields of study in which diffusion has been studied, from the international richness of these studies, and from the variety of new ideas, practices, programs, and technologies that have been the objects of diffusion research” (p.1).

3.5.2. Key Components of Innovation Decision Making

By definition, diffusion is a process through which an innovation is communicated among the members of a social system across certain channels or media (Rogers, 2003). In other words, diffusion is the process of flow of information about the innovation among a group of people. This definition comprises four key components: (a) innovation (b) communication channel, (c) social system, and (d) time (Rogers, 1995, p.10; Rogers & Shoemaker, 1971), as elaborated below.

3.5.2.1. Innovation

In the Oxford dictionary, innovation is defined as “a new method, idea, or product” and “the action or process of innovating”. Congruently, Rogers (1995) states, “an innovation is an idea, practice or object that is perceived as new to an individual or another unit of adoption” (p. 132). He elaborates his definition, as “development of an innovation is the process of putting a new idea in a form with the aim of meeting the needs of an audience of the potential adopters” (p. 137). In our context, the innovation to diffuse is Knowledge Building pedagogy.
3.5.2.2. Communication channels

Communication channels refer to media whereby people are exposed to information about innovation and perceive its advantages. There are two common communication channels: (1) interpersonal or mass media and (2) local or cosmopolite sources (Rogers, 1995); each have distinctive advantages. Rogers’ defines cosmopolite communication channels as those from outside the social system being investigated (Rogers, 1971); cosmopolitiveness is thus the degree to which an individual is oriented outside a social system (Rogers, 1995).

In comparison to interpersonal communication, mass media such as the Internet enable the message to reach a large audience rapidly. In addition to enhancing spread of a large amount of information around the world, the Internet involves users in knowledge creation through Web technologies—mass media channels that are significant at the knowledge-spread stage. The choice of communication channel in a particular stage represents a significant decision; inefficient communication channels cause delays and late adoption. Cosmopolite channels tend to be more effective at the knowledge-spread stage while the local channels are more decisive at the persuasion stage. Mass media represent external cosmopolite communication; change agents represent interpersonal channels that may be either local or cosmopolite. Change agents and opinion leaders can come from outside or from within the local community, city, or system (Rogers, 1995).

Change Agents. A change agent is an individual who bridges two or more social systems. Change agents are responsible for influencing individuals’ innovation-decisions in a positive direction and for providing communication between systems. Key roles are
identifying adopters’ needs and problems, obtaining feedback about the change program and forwarding it to the change agency (Rogers, 1995).

*Opinion Leaders.* Opinion leaders also have significant influence on attitudes as members of the system to be influenced consider them a source of information and ask for advice from them about the innovation. In contrast to change agents, opinion leaders are not officially assigned to their position in the innovation process and that position is not directly related to their formal status in the system (Rogers, 1995). Opinion leadership arises from some distinctive characteristics of the individuals such as technical competence, social accessibility, and conformity to the system’s norms. Opinion leaders’ behaviors represent the general structure of the system. For instance, if the system is change-oriented, opinion leader show more innovative attitudes; if the system is not open to change, the opinion leaders’ behaviors oppose innovation.

The most innovative member of a system is usually not an opinion leader in the social system. That is because innovators tend to display marginal characteristics; thus average members of the system do not follow the innovator’s behaviors. Opinion leaders also have distinctive characteristics such as being exposed to different cosmopolite communication, having higher social status, and being more innovative. Their most remarkable characteristic tends to be their central position in the system’s communication network. Since information flows through interconnected individuals within a communication network, the unique position of opinion leaders lets them reach and influence a large number of people in the communication network (Rogers, 1995). As elaborated below, school principals and Professional Learning Teams comprise the opinion leaders in the context of the current study.
3.5.2.3. Social system

The nature of the social system in which the innovation is diffusing is another key element that affects the attitude of the individuals toward the innovation, and ultimately the rate of adoption. Rogers (1995) defines the social system as, “a set of interrelated units engaged in joint problem solving to accomplish a common goal” (p. 23). A social system may be composed of individuals, informal groups, organizations, and subsystems. All members of the system come together around a shared goal and spend effort to seek a solution for a common problem. This mutual goal holds all members together in the social system (1995).

3.5.2.4. Time

Time, an important dimension of diffusion research, is considered in three sections of Rogers’ five-stage model: (i) innovation-decision process, (ii) innovativeness of an individual, and (iii) rate of adoption.

3.5.3. The five-stages model of innovation-decision process

Innovation decisions occur over time, through a series of actions rather than an instantaneous act. The process starts with knowledge of an innovation to be adopted or rejected and continues through the confirmation of the decision (Rogers, 1995; 1971). As depicted in Figure 6 below, Rogers suggested a five-stage stepwise model of the innovation-decision process: (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation.
3.5.3.1. Stage 1: Knowledge of Innovation

An innovation-decision process starts with first exposure of a decision-making unit to the innovation’s existence. In this stage, the individual seeks more information about the innovation to receive some understanding of how it functions (Rogers, 1971). In the Knowledge Stage, individuals ask questions such as “What is the innovation?”, “How does it work?”, and “Why does it work?”. Through these questions, they collect three types of knowledge of the innovation (Rogers, 1995; 1971).

Awareness – knowledge. Awareness – knowledge represents the initial knowledge of the innovation that makes individuals recognize its existence. First impressions motivate additional questions and efforts to learn more. Diffusion of innovation researchers discuss two different perspectives regarding the role of individual-awareness knowledge. Individual awareness may occur incidentally; the individual is not actively looking for an
innovation because the person is not aware of its existence. Individual awareness may also result from individuals purposefully exposing themselves to innovation possibilities. Individuals tend to expose themselves to communication messages that are compatible with their existing attitudes and values. This is called selective exposure. They further engage in selective perception—the tendency to interpret messages in terms of existing attitudes and beliefs. This especially occurs with messages about an innovation for which there is no perceived need and/or problem to be addressed (Hassinger, 1959; cited in Rogers, 1971). In such a case, the effect of this exposure is very limited. And if input regarding an innovation conflicts with existing attitudes and beliefs, avoidance behavior results.

*How-to knowledge.* After becoming aware of an innovation, individuals seek how-to knowledge to be able to use or implement the innovation properly; how-to knowledge also supports persuasion and decision stages. Adopters must determine how much information is needed to use the innovation correctly; if how-to knowledge is insufficient, there is risk of rejection or discontinuance.

*Principles knowledge.* After initial trials, people focus more on principles behind the innovation to improve their implementation and solve problems. Adopters need this type of knowledge to understand how and why an innovation works. There is a common misunderstanding of change agents’ responsibilities as it is mostly assumed that change agents provide awareness-knowledge. However, mass media channels effectively advertise the innovation. Change agents are needed more to provide how-to knowledge and implementation at the decision stage, but providing principle-knowledge is often too complex for change agents and beyond their responsibilities (Rogers, 1995, p. 166).
3.5.3.2. Stage 2: Persuasion

The second innovation-decision stage defined by Rogers is the persuasion stage. This stage is simply defined as the formation of an attitude – either favorable or unfavorable – toward the innovation. This requires more cognitive action than the knowledge stage and it is also a more affective stage as strong feelings may be generated by beliefs about the new idea, influencing messages received and interpreted.

The general perception of the innovation is developed through the following perceived attributes of the innovation.

*Relative advantage.* Relative advantage “refers to the innovation's superiority to existing products or methods” (Lowrey, 1991, p.645) in terms of profitability, social prestige, and so on.

*Compatibility.* The integration and congruence of the innovation with the existing technical and social environment, values, past experiences, and the needs of the potential adopters is positively related to its rate of adoption (Rogers, 1995).

*Complexity.* The more an innovation is perceived as difficult to understand and put into use, the less likely it is to be accepted by end users (Rogers, 1995).

*Observability.* When outcomes and benefits are visible to potential adopters rate of adoption increases (Rogers, 1995).

*Triability.* If the potential adopter is able to experiment without a full commitment and with limited risk this increases triability and rate of adoption (Rogers, 1995).
At the end of the persuasion stage an attitude might be favorable, leading to adoption, or unfavorable, leading to rejection, but there may also be inconsistency between attitudes and actions.

3.5.3.3. Stage 3: Decision

In the decision stage individuals may presume advantages and disadvantages and/or outcomes of full use of an innovation and the decision-making unit chooses adoption or rejection (Rogers, 1995). Initiatives may include

*Intention to try the innovation.* Trying the innovation on a probationary basis may increase the rate and pace of adoption, but a trial opportunity is not always possible. In order to encourage potential adopters different methods are used. For instance, free samples or a peer who has their own trial sample provides individuals a chance to try the innovation. This “trial–by-others” constitutes a vicarious trial for an individual (Rogers, 1995).

In the decision stage, one of the most important responsibilities of change agents is supporting convenience of trial, with demonstration to accelerate the innovation-decision. Demonstrations are particularly persuasive when the presenter is an opinion leader (Magill & Rogers, 1981). Someone local in the system is typically more influential (Magill & Rogers, 1981; cited in Rogers, 1995).

*Intention to seek additional information about the innovation.* Potential adopters often seek additional information from the system and their personal network.
3.5.3.4. Stage 4: Implementation

In this stage, the innovation is put into use to varying degrees by the adopters. While the previous stages include strictly mental exercises, implementation involves overt behavior change. Even after the decision to adopt adopters might have a degree of uncertainty about expected consequences. Thus change agents have a crucial role in providing more information: “How do I use it?”, “How does it work?”, “Where do I obtain more information?”, and “What operational problems am I likely to encounter and how can I solve them?” (Rogers, 1995, p.173). After deciding to adopt, individuals put the innovation into use differently. The role of change agents here is usually to provide technical assistance as well as prevent problems (Rogers, 1995).

3.5.3.5. Stage 5: Confirmation

The length of the implementation of an innovation depends on its nature. When it becomes a part of the adopter’s ongoing routine or established in an institution, innovation loses its novelty; this marks the end of the implementation stage (Rogers, 1995).

Rejection or non-adoption. In the decision stage, an individual might either accept or reject the innovation. Rejection might occur at any stage; for example, an individual can forget awareness-knowledge at the knowledge stage. In the decision stage, two types of rejection are defined (Eveland, 1979): an individual deliberately rejects the innovation after considering adoption (active rejection) or never consider the innovation (passive rejection or non-adoption).
On the other hand, when individuals feel uncomfortable, they change their behaviors, attitudes, or perceptions in order to reduce mental disequilibrium (Festinger, 1957; Rogers, 1995). This uncomfortable state is termed dissonance. In the Oxford dictionary, dissonance is defined as the “lack of agreement or harmony between people or things.” In the innovation-decision context, the dissonance reduction may occur in three situations (Rogers, 1995). In the first case, an individual realizes a need and seeks information to meet this need. With this provocation the individual finds out about the innovation. This mostly happens at the knowledge stage of the innovation-decision process.

The second case is about the behavior, which occurs at decision and implementation stages. In this case, even though individual awareness knowledge is positive the adoption has not occurred yet. The individual needs to be encouraged to eliminate the inconsistency between behaviors and thoughts/feelings.

After implementation, at the confirmation stage, an individual may have enough reasons or excuses to quit the innovation or, alternatively, shift from rejection to adoption (Rogers, 1995).

Even though change agents are mostly charged with encouraging adoption decisions, they have an important role in preventing dissonance from occurring. They should provide supportive messages and help support the adoption decision. Of course if individuals find a better alternative and/or are not satisfied the innovation is replaced. Replacement occurs when a better alternative is found; disenchantment when the innovation is unsuitable or inadequate—or often caused by misuse of the innovation. Accordingly, in confirmation
stage reinforcement for adopters exposed to conflicting messages is substantial (Rogers, 1995, p. 162).

3.6. Chapter Summary

First, I discussed the literature on teacher learning and professional development and the need to shift from traditional forms to more innovative teaching practices. Then I presented two powerful forms of teacher learning and professional development to address teachers’ dual capacities of learning and teaching; (1) school-based professional learning communities, and (2) partnerships with school boards and districts. Next, I provided an in-depth discussion of teacher learning communities from a social constructive perspective. This section was followed by a review of Knowledge Building Community literature focusing on research on teacher learning in Knowledge Building Communities. The second dimension of the literature review focused on diffusion of innovation theory (Rogers, 1995) and key components of a stepwise model of the innovation-decision process to explore evidence for the spread of Knowledge Building pedagogy in Ontario.
CHAPTER 4

4. Methodology

4.1. Chapter Overview

In this methodology chapter I formally present the purpose of the research and the research questions to be investigated. I start with a discussion of process research within the “naturalistic” design of diffusion and then qualitative case study methodology used to conduct this research. After that, I introduce the research design, settings, and data sources for the study, including research sites, participants, data sources utilized in data analyses and three types of data analyses applied in this research. I conclude with explanations of data interpretation and validation and ethical considerations.

4.2. Purpose of The Study

The purpose of this study is to explore the diffusion and adoption of Knowledge Building as an innovative pedagogy within multiple levels of the Ontario school system, within the Leading Student Achievement (LSA) initiative elaborated above. The focus is on the movement toward Knowledge Building and ways in which schools, teachers, and administrators buy-in and take responsibility for developing and implementing effective practice grounded in Knowledge Building principles. More specifically, this study aims to conduct a holistic, in-depth investigation into diffusion and adoption of Knowledge Building within Upper Grand District School Board.

4.3. Research Questions

Three primary research questions are investigated:
Research question 1: What factors have affected diffusion of Knowledge Building as an innovative pedagogy within and across schools in Ontario? Does Everett Rogers’ five-stage model of diffusion of innovation help explain how and why Knowledge Building has spread in Ontario?

Research question 2: In what ways do principal learning teams (PLTs) support teachers in implementing effective Knowledge Building practice?

Research question 3: What do teacher practices convey regarding engagement of students in principle-based Knowledge Building Communities?

4.4. Research Approach

Diffusion of Knowledge Building was investigated through a qualitative case study approach to build in-depth, multi-faceted understanding of this complex process in an education context. By definition, “a case study is an examination of a specific phenomenon such as a program, an event, a person, a process, an institution, or a social group” (Meriam, 1988, p.9). The bounded system refers to the specific case that will be the focus of the investigation--an instance of some concern, issue, or hypothesis (1988).

Process research (Rogers, 1995) is utilized within this “naturalistic” design; data gathering and analysis in process research aims to determine time-ordered sequences of events, in contrast to variance research that aims to determine the co-variances among a set of variables, requiring highly structured data gathering and quantitative data analysis of cross-sectional data. For example, cross-sectional data from a specific time (e.g. one-shot surveys) is related to the variance in a set of independent variables; it does not
elucidate a process or sequence of events and their relation and interaction across time. In the context of this research, variance research might be more appropriate for investigating variables related to innovativeness, but the goal was to investigate the innovation-decision process over time. This dynamic perspective allows the researcher to explore causes and sequences of a series of events over time. In process research data collection methods are less structured; the type of data is more qualitative; and statistical methods are rarely used for the data analysis (Rogers, 1995, p. 188-189). While variance-type investigations have been used in much of the diffusion and social science research, (see Rogers, 1995, p.42-43), process research is more congruent with the current inquiry.

Following the purpose of this research, I determine the chronology of the LSA events and the relation of those events over time, exploring a range of events using a dynamic perspective and data from multi-levels and sources (e.g. system level, school level, and classroom level) in order to gain insight and build an explanation for the causes and sequences of those events over time.

4.4.1. Case Study

This case study of how Knowledge Building was introduced in Upper Grand District School Board and adopted by teachers and principals in the primary and secondary schools aims to inform others wishing to embark on a similar journey. It thus provides a holistic description of the adoption process, with attention to the broader provincial context and with attention to the interaction of significant characteristic of dissemination of Knowledge Building within and across the schools in a specific school board and characteristics of the teachers and principals who participated in this study. As stated by
Becker (1968), the case study approach is useful to “develop general theoretical statements about regularities in social structure and process” (p.233).

Corresponding to the methodology of this research, Meriam (1988, p.11-13) summarized the four common specifications of case study drawing on five resources (see Hoaglin and others, 1982; Guba and Lincoln, 1981; Stake, 1981; Wilson, 1979; Helmstadter, 1970) as particularistic, descriptive, heuristic, and inductive.

Particularistic: This inquiry focuses on a particular situation and events of a specific program. It is significant itself for what it reveals about those events and what it might represent. The readers learn from the case studies what they do or do not do in a similar case. Even though the cases are specific instances, they elucidate a general problem.

Descriptive: The case study as an end product is a rich, thick description of the phenomenon that is focused on the study. It includes several variables and portrays their interaction over a period of time from a holistic perspective.

Heuristic: The case study brings a discovery of new understanding, extends the experience, and confirms what is already known about the phenomena.

Inductive: Case studies mostly rely on inductive reasoning by focusing on the generalizations, hypotheses, and concepts emerging from data analysis that is grounded in the context itself. Case studies aim to disclose the relationships and identify the concepts, instead of prove a predetermined hypothesis.

I aimed to gain a broader appreciation of the LSA project’s Knowledge Building initiative by generating a descriptive case study for the diffusion process and instrumental
case study (Crowe et al. 2011; Stake, 1995) to examine a certain pattern of teachers’ and administrators’ practices in the schools and classrooms. Since the Upper Grand District School Board case reflects system support across schools it represented a particularly promising model for other school boards wishing to grow Knowledge Building Communities.

### 4.4.2. Types of case studies

Depending on the aim of the research three types of case studies are distinguished by Yin (2003): (1) exploratory case studies (2) explanatory case studies, and (3) descriptive case studies. In the current study, the third type, descriptive case study, is used. Stake (1995) defines the purpose as producing a document that reveals all details and complexities of an incident or experience. The usual aim is to find out answers to a series of questions based on theoretical constructs (Yin, 2003)—especially useful since this study aims to understand diffusion of a theory-based pedagogy. In contrast, exploratory case studies are mostly used in the formation of the frameworks for future studies and explanatory case studies to explain cause-and-effect relationships, challenged with the fact that one case does not make for a true experiment (Tellis, 1997).

The current case study can also be classified as instrumental, used to focus on a particular case that provides broader appreciation (Crowe et al. 2011) of LSA’s Knowledge Building initiative. This instrumental case contrasts to other forms described by Stake (1995) who distinguishes between instrumental, intrinsic, and collective case studies. The intrinsic case study focuses a unique situation, not transfer or generalizability and the collective case study (also referred to as multiple case by Yin, 2003) explores differences within and between cases with the aim of replicating findings across the cases.
This descriptive, instrumental case study is meant to help other schools and school boards develop an understanding of the diffusion and adoption of an innovative pedagogy and supports required from the system and peers. Toward this end, collaborations of different parties in the school system, teachers’ departmental activities and classroom practices that help establish a Knowledge Building ecology are described.

4.5. Research Design

This research investigates adoption of Knowledge Building to reveal practices conducive to diffusion of innovation with a close look at teachers’ and principals’ relations and enactments of Knowledge Building. In this non-experimental, descriptive and instrumental case study (Meriam, 1998), variables are difficult to uncover since they are embedded in the complex phenomena. This study aims to characterize issues and suggest some tentative causal explanatory relationships.

A single case study of one school board in Ontario is provided. To increase interpretation credibility, different triangulation protocols are used (Stake, 1995); data source triangulation, investigator triangulation, theory triangulation, and methodological triangulation (Denzin, 1984, cited in Stake, 1995). Methodological triangulation was conducted to overcome the drawbacks of a single case study design and to provide generalization and confirm the validity of the process (Zainal, 2007). As suggested by Yin (1994) the theory is more effective for making generalizations drawn on results of either single or multiple case studies rather than populations. Additionally, data source triangulation was carried out through collecting data from a number of schools and two different participant groups: teachers and principals.
With respect to types of data, the semi-structured interviews revealed the nature of teachers’ learning, analyses of the systems of support for Knowledge Building, video records of the interactive webinars and types of documents from LSA events all helped to convey the process of dissemination and provide some perspective for effects on schools and classrooms.

### 4.5.1. Data collection

Data collection was completed in two phases. The first phase, June 2015 to September 2016, focused on the “big picture” —a descriptive account of public meetings, transcriptions of video recordings of interactive webinars where administrators and teachers were engaged in activities including presentations, virtual chats, questions and comments— and collecting publicly published documents such as LSA and Learning Exchange resources and LSA Real Stories. The second phase, October 2016 to March 2017, focused on interviews with principals and teachers who had adopted Knowledge Building. In this phase, semi-structured interviews were conducted with principals and teachers from four schools at Upper Grand District School Board.

In addition to information gained from teacher interviews, examples of classroom practices were taken from teacher reports in virtual learning sessions of their experience with students.

#### 4.5.1.1. Online archival data

The online public data constitutes archival records of LSA project including records of webinars in LSA website (http://www.curriculum.org/LSA/virtual-sessions.shtml) and
video records of teacher stories published on the Learning Exchange (http://thelearningexchange.ca/project_category/knowledge-building/) web portal. The online public data provides the number and types of events and markers of participant engagement (e.g., questions, comments, and presentations) in webinars as well as video records on the Ministry’s Learning Exchange website.

4.5.1.2. Documentation

There are a large number of documents related to the study; for example, letters, e-mail correspondence, personal agendas, diaries, announcements, minutes of meetings, administrative documents, proposals, progress reports, newspaper articles, and formal studies or evaluations. Publicly available documents such as teachers and principals’ stories were downloaded from LSA websites. Dr. Ken Leithwood compiled teachers’ and principals’ stories in “LSA Real Stories: How LSA Participation Has Improved Leadership, Teaching, and Student Achievement” in November 2012. In 2014, the second volume “LSA More Real Stories” included six stories (out of eleven) focusing on Knowledge Building experiences of teachers and principals. The stories written by teachers and principals compiled in these two volumes were analyzed to understand community building to disseminate Knowledge Building. Additionally, several teachers and principals’ e-mailed me personally and webinars were downloaded and analyzed to corroborate evidence from video records of webinars.

4.5.1.3. Semi-structured interviews

Interviews are useful to collect extensive information about participant experiences. Interviews can take several forms; open-ended, focused, or structured. In this research
individual semi-structured and in-depth interviews were separately conducted with 4 principals and 11 teachers to identify their adoption process and to disclose their use of Knowledge Building and their perspectives on this pedagogy. The interview includes forty-six questions: (a) professional development activities attended by participants; (b) collaborations with other teachers and principals; (c) participants’ perspectives about Knowledge Building; (d) classroom practices based on Knowledge Building; and (e) opinions about Knowledge Forum. Participants were also asked to briefly introduce themselves and their professional life (see Appendices A and B for interview questions).

Interviews ranged from 60-120 minutes for each interviewee and each interview was audio- and videotaped. These records were transcribed for the analysis by researchers. Depending on the participant’s preference, the interviews were conducted in one or two sessions.

4.5.1.4. Focus group interviews

Focus group interviews were used to confirm data collected from individual interviews and sources. In one school—School-B—two focus group interviews were held with teachers from the social science department and math department to identify cross-department collaboration. Seven teachers (four of them were individually interviewed previously) participated from the social science department and two from the math department. The focus-group interview lasted thirty minutes for the social science department and forty-five minutes for the math department. As with semi-structured interviews, open-ended questions were asked (due to time limitations a subset of
questions was used). Audio/video tape and transcription procedures were the same for the focus group interviews.

The summary of data collection for each phase is shown in Table 1 below.

Table 1
Data Collection Phases

<table>
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<tr>
<th>Phase 1</th>
<th>Phase 2</th>
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<tbody>
<tr>
<td>• descriptive account LSA events (see Appendix E)</td>
<td>• semi-structured, in-depth interviews with 4 principals and 11 teachers at Upper Grand District School Board</td>
</tr>
<tr>
<td>• transcriptions of the video records of interactive webinars (activities administrators and teachers were engaged in included <em>presentations, virtual chats, questions and comments</em>)</td>
<td>• 2 focus group interviews</td>
</tr>
<tr>
<td>• publicly published documents (LSA and Learning Exchange resources and LSA Real Stories)</td>
<td>• presentations of Upper Grand District School Board teachers and principals</td>
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4.5.2. Participant selection

This research was conducted within the LSA project in Ontario public schools. Schools in districts of three provincial principals' associations – eleven districts from ADFO, twenty-nine districts from CPCO, and twenty-one districts from OPC-- were included in broader scope and four schools in Upper Grand District School Board were selected for the case study.

In Upper Grand District School Board, Knowledge Building extends back to 2012. Principals of three secondary schools and one elementary school adopted Knowledge Building as an innovative pedagogy when they came together to work as a principal.
learning team. Andrew Marshall who is a Physics teacher in one of those secondary schools had been working with Knowledge Building theory, pedagogy, and technology for his graduate studies. With the support of Andrew Marshall, four principals decided to invite the teachers in their schools to create a teacher professional learning community.

After the composition of original team with almost 20 teachers (aka original twenty) from four schools, they continued with designing Knowledge Building workshops for a larger group with the involvement of increasing number of teachers over time.

The sampling method in this study is a mix of purposeful sampling and snowball. First Andrew Marshall and four principals were invited to participate and then they were asked to provide names of more teachers who had been working with Knowledge Building in their classrooms. The recommended teachers who adopted Knowledge Building were invited to participate in the interviews. In all, an invitation email was sent to four principals and twenty-eight teachers including Andrew Marshall. While all four principals positively responded to the invitation, only twenty teachers accepted the invitation. One of the teachers declined to participate because of an overly busy schedule and another provided basic information by e-mail. Six teachers never replied.

Two of the principals are still administrators in the same school. However, the vice-principal of School-A started a new position at the Board Office two years ago and the vice-principal of School-D was promoted to principal in School-A. Also a few teachers were transferred (see teachers’ profiles below). Currently, none of the principals or teachers are at School-D, but their experiences are still reported.
Profiles of the teachers and principals who participated in the interviews are provided in the next two sections. Real names are replaced with pseudonyms.

4.5.2.1. Teachers’ and principals’ profiles

The teacher group consists of sixteen teachers -- 4 teachers from School-A, 9 teachers from School-B, and 3 teachers from School-C -- who have been teaching grades ranging from six to twelve and subjects across the curriculum. Administrators consist of four principals, each with several years of experience. Accordingly, the total number of participants is twenty.

4.5.2.1.1. Teachers’ profiles.

The Table below shows the summary of teachers’ profiles from the first interview.

School-A.

Table 2
School-A Teacher Profiles

<table>
<thead>
<tr>
<th>Name</th>
<th>Teaching experience</th>
<th>Knowledge Building experience</th>
<th>The subject(s)</th>
<th>Grade(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrew Marshall*</td>
<td>27</td>
<td>8 years (since 2009)</td>
<td>Science, Healthcare, Physics</td>
<td>Gr.10, 11,12</td>
</tr>
<tr>
<td>Morgan Parker</td>
<td>18</td>
<td>less than 1 year</td>
<td>Applied science, Biology, Health-Care</td>
<td>Gr.9-12</td>
</tr>
<tr>
<td>Dylan Moss</td>
<td>12</td>
<td>3 years</td>
<td>Biology</td>
<td>Gr. 9, 10, 11, 12</td>
</tr>
</tbody>
</table>
Andrew Marshall

Andrew is a high school science and physics teacher, teaching at School-A for twenty-five years until 2014. Two years ago, he was seconded by a Theoretical Physics Institute for work with an outreach program workshop and with teachers. Andrew’s twenty-five years of teaching that has spanned from grade nine and ten science, to grade eleven healthcare, grade twelve physics and also grade twelve science for the non-scientists. Simply he had pretty much taught almost all of the subjects except for biology and chemistry on the very edge of science.

Andrew first heard of Knowledge Building when he started graduate school approximately eight-nine years ago. He has been pursuing his Ph.D. degree with Dr. Marlene Scardamalia who is one of co-investigator of Knowledge Building theory and pedagogy. At the time of he started graduate study, he was looking for a new notion of teaching, a topic area that he would be interested in. And finally he saw Dr. Scardamalia’s name and read her biography. She talked about expertise and so forth about that was a perfect match for what Andrew wants to do. Then he contacted Dr. Scardamalia and had a quick conversation with her about Knowledge Building, He was so intrigued by this conversation and thought ‘Oh well, that sounds really interesting.’ He started to implement Knowledge Building in his high school classroom as soon as he
completed an introduction to Knowledge Building course with Dr. Scardamalia in the spring of 2009 and he has been progressively implement it every year since that time.

Reflecting on his twenty-five years teaching, he stated that his goals for teaching and student learning changed over the years. He explained his initial goal when he first came into teaching is to cover the curriculum, which was the most important thing he believed at the time. However, he believed that going back now about sixteen years ago, he transformed his teaching based on the readings of the educational research in physics and science to make it more of an inquiry-based, more student-centered type of environment. As he mentioned, he took the stuff from the research to improve student learning and adapted that to his classroom to see if that actually made a difference in the classroom instruction.

Morgan Parker

Morgan is an eighteen-year experienced science teacher teaching at School-A for the last twelve years. He is currently teaching grade nine applied science and grade twelve university-biology at 2016 fall semester. He also has health-care courses and grade twelve-biology courses at the next spring term. Morgan first heard of Knowledge Building through Andrew who was his former department head six years ago. After Andrew began implementing Knowledge Building with his health-care class that he is currently teaching his professional development experience with Knowledge Building also began.

Morgan’s goal for teaching is to find the best avenue for students to be able to learn the materials. He aims to enhance students ultimately to find the area that captivates them the
most and to find the best way for them to access the materials related to their interest area. He believes that if the interest is there, then that gives them the motivation and they want to learn more. Morgan prefers not to be the person who transmits information; instead he wants to be a coach, a supporter, or a facilitator who gives strategies to the students for how they navigate through the materials.

Dylan Moss

Dylan has been teaching at School-A since 2005 except one semester when he taught at another high school --School-D-- in the same region. He has two sections of grade ten science and one section of grade eleven biology at 2016. He has also taught grade twelve Biology in the past. He also first heard of Knowledge Building through Andrew while he was his department (the science department at School-A) head until about two years ago. A year before he was seconded by another institution, Andrew encouraged teachers in his department to use Knowledge Building. Then Dylan and a few teachers gave it a try with Andrew’s support. Thus he has been using Knowledge Building in grade nine, grade ten and grade eleven for the last three years.

Dylan defines his primary goal for teaching and students learning as “Obviously there's a curriculum that we've got to cover and those are I certainly try to cover those big goals.” But he also mentions that he tries to get the students to hopefully develop a little bit of independence and also hopefully teach them how they can begin to answer some of the questions that they have for themselves. He aims to get his students to realize that they can figure out the answer for themselves and that's what he likes about the Knowledge
Building; that they do a large part of that part by themselves; they figure out the answers to the questions on their own.

Sofie Preston

Sofie is currently a curriculum leader with the Upper Grand District School Board. This is the second year she has been at the board office. Prior to her current position at the board office, she had been teaching a range of subjects and grade levels (including grade ten to twelve history, social science, law, civics and literacy) at School-A for twelve years until 2014.

Like Morgan and Dylan, Sofie first heard of Knowledge Building through Andrew when they both were teaching at School-A. Sofie’s history classroom was right next door to Andrew’s physics room. She heard Andrew talking about Knowledge Building and told him she was interested in learning more. Then Andrew invited her to join a group of teachers who were working with Knowledge Building at their school. After that, she became part of that work-group in which some other teachers from other schools in the Board joined them over time.

Sofie explained her goal for her teaching and students’ learning as she wants students to leave high school being literate and by that in terms of a more global perspective of literacy; so not just reading and writing but being able to understand and communicate with the world around them. She expressed that is very key for her. She also supports students to be critically literate and to be critical thinkers to like the prevalence of all these fake news stories and be deep thinkers, critical thinkers.
**School-B.**

Table 3

**School B Teacher Profiles**

<table>
<thead>
<tr>
<th>Name</th>
<th>Teaching experience</th>
<th>Knowledge Building experience</th>
<th>The subject(s)</th>
<th>Grade(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vincent Clarke</td>
<td>7 years</td>
<td>4 years</td>
<td>Business, Math, Civics, some combination of History and Math</td>
<td>Gr.9, 10</td>
</tr>
<tr>
<td>Oliver Ross</td>
<td>7 years</td>
<td>3-4 years</td>
<td>any social sciences (geography, history, law and Anthropology, Family studies)</td>
<td>Gr. 9 to 12</td>
</tr>
<tr>
<td>Claudia Conley</td>
<td>7 years</td>
<td>4 years</td>
<td>Resource and History</td>
<td>Gr.10, 11,12</td>
</tr>
<tr>
<td>Aiden Duke***</td>
<td>17 years</td>
<td>6 years</td>
<td>Biology, Applied Science</td>
<td>Gr. 10</td>
</tr>
<tr>
<td>Jamie Goodwin</td>
<td>4 years</td>
<td>less than 1 year</td>
<td>Math and Computer Science</td>
<td>Gr. 9, Gr.10, 11,12</td>
</tr>
<tr>
<td>Alisha Ballard</td>
<td>17 years</td>
<td>less than 1 year</td>
<td>Math MHFYY (x2) MAT 2L</td>
<td></td>
</tr>
<tr>
<td>Isabella Woods</td>
<td>12 years</td>
<td>2 years</td>
<td>CHC 2D1</td>
<td>Gr.10, 11</td>
</tr>
<tr>
<td>Liam Jordan</td>
<td>8 years</td>
<td>2-3 years</td>
<td>Civics, Raising Health Children, Guitar, Special Education</td>
<td></td>
</tr>
<tr>
<td>Scott McLean</td>
<td>more than 30 years</td>
<td>since early 2000s</td>
<td>Geography, Learning Strategies to Special Education, Travel-Tourism, World Issues</td>
<td>Gr.9, 11,12</td>
</tr>
</tbody>
</table>

** previously teaching at School-A

*** previously teaching at School-D

Vincent Clarke

Vincent is the department head of the Canadian World Studies including history, geography, family studies, and social studies at School-B. He has been teaching a
different spread of courses, some combination of history and math for seven years.

Currently he is teaching grade nine business, grade nine math, and grade ten civics class.

Vincent started to implement Knowledge Building in his classroom four years ago. He received an informal invitation from his school principal to an LSA project that they got connected with through Andrew a couple of years ago. He found it interesting and attended to an LSA symposium and met a couple of people who talk about how they had implemented Knowledge Building in their classrooms and how/why it would work.

Vincent explains his goal for teaching as to become less of a teacher and more of a participant in learning. He wants to step away from being a guiding force in the classroom and more participating there, occasionally stepping in as kind of authority or director as opposed to being an ongoing actual dictator of sorts. For student learning he aims to move towards supporting student directed learning, not only just like students identified success but actual towards student directed learning; what's valuable for them to learn within the confines of the topic that he is teaching. He thinks that they currently talk more about asking students to say what it means to be successful in something. However he still thinks that the predesigned curriculum that tells students what they learn is problematic. He believes that students should be asked for what they want to know about for instance math and then moving forward to what is valuable for them.

Oliver Ross

Oliver has been teaching at School-B for the approximately five years. Prior to his current school, he taught one year in London/England and worked as a supply teacher for a short time in Brampton/Ontario. He also taught in between at School-A for about a year
and a half. Currently he is teaching all grade nine to twelve any social sciences including geography, history, law and also anthropology and family studies.

Oliver started using Knowledge Building in his classroom four years ago. At the time of Oliver was contracted teacher at School-A, he met Andrew and Andrew was working to expand the idea of Knowledge Building to other subject areas at that exact time. Oliver and a few of colleagues started to work with Andrew on the basis of Knowledge Building pedagogy. After a while they started talking about it, Oliver realized that it was something he would definitely want to be involved in. Oliver summarizes his introduction to Knowledge Building as having Andrew at the School-A plus having his current colleagues in School-B as his orientation.

Oliver mentions that getting students to develop their critical thinking as his big goal. He wants his students to become problem solvers, critical thinkers with history and any of the social sciences. He adds on this, “most kids are going to go of to become a social scientist, become a historian” (Oliver, Interview). His purpose in using history, geography, or any of those courses is to teach them to develop skills they can help them in life, of critical thinking about whatever they are doing, how they can problem solve, and use people around them, use their resources to help figure things out and become more innovative that pretty much.

Claudia Conley

Claudia is a social science teacher at School-B. She is currently teaching grade ten history course and grade nine to twelve resource course. She also taught geography and
physical education before. She has seven years of teaching experience now. Prior to her
current school, she taught in another high school in the same neighborhood.

Claudia was introduced Knowledge Building by the other teachers in her department who
were implementing it in their classroom. Four years ago one day, in the shared
workroom in their school, Claudia eavesdropped Vincent’s talk; he was talking about an
example, which were given by Andrew in a workshop. This example intrigued Claudia
and she thought that would be phenomenal if she used this question in her World Issues
course. Then she had more conversations with Vincent and Oliver about Knowledge
Building and she participated in Knowledge Building workshops.

Claudia defines her overall goals for teaching and students learning as to make sure the
kids have a good understanding of the past, how to think critically and just be successful
overall.

Aiden Duke

Aiden has more than seventeen years teaching experience at School-B. Prior to this
school, he taught at School-D for a few years. Currently Aiden has a special assignment -
an administrative position-- in the school. Although he teaches science and physics in
general, he is teaching only a grade ten applied science as his regular classroom at 2016
Fall semester. Aiden was initially introduced to Knowledge Building by Andrew six
years ago. He first started to implement Knowledge Building in his classroom while he
was teaching at School-D and gained two-three years experiences with it and then he has
been working with Knowledge Building at School-B for the last three years. He met
Andrew in a board-wide committee about practices and assessments. In one of the
meetings, Andrew started talking about Knowledge Building and what he was doing in one of his classes. Aiden defines his reaction to Andrew’s talk with the following quote: "I drank the Kool-Aid. I'm in. How do I get set up?" Briefly, he liked the idea and he had a talk with Andrew about it right after the meeting. Then Andrew invited him to a little seminar that he actually put on at his school – School-A--. Aiden attended that seminar with a couple of other teachers. Subsequently, he started to implement this new pedagogy in his physical education classroom. Then the principal learning team started to disseminate Knowledge Building around the board, and Aiden was transferred to School-B where a large group of people was doing Knowledge Building. That was a great place for him to get some new ideas about how people were using it for assessment and understanding.

With respect to teaching and students learning goals, Aiden would like students to have a high level of interest in the topics that they are actually looking at and which is why he would like them to generate some of the questions. He supports them to go well beyond just something that could be yes-no, true-false, a,b,c type (multiple choice) answers. He wants to make his students to be equipped for how or why questions and to be capable of understanding how to do something work, why would this happen, or why would this not happen. He simply aims to get away from straight knowledge regurgitation, which tied in with this sort of questioning with students. He wants to raise students who go deeper and actually understand the topic and be able to talk about it and be able to address the issues around it instead of just straight up. According to the specific definition he made, his aim is to get away from gulp and puke information; students gulped down the information and keep it out of the page and that's gone forever.
Jamie Goodwin

Jamie has had four years of teaching experience; he has been teaching at School-B for the last three years. He is currently teaching math and computer science. His goal for teaching and students’ learning is to make his students understand the reason of why they teach them those the skill. He was introduced to Knowledge Building by his two colleagues Oliver and Vincent. Jamie had already started to implement Knowledge Building in his class last semester (Fall 2016) with his colleagues Alisha. He expressed his motivation and willingness to try again with one of his classes and he is looking for a unit for it. He stated, “this September 2016 was the big; we want to try this and we want to make it something that we figure out how to do, and it is us sort of adapting in our comfort zone” (Jamie, Interview).

Alisha Ballard

Alisha has been teaching math at School-B for seventeen years. She aims to engage her students with deep learning. Similar to Claudia, Alisha first heard of Knowledge Building in collaborative staff workrooms in their school. When they overheard the social science teachers’ conversations all the time and as math teachers they thought that sounds really interesting. Based on Alisha’s reflection the social science teachers had been super helpful with sharing resources. As she told for instance, Claudia gave her a binder yesterday that she had received two years ago when she was introduced to it. Like Jamie, Alisha is very new in Knowledge Building. She tried it twice in that semester for the first time (Fall 2016).

Isabella Woods
Isabella is a social science teacher at School-B. She has been teaching grade ten and grade eleven academic history for twelve years. She first heard of Knowledge Building in a professional development session. She started to implement Knowledge Building in her classroom two years ago. Her aim is to provide students meaningful opportunities to learn using a Knowledge Building approach.

Liam Jordan

Liam has eight-years teaching experience. He has been teaching courses for civics, raising health children, guitar, and special education at School-B. He first heard of Knowledge Building through a professional development day and his learning group. He started to use Knowledge Building in his classroom almost three years ago. His goals for teaching and students learning are to enhance them to enjoy learning and to criticize information they have learned.

Scott McLean

Scott is the most experienced teacher in School-B with his more than thirty years in teaching. He first heard of Knowledge Building at early 2000s. He has been teaching a range of subjects including geography, learning strategies to special education, travel-tourism, and world issues for grade nine to twelve. He has been working with Knowledge Building for a long time at some level. He aims to teach his students critical thinking through inquiry based learning.

School-C
Table 4
School-C Teacher Profiles

<table>
<thead>
<tr>
<th>Name</th>
<th>Teaching experience</th>
<th>Knowledge Building experience</th>
<th>The subjects</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kathy Hudson</td>
<td>10</td>
<td>3 years</td>
<td>All Grade 5 subjects (except French)</td>
<td>Grade 5</td>
</tr>
<tr>
<td>Amelie Barnett</td>
<td>14</td>
<td>3 years</td>
<td>All Grade 5-6 subjects (except French) and special education</td>
<td>Grade 5/6</td>
</tr>
<tr>
<td>Justin Floyd</td>
<td>20</td>
<td>2 years</td>
<td>All Grade 5-6 subjects (except French)</td>
<td>Grade 5, 6</td>
</tr>
</tbody>
</table>

Kathy Hudson

Kathy is an elementary school teacher who has been teaching for ten years at School-C. She currently teaches all grade 5/6 subjects except French. She was introduced to Knowledge Building in a local workshop given by Andrew. After she learned about Knowledge Building at this workshop, she started to implement Knowledge Building in her classroom at 2013 -2014 school year.

She defines her teaching goals for students as to gain life to 21st century skills and social skills and to be independent learners. At the beginning, her original goal in Knowledge Building is to get students engaged in their own learning so that students get interested in coming to school and they found what is interested them under the umbrella that she had to teach. Then it turned a little to teaching students about 21st century skills and research
skills as well as working together and becoming more independent learners. Moreover, Kathy aims her students having a slight transmission from elementary school to high school.

Justin Floyd

Justin has been teaching for more than twenty years. He is currently teaching all grade 5/6 courses except French at School-C. He heard of Knowledge Building first through his school principal. He and a couple of teachers in his school were asked last year to take part in a Knowledge Building group for junior division teachers. He liked the idea and accepted to be part of it. As the group of junior division teachers, they met once a month to discuss how they could incorporate these ideas in social studies.

His goals for teaching is to keep himself up to date with new ideas in various subjects so that he can allow his students to grow. For his students’ learning, he wants to model and share techniques so that students can explore and learn new ideas in the various subjects they take.

Amelie Barnett

Amelie has been teaching since 2003. She is currently a special education teacher at School-C. However, until last year she was teaching grade 5/6 classes. She had actively used Knowledge Building for her social studies and science programs when she was a classroom teacher.
Similar to Justin, Amelie heard of Knowledge Building from his school principal and then she participated in a couple of Knowledge Building seminars. As soon as she learned about Knowledge Building she started to implement it in her classroom in 2013. Her teaching goal is first to help students learn to gather knowledge from different sources - many mini lessons on jot notes, internet researching, primary and secondary sources and so on, then how to share and engage in active listening. With respect to students’ learning, she aims her students to be an engaged learner, being excited about learning new things and sharing their new knowledge with peers.

4.5.2.1.2. Principals’ profiles.

Table 5
School Principal Profiles

<table>
<thead>
<tr>
<th>Name</th>
<th>Years of Experience as Administrator</th>
<th>Current School</th>
<th>Previous School (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edward Thompson</td>
<td>7 years</td>
<td>Board Office</td>
<td>School-A</td>
</tr>
<tr>
<td>Rosie Poole</td>
<td>5 years</td>
<td>School-B</td>
<td>N/A</td>
</tr>
<tr>
<td>Stanley Lloyd</td>
<td>4 years</td>
<td>School-A</td>
<td>School-D</td>
</tr>
<tr>
<td>Conner Porter</td>
<td>14 years</td>
<td>School-C</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Edward Thompson

Edward had been the vice-principal of School-A for four years from 2010 to February 2014. He is currently an administrator in the board office. He has seven years experience in total as an administrator.
Edward defines his current work as a manager in two streams; one is managerial component and the other is an instructional leadership component. On the managerial end, he is responsible for ensuring that schools and classrooms have the supplies that they need to function well, that policies and procedures are in place, and that things are running smoothly. As an instructional leader, which is the other face of his job, he is looking at pedagogy and the practices used to make engaging classes and ensuring that the instructional tools they are using are the best ones to help to deliver curriculum and help students grow. In this current assignment, he has been working with thirteen school sites and forty staff in total including thirty teachers and the rest of them are educational assistants, office report staff, and also two retired vice principals that work with him to help to supervise the sites. The student population is approximately 130-140 depending on how many students are in the program, and the number fluctuates on an almost weekly basis. As he reported, there is a continuous intake and continuous exit process because the kids are in treatment and thus need to accommodate a more individualized instructional schedule. But he has also the other responsibilities as part of his position, including SAL (supervised alternative learning), which is a new addition to his portfolio. There are about another 250 students in that program. Most of the work that those students do is experientially based. It is driven by the demands of co-op placements and largely independent work although students do connect with the teacher once in a while. Their focus is just being able to have more support.

He defines his primary goal in his current job on the managerial side as aligning practice for these external programs to be the same or similar to practice in a regular school. He
states that his focus and goal there right now is making sure that health and safety procedures are equivalent for the teachers that they would be in a regular school.

On an instructional level, his goal is to solidify an assessment and evaluation procedure for his group because it has been a little bit disconnected. And the other piece he would like them to re-examine is the instructional practice (e.g. ‘are they giving the kids the best opportunity to be successful?’). Based on his words, right now they are in an examination phase; they think of professional learning community, learning cycles, and the planning phase. They are working to identify what is their big problem of practice and part of that building the cohesion between out sites. He has thirteen sites between in Guelph and North Wellington and Dufferin and it might be one teacher or four teachers who can only see each other five times a year. He is mainly focused on planning how they can best become a team and have a common goal to serve the complex student needs.

With respect to teaching and student learning in his school, he mentioned that right now his students do a lot of independent work. Students are working through small modules independently. The current curriculum is very heavily focused on text and writing and so he has been looking for the staff to rethink the delivery method and what they are asking students to do. One strategy is to introduce technology to the sites. They have done a big technology refresh to introduce new tools to all students so they have access to the Internet, as well as having access to modern tools to collaborate with each other, and to develop work related skills. He asks the teachers to think about more critical problems for students to engage with rather than the traditional ways like here’s your ten questions, here is the reading, here is the ten questions and so on. He is mainly trying to ask them to become more applied and have more learning based on real world experiences.
Considering his Knowledge Building effort in his previous position at School-A, he heard of Knowledge Building through Andrew. Edward attributed Andrew as the key teacher at School-A. At the time of his first year in School-A in 2010 as the vice-principal Andrew talked to him about Knowledge Building. Andrew wanted to try introducing it beyond his classroom to see if there is support at a larger level. Edward says that it sounded interesting to him however he still did not know where it fits in the big picture.

Drawing on Edward’s words, they started to look for ways to include it into their school culture. After a while Andrew and Edward started to publicize Knowledge Building in their school and the following year the LSA came with Knowledge Building specifically as their main focus. Edward and Andrew had a talk about Knowledge Building at one of the LSA sessions. So the project naturally mashed within the interest of one of his staff members and the project was easily getting started.

In that way, they initiated Knowledge Building anyway in their school. According to Edward, because that was also a part of the 21st century skill, building in that was an easy fit when it became an official piece of LSA. He also admitted that they had provincial expert (refers to Andrew) right in the school board made it easy for them to pull that together. He also underscored that the teachers in his school were already playing with innovative concept and doing different things that were very similar like inquiry-based work.

With respect to school board diffusion, they had a little strategy to get a group of people together in their school. Within the participation of Stanley, Rosie, and Connor in LSA, the four of them got a little team together. That was the beginning of the journey and they
found some teachers who were already interested in collaborative inquiry, project-based learning. According to him, they are always interested in innovating and the group of teachers they worked with had a natural curiosity. When some people that was curious but skeptical of new technology and new ideas, they invited them so they could participate and got their feedback as well. As he briefly told, they just grew from there.

Rosie Poole

Rosie has been an administrator at School-B (a rural, fully composite secondary school) for the last five years. As a principal her primary goal is to achieve student success and student learning, helping teacher to be the best they can. She believes if the teachers complete their self-actualization, they can help students to do that too. Rosie defined three school goals for School-B. The first school goal is around instructional practice. It’s that 21st century learning focusing on those skills that students need like critical thinking, problem solving, deep learning, and that’s how Knowledge Building fits into this goal-1. As she mentioned, they particularly focused on their applied learners and trying to help them to reach a level 3-4. They have been keeping track of their distribution of marks like A, B, C, D or level 1, 2, 3, 4 for the last four years and they have been trying to close the gap between the academic and applied students. While the academic students tend to more a level-3 or level-4, the applied kids, at the beginning, were more level-1 or level-2. Therefore they aim to close that gap and help the learners do more level-3 and level-4. They have been looking at instructional practices that help to engage the students and get them talking and involved in their learning and owning their learning and help them do better. The second goal is around assessment and this goal is around how they communicate their expectations to students. Being really clear about what they want, how
they’re going to do it, and how they’ll know if they’re successful through looking at their learning goals and their success criteria and giving descriptive feedback. That’s one strategy the teachers are using. The third goal is around developing a growth mindset. They aim helping their students understand that it’s about hard work, persistence, and effort that helps them be successful and sort of recognizing when they do that and promoting those learning skills that will help them do better in school. She alluded these three goals as her teachers and students learning goals too.

The Knowledge Building journey in her school started with LSA in that they started sharing some information with them. As she explained, she attended to an LSA symposium where Dr. Scardamalia and Andrew presented in. So that was her first introduction to Knowledge Building.

After this first symposium she came back in her school and had a meeting with her teachers. As she reported, some of teachers seemed very interested. As she told, they were ready to go for Knowledge Building in her school with a high motivation after that symposium.

Rosie said they had been involved with LSA right from the beginning and they have done a variety of LSA projects at their school before. For the Knowledge Building initiative, in November --just after the October symposium she attended-- they had a learning session with other principals and teachers. They were first partnered with two high schools -- School-A and School-D-- at the time and brought teachers together with Andrew to start to learn what Knowledge Building was. With the participation of one of the system leaders (Bob Jackson), teachers from each of the high schools, and some elementary
teachers from Conner’s school –School-C-- they had the first session at School-B. They did an online webinar with the whole group of teacher and presented that idea. Rosie mentioned that from that moment, it started to creep its way into people’s practices.

Rosie proudly claimed that all teachers (almost nine-ten teachers) in the social science department are implementing Knowledge Building in their classrooms. She mentioned that, Vincent, who was the biggest up-taker of the whole program, was one of the math teachers at that time and then he went off into social science and spread it all through that area. The nine or ten teachers who are associated with that group are using knowledge building in the Canadian World Studies and social sciences courses and all history and geography classes where they really see it being implemented on a regular basis as part of their program. The social science teachers aligned it with overall instructions; they have a series of different themes that are throughout their courses and each theme is built around questions. So, each unit is re-designed in that Knowledge Building format. She also mentioned that a few teachers in science and math departments are working with of Knowledge Building at some level and they are spending effort to improve their practices.

Conner Porter

Conner who is a fourteen-year experienced administrator has been the principal of School-C for the last four years. Conner mentioned his job in two-fold; managing is one part and being an instructional leader is the other part. As he reported that managerial tasks are getting paper done, providing health and safety and so on. He explained that those tasks take about almost half of his time depending on what time of the year it is.
The instructional leadership is the other fifty percent; getting teachers to get the resources, introducing them to new instructional strategies, promoting good teaching and learning for students through staff meetings and meetings, and so on.

His primary goals as a manager are doing an efficient job of running the school building and making sure health and safety is a big part of that; safety of students, staff, and anybody who comes into the school including community members. He mentions that he is talking with the partners to make sure the building is clean and everything is working well. Basically, it is more logistic where things go and how things work such as the systems that are in place for how students enter, time schedules and so on. He explained that it is more than management of those mentioned before but it also affects student learning. So instructional leadership is a major piece of his job is most of what he tries to do anyways.

His goals as instructional leader are to increase student achievement and well-being as well as to make sure its an equitable way and all the things that are in achieving excellence in the Ontario guide for the Ministry goals.

He clarified that the goals for teaching and student learning in his school change a little bit since they have students from kindergarten through grade eight. Therefore, he defined his goals in kindergarten are more focusing on how to set up the environment to create more play-based learning. As he told, there’s a new curriculum and there's a new assessment document right now and they are using those to drive what they are trying to do in the classroom in the scope of their school improvement plan; it's a lot of inquiry-based learning. He also mentioned their goals in primary level as around mathematics and
problem solving in mathematics and he stated, it actually continues right through to grade four, five, and six.

Like Rosie, Conner first heard of Knowledge Building through the LSA project. He has been involved in a project for approximately seven years. Then in the last three years they have been talking a lot about Knowledge Building. He first started with involving in Tri-board project and he attended to Dr. Scardamalia’s presentation in one of LSA events.

Kathy was involved in this initial project along with him. Conner invited her to work with the high school teachers on the basis of science and math units. Those teachers worked together to say what is Knowledge Building and how can they get it working in the school. Then they came together as four principals with Edward, Stanley, and Rosie-- as a learning team. He mentioned the same principal learning team story with Rosie told. They met as elementary and high school teachers and first started getting together to learn about Knowledge Building as well as to build their own knowledge about that, then they discussed how they could bring that back to the classroom in their different grades. He explained that they basically did out of the twelve Knowledge Building principles they really concentrated for.

Stanley Lloyd

Stanley has been the principal at School-A for the last two years. Prior to this school, he was the vice-principal at School-D where he did the majority of his Knowledge Building work. He told that it was an interesting switch with a nice coincidence because Andrew and Edward worked together at his current school. But then Edward took a new position
at the board office and Andrew was seconded at the Physics Institute. Now he is at School-A with already knowledge around the Knowledge Building.

As he explained obviously his primary goal as a manager is student success. He aims to enhance students to achieve their highest ability and to support teachers to push students in order to make them aware that they're capable of more than they usually assume. Briefly his utmost goal is getting students to achieve the best that they can do. He also stated, “packaging that around the wellness piece of students so it's really centered around the students” (Stanley, Interview).

For the particular school goals, he said that last year he spent a year with the leadership team walking through mission and vision and setting up some goals for the school that when he first walked in. As he told, teachers mostly didn't feel at that time but after he had interviewed with every single department leader that they had a common mission, vision, and goal they felt like everyone was doing their own thing. He thought that there was a common vision on where things were going. So the goals that their team came up with was around focusing on applied and essential level students, which is in line with the board improvement plan and which is in line with the ministry plan around how they close the gap between applied and academic students. They are working on some questions such as: Do we have good programming for essential level students? How do we engage applied and essential students, which is what the staff really wanted to do a better job with how do we engage students who aren't achieving at the level that they want them to achieve at. The other goal he defined came up around assessment. They are looking for an answer around the question of what can they do in terms of mostly formative feedback in order to allow students to know where they're supposed to be
before they hit that final summative assessment. He underlined that “it shouldn't be a surprise, we're really working on how the students know where they are; how you know where they are at; how you move them?” (Stanley, Interview). Focusing on the feedback portion (telling students this is how they get there and this is how they are going to move there), they are spending effort to find ways to increase lower level students move upper levels. They have been doing some work with an expert (Sandra Herps) who is also working in the same parallel with the school board in that realm. The last school goal he mentioned is around culture. They aim to develop a better and stronger connection for the students to the school and to the academic staff, to the school community in sum.

Stanley also said that there is a professional development planning committee in their school. They just started and they are talking about how professional development is going to look throughout the next three or four years. He mentioned that he sat down those three goals that they have set up are the goals they are focused on for the next three or four years. They talked about the Ministry and all the different types of initiatives how does that fit into their school goals as they come down. As he told, he knows the Ministry in terms of negotiations has agreed that they are not going to throw as many things down at schools. He believes that Ministry is going to work with schools to help them and they are going to be more of a supportive role rather than giving them obligations. That provides an opportunity for him to say to his staff “hey we're going to work on these three things and we're going to work on them for this period of time” (Stanley, Interview) so that they are doing things really well rather than doing one hundred things and just scraping the surface. The professional development planning committee is looking at those three goals over a period of time and how they support each of those goals.
Therefore people can see where the plan is over that time. He admitted that it gives more coherence to the plan and makes people feel more comfortable.

With regard to student learning goals, he stated, there are lots of different things that they look at as the drive their learning roles for students. As he mentioned, they mainly consider the graduation rates, the course pass rates as well as EQAO data. Moreover, one of the learning goals that they are looking at is around applied and essential learners’ growth mindset. Stanley told that they are looking for how teachers change teaching practice to get students to believe that they can achieve. He grounded his words on Jo Boaler's book around growth mindset in mathematics especially “what you know is ‘this person you can only get to this level’ and change that mindset to ‘everybody can learn to a high degree’” (Stanley, Interview). He briefly explained that they are looking for how they get students to believe that and what their teaching practice needs to say about doing that. In other words, how that growth mindset in students can be combined with teaching practice change the students or students’ perspective and how they learn.

Stanley also was initiated to Knowledge building through LSA project. However before LSA came up with Knowledge Building, he heard of it first through School-A from Andrew and Edward who have been colleagues for quite a long time. Similar to other participant principals, Stanley had been on LSA before Knowledge Building happened. As things came up through LSA, the principal learning team brought it towards; they talked about something to do as a group for LSA and they started with that group of 20 more than three years a go. As he expressed, they were all right on the same page as it started. He mentioned how his Knowledge Building journey started as he was asked as a part of our LSA project with other three principals. Then they started looking at
something that they could do as a cross panel focus, but cross-curricular as well. Thus they decided to choose five teachers from each school and they were looking at similar subject areas, for instance at math and science were some of the subjects, which were chosen. Additionally, some elementary schools from School-C came on the board.

At the initial session, they talked about how they might bring Knowledge Building to each individual subject area or classroom and how they might collaborate. As they walked through the process, they went back and they attempted to try Knowledge Building to each one of their different states and the way that the project where they would come back and revisit it every time. Stanley underlined that it was interesting to see it as more of like a professional learning community develop and he attributed it as one of the best professional learning communities he had been involved with. He explained why he thinks in that way as the teachers they had who were all trying something that was totally new to them, everyone was on the same playing field - even the administrators-, and the only person who had a little bit more knowledge at that point was Andrew who had been trying it in his classroom. As they got come back together, he said it was evident that teachers were becoming more and more open about what they were doing and how things were working and how and more importantly how things were not working well in their classroom so that they could change their practice based on feedback from other teachers.

4.5.3. Research Design Plan

Yin (2003) and Stake (1995) suggest six main categories of data sources to support case studies: archival records, interviews, documentation, physical artifacts, direct
observation, and participant-observation. In this research three types of data were used for triangulation; online archival records, documents, and interviews. The table below shows the research questions.

Table 6
Research Questions

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Data source(s)</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What factors have affected diffusion of Knowledge Building as an innovative pedagogy within and across schools in Ontario? Does Everett Rogers’ five-stage model of diffusion of innovation help explain how and why Knowledge Building has spread in Ontario?</td>
<td>(1) Number and type of events (e.g. public meetings, webinars, and activities that administrators and teachers were engaged) and markers of principal and teacher engagement (e.g., questions, comments, presentations, stories); (2) Semi-structured interviews; (3) Learning Exchange resources (transcriptions of the video records of students’ reflections in a student panel)</td>
<td>content analysis and thematic analysis</td>
</tr>
<tr>
<td>2. In what ways do principal learning teams (PLTs) support teachers in implementing effective Knowledge Building practice?</td>
<td>(1) Semi-structured interviews; (2) LSA More Real Stories; (3) Webinars (e.g. questions, comments, presentations, stories); (4) presentation documents of the principals and teachers in the variety of events</td>
<td>narrative analysis and thematic analysis</td>
</tr>
<tr>
<td>3. What do teacher practices convey regarding engagement of students in principle-based Knowledge Building Communities?</td>
<td>(1) teachers’ and principals’ presentations from webinar that include classroom examples</td>
<td>content analysis and narrative analysis</td>
</tr>
</tbody>
</table>

4.5.3.1. Data analysis and coding scheme

In this section data analysis used to develop credible and functional findings are explained with sample codes provided. As claimed by Tellis (1997, p.10), “the original
objective of the case study may help to identify some causal links that could be analyzed.” Clarke and Brune (2013) also mentioned three types of qualitative data analysis; searching for patterns, looking at interaction, or looking at stories. In this study, two strategies suggested by Yin (1994) are adopted. The first one is analyzing the data depending on the theoretical propositions of the study (searching for patterns) and the second one is developing a case description that would be based on framework for organizing the case study (looking at stories). Coding scheme and example quotes are provided in Appendix I.

4.5.3.1.1. Qualitative content analysis.

The data collected in this research largely consists of narrative text. Thus, for the data analysis, I applied qualitative content analysis on the text in an effort to explain and describe the advantages and complexities in the diffusion process. Weber (1990) defines content analysis as a qualitative research method to make valid inferences from the text. In qualitative content analysis, researchers apply step-by-step systematic analysis on the content of text data. As a result of the content analysis, the text data is classified into codes and themes or patterns within its own context of communication (Hsieh & Shannon, 2005; Mayring, 2000).

As indicated by Weber (1990), deciding on the specific type of content analysis approach depends on the researcher’s theoretical and substantive interests and the nature of the problem being studied. Hsieh and Shannon (2005) define three distinct approaches to qualitative content analysis: conventional, directed, and summative. Among these three approaches coding schemes, origins of codes, and threats to trustworthiness are
distinctive. Directed approach analysis starts with a preconceived theory or research findings to guide initial codes; the conventional approach analyzes text data to define coding categories. In summative content analysis researchers count and compare keywords to make inferences and interpretation from the context of data (Hsieh & Shannon, 2005). Following the first strategy suggested by Yin (1994) data analysis follows a directed approach based on two focal theories: diffusion of innovation theory and Knowledge Building theory.

Accordingly, for the investigation of the first research question, qualitative content analysis was applied based on the diffusion of innovation theory. All documented resources and publications related to the LSA project such as LSA Real Stories, interview data, webinars including questions, comments, and presentations as well as the video records of teachers’, principals’, and students’ stories shared in Learning Exchange web portal were analyzed to find indicators of innovation-decision and adoption process. The empirical pattern was compared with the predicted pattern in the diffusion of innovation theory through pattern matching with the aim of enhancing the internal validity. With the aim of exploring the indicators of innovation-decision and adoption, Roger’s five stages model of the innovation-decision process (see Figure 6, Chapter 3) was used as the coding scheme.

4.5.3.1.2. Thematic analysis.

In addition to directed analysis, conventional thematic analysis was also adopted. Thematic analysis is one of the most useful and common methods to reveal the complexities of meaning (Guest, MacQueen, & Namey, 2012) and hidden characteristics
within the data (Clarke & Braun, 2017). By definition, thematic analysis is “a method for identifying, analyzing and reporting patterns (themes) within data” (Braun & Clarke, 2006, p.79). It provides the flexibility to generate codes and themes from the text data beyond the adopted framework to develop a deeper and broader understanding. Using this type of analysis, I aim to uncover the features of the data, which are not addressed in the diffusion of innovation framework. Briefly, thematic analysis was used to provide depth and breadth to consolidate content analysis. To apply thematic analysis, I applied six steps, which are defined by Braun and Clarke (2006). First I read and re-read all transcribed texts several times taking notes to get familiar with the data. Following this, I identified preliminary codes that I found interesting and meaningful. As the third step, I continued with interpretive analysis of the collected codes and identified overarching themes. Then I reviewed those themes to find either coherence or incoherence among them with the aim of combining and refining or separating and discarding some of them, as required. This step was completed in two phases: I focused on codes first, and then worked on the overall data set. At the fifth phase, I defined the themes and potential sub-themes. I also named the themes and wrote theme definitions in this step. At the final phase, I wrote the results of thematic analysis by citing exemplary quotes from the data. This procedure was followed for each type of data where the thematic analysis was needed.

4.5.3.1.3. Narrative analysis.

Results of the second research question informed by the instrumental case study of Upper Grand District School Board were obtained by following narrative analysis procedures to
illuminate the implementation of teachers’ and administrators’ effective practice grounded in Knowledge Building pedagogy.

The narrative approach focuses on individual stories to reflect and interpret their action and real-life experiences (Muller, 1999); participant stories provide “their personal accounts about classrooms, schools, educational issues, and the settings in which they work” (Creswell, 2012, p.501).

I focused on the specific story of a principal learning team and the teachers from four schools in Upper Grand District School Board around their adoption of Knowledge Building and their collaboration to improve their Knowledge Building practice. This collective story of Upper Grand District School Board was formed around the specific interview questions and specific events the participants experienced. The data were gathered through teachers’ and administrators’ presentations in webinars, the chapters in LSA publications, and semi-structured interviews.

To present the results of the third research question I used narrative analysis for five cases of classroom practices. The third research question explores teacher and student engagement in Knowledge Building Communities. In order to reveal the classroom practices teachers and students engaged in, I analyzed teacher webinar presentations.

For the investigation of the third research question, the combination of qualitative content analysis and narrative analysis was used. The directed content analysis focused on classroom practices and activities that correspond to Knowledge Building pedagogy. Twelve-principles of Knowledge Building guided the coding categories for content analysis of classroom practices narrated by teachers.
The table below shows the list of the data sources analyzed in this research.

Table 7
List of Analyzed Data

<table>
<thead>
<tr>
<th>Type of Data</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>The principal learning teams investigated</td>
<td>1 principal learning team, which consists of 4 principals</td>
</tr>
<tr>
<td>The school boards investigated as the case study (Chapter 6)</td>
<td>1 (Upper Grand District School Board)</td>
</tr>
<tr>
<td>The schools studied as the case study (Chapter 6)</td>
<td>4</td>
</tr>
<tr>
<td>Virtual learning sessions (webinars) analyzed</td>
<td>14</td>
</tr>
<tr>
<td>Learning Exchange Students’ Panel videos analyzed</td>
<td>13</td>
</tr>
<tr>
<td>Printed documents analyzed</td>
<td>4</td>
</tr>
<tr>
<td>Upper Grand District School Board teachers/principals' presentations and proposals analyzed</td>
<td>7</td>
</tr>
<tr>
<td>The teachers individually interviewed</td>
<td>11</td>
</tr>
<tr>
<td>The focus group interviewed</td>
<td>2</td>
</tr>
<tr>
<td>The principals individually interviewed</td>
<td>4</td>
</tr>
<tr>
<td>Classroom cases analyzed</td>
<td>18</td>
</tr>
<tr>
<td>Classroom cases selected and provided in this thesis (in Chapter 7)</td>
<td>5</td>
</tr>
</tbody>
</table>

4.5.4. Data Validation

Validity and reliability refer to the extent of the findings of a qualitative research are trustworthy and generalizable. Validity and reliability are essential in any type of research and should be approached “through careful attention to a study’s conceptualization and the way in which the data were collected, analyzed, and interpreted” (Meriam, 1998, 165); at the same time, taking into account relevant
perspectives to the paradigm under which the research is conducted is crucial.

Considering qualitative research within an interpretivist paradigm some researchers (Denzin and Lincoln, 2005; Kirk and Miller, 1986; Lincoln and Guba, 1985) suggest different criteria for the standards by which validity and reliability are to be evaluated. They recommend different terms than those used by positivist paradigms (truth value or credibility for internal validity, applicability or transferability for external validity, consistency or dependability for reliability, and neutrality for objectivity).

4.5.4.1. Internal validity or truth value

To reduce the level of subjective interpretation with qualitative research, maximizing internal validity is essential. Drawing on the literature and research experience, several strategies such as triangulation, member checks, long-term observation at the research site, peer examination, participatory modes of research, and making clear of researcher’s biases are suggested to ensure internal validity (Denzin & Lincoln, 2005; Meriam, 1998). The credibility in this research is enhanced through methodological and source triangulations.

4.5.4.2. Reliability or consistency

Reliability, which is one of the central concepts in traditional experimental research refers to the consistency of the findings from several replications (Meriam, 1998). Because qualitative research aims to describe or investigate incidents many interpretations are possible. The term reliability does not fit well (Stenbacka, 2001) in social science research; researchers (Lincoln & Guba, 1985) suggest more applicable
terms such as dependability or consistency as researchers expect consistent results rather than replication.

As explained above, methodological and source triangulation as well as disclosing the investigator’s position are used to enhance reliability of this study. Methodological and source triangulation is accomplished through the collection of multiple sources of data from teachers, principals, and students from multiple schools in the school board. To maximize validity

- Three types of data were used for the analysis; online archival records, documents, and interviews (semi-structured and focused group),
- Interviews with both principals and teachers in four different schools and students’ testimonial were used,
- Different types of qualitative analysis were applied: content analysis, narrative analysis, and theme analysis.

4.5.4.3. External validity or transferability

External validity refers to the transferability of the results of a study to other situations. However, as cited by Meriam (1998), Erickson (1986) discusses the feasibility of generalizable knowledge in interpretive research. He asserts that qualitative research aims to arrive at concrete universals by focusing on a particular case in detail rather abstract universals. According to Erickson, the general idea is concealed within the particular situation; what we learn is transferable and generalizable to parallel situations. There are several ways to increase the external validity but first it should be kept in mind that ensuring internal validity is a pre-requisite for achieving external validity (Guba &
Lincoln, 1981). As Meriam (1998) suggested, I provide a rich and thick description to provide a detail account of the Upper Grand District School Board case to help the readers understand whether their own position might be related to the research situation. Another data point relates to how typical the incident under investigation is. I present the teachers’ and principals’ perspectives to teaching, students’ learning, professional development and so on. Multisite design is also helpful to maximize external validity. Meriam (1998) explained that purposeful and random sampling is useful for this. As mentioned earlier, I used a mix of purposeful and snow-ball techniques for sampling.

4.5.5. Researchers’ role and position

In order to gain deeper insight and provide detailed description of the phenomena, the researcher needs to continually make decisions, choose data and incidents among the alternatives, and exercise judgments (Meriam, 1988). As the investigator of this research, I personally followed the LSA events since the beginning of the LSA Knowledge Building endeavor. For the last four years, I have participated in various events such as workshops including local ones at Upper Grand District School Board, symposia, meetings at Ontario Principals Council, and the webinars. Being individually present in those events resulted in meeting teachers and principals in person, to hear their reflections through small informal conversations, and to make connections for future interview opportunities. After this, I investigated Learning Exchange resources, published documents, and webinars over and over to select the specific case(s). These ready-made sources of data were easily accessible for me and for anyone. Once I decided to focus on the case of Upper Grand District School Board, I contacted the members of principal learning team and the teachers involved for individual and focus group interviews. In the
data collection process, informal conversations in the events were interwoven with formal
interviews, and other data stemmed from online archives and documents.

4.6. Ethical Considerations

This study aims to inform the Ontario Ministry of Education project titled “Leading
Student Achievement: Networks for Learning”. All webinars and video data are publicly
available. I obtained consent from LSA and University of Toronto ethics for use of
survey results. Teachers and principals who participated in an additional interview signed
the consent form presented in Appendix D. I initiated work on data after obtaining
University of Toronto Ethics Committee approval for my thesis research (see Appendix
C). This research does not have any foreseen risks or harm to the participants. The
identities of the participants are confidential and pseudonyms are used to protect privacy
and confidentiality. All data such as audio/video tapes, transcripts, consent forms will
remain confidential and will be kept in a locked cabinet. The data will eventually be
destroyed but there is no definite date set for this.

4.7. Chapter Summary

In this chapter, I defined the practical purposes of this research, listed research questions,
and rationalized the use of the case study approach by describing the central
characteristics and different types of case studies. Following this, I presented research
design elements including data collection process and tools, research sites, and
participants. Participants’ profiles were presented followed by a detailed account of data
analysis. I concluded by explaining data validation including internal validity, reliability,
and external validity as well as ethical considerations.
CHAPTER 5

5. Results Part (1): Diffusion of Knowledge Building among teachers within and across the schools

5.1. Chapter Overview

This chapter presents a descriptive case study of the diffusion of Knowledge Building among teachers within and across schools and school boards. Indicators of principal and teacher engagement are examined through content analysis and thematic analysis of (1) the questions, comments, and presentations delivered in webinars, (2) Learning Exchange resources, (4) LSA “More Real Stories” text, and (4) interview questions. Data are examined for evidence of the diffusion and adoption of Knowledge Building by applying the five-stage model of innovation-decision process defined by Rogers’ (1962). Following each stage, thematic analysis is applied to uncover emerging themes that capture the essence or meaning in the implementation of Knowledge Building to address the first research question of this study.

5.2. The five-stage model of innovation-decision process

Content analysis was applied to the qualitative data following the five-stage model of innovation-decision (see Figure 6) defined by Rogers (1995; 1971). The following sections present the findings for each stage respectively.

5.2.1. Stage 1: Knowledge of Innovation

In this stage, the results are categorized according to three types of knowledge of the innovation; awareness-knowledge, how-to knowledge, and principles-knowledge.
5.2.1.1. Awareness – knowledge

In the Upper Grand District School Board case, two factors in recognizing Knowledge Building as an innovative pedagogy are identified: (1) colleagues who had already adopted Knowledge Building (especially the innovator teacher) and (2) invitations from the principals to LSA events. Primarily, school administrators heard of Knowledge Building from the innovator teacher, LSA representatives (e.g. district and system leaders) as well as through other principal and teacher personal contacts.

In Upper Grand District School Board, the innovator teacher, Andrew who is a Physics teacher in one of the secondary schools, has been working with Knowledge Building theory, pedagogy, and technology for his graduate studies with Dr. Marlene Scardamalia who is the co-developer of this principle-based innovative pedagogy. Andrew had been teaching for about twenty-five years and he has been seconded through an outreach program at the Theoretical Physics Institute in Ontario for the last two years. Andrew first heard of Knowledge Building when he started his graduate study. As he explained, in those days he was looking for a research area that could help him to understand the nature of expertise and how humans get good at learning. After he reviewed several of Dr. Scardamalia’s Knowledge Building articles, he contacted her. His reflection was “Oh well that … sounds really interesting”. Then he started to work with Knowledge Building as soon as he completed the Introduction to Knowledge Building course with Dr. Scardamalia.

Andrew took an active role in the knowledge stage. In diffusion of innovation literature, he is called an innovator because he was the first teacher in the board willing to use this
this novel pedagogy. In the interview, Andrew explained his positive attitude toward a novel pedagogy by stating “that's just part of my personality and my view of things that if it looks like it would benefit the kids I'll just give it a try and if it works great if it doesn't that's OK too.”

Andrew appreciated the effectiveness of Knowledge Building and started to talk with other teachers and administrators in his school about what he was doing in his classroom. He asked them to have a quick look at students’ work on Knowledge Forum and explained how it supports students’ collaboration and work with ideas.

He introduced Knowledge Building to his colleagues (e.g. Morgan, Dylan, and Sophie) who had been teaching at the same school and department with him. Morgan mentioned that Andrew recommended this pedagogy to him because he knew that Morgan was engaged in problem based learning, case based learning, and so on. Andrew thought that Knowledge Building could be a good platform for Morgan’s students to do problem based learning.

Most of the participant teachers were invited to a LSA event (i.e. workshop, symposium, or webinar) by school principals. One of the elementary school teachers, Justin, mentioned that he first heard of Knowledge Building from his principal. Conner asked him whether he would like to take part in a Knowledge Building group for junior division teachers. He welcomed this invitation and joined the group that met once a month to discuss how they could incorporate these ideas in social studies. At the first glance, it might seem a top-down approach, however participant teachers stressed that it was not a job requirement and there was no obligation to proceed. Vincent who is the head of the
Canadian World Studies department in his school gave the following reply to the question of whether Knowledge Building was mandated.

No not by any means. Just she [his principal Rosie] just said ‘hey there's something going on’. But they all say this is the rough idea and I was that kind of found it interesting so. I went and then it was like a deep hole that I just haven’t got out of yet. (Vincent, Interview)

Another teacher in Vincent’s department, Claudia, explained that four years ago, while she was teaching CHW4U (World Issues: A Geographic Analysis--a grade-twelve history course), in the common workspace, she overheard a conversation between Vincent and another teacher reflecting on a student question Andrew mentioned in a workshop: “Why do first world nations never go to war?” She was impressed and asked, “Can you imagine what that would lead to in a 4U course it would be phenomenal!” Briefly, Vincent brought that example question back from an LSA workshop and she said “let's roll with it for my 4U, grade twelve university level history course.”

Oliver, another teacher from the same department, also provides an example of the influence of personal contact in the diffusion process. Oliver had been teaching in his current school for seven years. Prior to that he had a short-term contract with School-A where Andrew used to teach. While both were teaching at this school, they started to chat about Knowledge Building. As he explained, Knowledge Building was something he definitely wanted to be involved in so he tried it out in his class. After he moved to his current school, he met Vincent and they started to collaborate to improve Knowledge Building in their department. As he explained, “having Andrew there at the school plus having my colleagues still here, it just kind of made sense.”
In this case, Oliver’s attitude toward the idea of Knowledge Building clearly shows a selective exposure. In another excerpt he described compatibility with existing views,

I really wanted to switch it up. I remember there is a history lesson I was teaching … probably 4 years ago. I was teaching at and I was bored teaching it. I could tell that the students were probably bored too. I was like this isn’t working and I had started to do less like three part lessons and through problem-solving, which is similar to Knowledge Building but I had heard that the math was doing these three-part lessons for problem solving and I heard all the math teachers talking about it. I thought I could do that for history. I started doing that and I saw great results and then the Knowledge Building thing happened right after and I was like, this works perfectly. (Oliver, Interview)

Similarly, Edward who was the vice-principal at School-A explained previous efforts of his teachers to find innovative approaches. He mentioned that it was convenient to include Knowledge Building since the teachers had already implemented related pedagogical approaches including inquiry-based work.

5.2.1.2. How-to knowledge

As indicated in Chapter 4, four principals, Stanley, Edward, Rosie, and Conner started to collaborate as a principal learning team under the LSA umbrella. As Rosie mentioned, they wanted to get familiar with Knowledge Building pedagogy and develop how-to knowledge like ‘what is Knowledge Building?’ and ‘how to implement Knowledge Building?’ Their first plan was to connect teachers from different subjects like science, math, social sciences, and phys-ed in order to see how they might apply Knowledge Building to their program. They decided to organize local workshops as professional development for the teacher with Andrew’s contribution. Each principal invited teachers from their schools to explore the concepts related to Knowledge Building. The group, which is known as the “original-twenty” started to work together with seventeen
participants. An additional administrator with three teachers from his school joined the project on December 2013 (MRS-Ch.13, p.76). They also created follow-up events and collaboration opportunities to connect people. For instance, they organized several sessions in School-A. When Rosie had a math teacher who was interested in Knowledge Building and needed a good math problem to use, Rosie personally called another principal to ask whether there were teachers who might help. Then they brought teachers together to share ideas they were excited about.

Following this original group, Andrew was also invited to different schools to give similar Knowledge Building workshops and seminars which provided how-to knowledge for additional teachers. By his report, Andrew demonstrated how he set up his first day with Knowledge Building and how he struggled with assessment issues. Yet, Andrew was not the only source from which teachers gained how-to knowledge; they also learned from each other and built their knowledge together.

Rosie pointed out how Knowledge Building resources shared in Learning Exchange websites were valuable and strongly recommended them to others. According to Rosie, it was important to see real classroom examples. She emphasized the value of activities that students were doing, conveyed in videos, especially the wall where student questions were posted and students talking in groups and presenting questions or pictures. She continued by saying “that helps the teachers’ go ‘Oh I could do that in my classroom’... I noticed that they really pay attention when it is a real classroom and real students.” She spread resources by tweeting and sharing links with her teachers.
In the webinars, participants posted questions about how to improve their classroom practices and how to develop this approach in their students:

- “What are the teacher "moves" that facilitate excellent Knowledge Building communities?” (School 4, VLS-C, 12.06.2015)
- “Do we value idea improvement in the classroom as much as it’s valued in the 'real world'?” (a group of teachers from Toronto, VLS-C, 12.06.2015)
- “Just wondering how you supported your students in learning to summarize and synthesize the overwhelming information when researching” (Stacy, VLS-C, 09.03.2016).

Additional how-to questions were related to cross-grade and cross-subject implementation of Knowledge Building. Examples include:

- “Question: How can we get older students (e.g. secondary school) who have not grown up with knowledge building, to "buy in" to it?” (Brandon, VLS-C, 12.06.2015)
- “We have had success at our school using Knowledge Building in Primary and Junior, but we seem to be having difficulty getting the intermediate students engaged. Do you have any suggestions?” (Nancy, VLS-C, 09.03.2016)
- “Are you using KB in numeracy?” (Liz, VLS-C, 09.03.2016)

In webinars, some teachers and principals presented their cross-grade/cross-subject experiences with Knowledge Building. For instance, several teachers from School Board-44 expressed how they participated as: “We hope to be sharing a glimpse of first year journey in Grade One Math” (VLS-C-A, 10.03.2015). Participants aimed to give ideas to
other teachers by sharing examples and receiving feedback to improve their practices as suggested by this excerpt from a small conversation between two teachers:

Kera: have you attempted a cross grade/division Knowledge Building Community?

Dorothy: Last year my class paired up with a Grade 2 class for "Inquiry" Buddies, rather than reading buddies. My students were able to model asking open-ended questions, and were able to support the Grade 2s to access the texts they were reading.

Kera: Thank you Allison, that’s amazing. We are doing the same thing. We are combing a grade a 3 and 6 class and having them do the same idea. We are finding the connections that they have together and how they developing and extending their understanding to the curriculum (VLS-C, 09.03.2016).

5.2.1.3. Principle-based knowledge

In the context of the current study, all twelve principles of Knowledge Building (see Appendix J) support effective adoption of Knowledge Building theory and pedagogy. While an adopter can start without implementing the principles, in practice this has been less effective, usually results in discontinuing the use of Knowledge Building theory. The consideration and use of principles-based knowledge is important to address problems as they arise and helps to manage the inherent complexity of a transformational model of education.

The content analysis of the participants’ questions and comments from the webinars showed that some of the teachers were trying to make Knowledge Building pedagogy clear in their mind and distinguish from other pedagogies and/or methods. Following are examples of questions raised by teachers:
• “I still question the interplay of 'intentional learning', 'knowledge building' and constructionism (as defined by Seymour Papert)” (Kevin Griffin, VLS-C, 12.06.2015).

• “Is Knowledge Building a process like inquiry, an outcome of inquiry or a vehicle for inquiry? How are the educator moves then other forms of educating?” (School 16, VLS-C, 12.06.2015)

• “How does the language of Inquiry differ from Knowledge building? The language sometimes overlaps and sometimes is presented as something separate” (School 14, VLS-C, 08.10.2015).

In the webinars as well, some administrators also referred to the importance of understanding those principles and their effort toward it:

• “I review and explore with my staff the twelve principles, explicitly, also with the students. It helps for them to articulate the process. And makes the swamp less murky” (Gloria Taylor, VLS-C, 08.10.2015).

• “We will be reviewing the twelve principles with staff and sharing that explicit teaching of how to ask good questions and give feedback are important to creating conditions for learning and collaboration” (Lindsay Parker, VLS-M, 08.10.2015).

• “We'd like to continue to build our understanding of how Knowledge Building principles play out in inquiry-based learning” (Elizabeth, VLS-C-M, 10.03.2015).

• “How we can further extend Knowledge Building Principles in our schools?” (Brenda, VLS-C-M, 10.03.2015)
To explore teachers’ level of understanding and implementation of Knowledge Building principles, I asked interviewees to indicate the principles they have been engaged with and to provide an example of classroom learning that reflects those. Teachers mostly reported that they were trying to touch on all of these principles in their classrooms however they recognized some of the principles early on while some others seemed them very broad and more difficult to understand.

Sofie mentioned that while she was teaching at School-A, she started a unit by applying basic principles. For instance she first transformed the unit titles into questions and then elicited questions from her students about what they wanted to learn in that unit based on their background information. She aimed to engage students to cover the curriculum and also respond to her students’ curiosities and questions.

Some of the teachers were aware of the embedded nature of principles. Andrew, as a teacher who has developed a good understanding of those principles, articulated that some of the principles are buried in other ones and when one of them is achieved, another principle comes with it. He gave one example as the principle of *democratizing knowledge* where everyone has a say and suggested that this principle is also inherent in the *community knowledge and collective responsibility* principle; *democratizing knowledge* comes out naturally. As he explained, building a strong community in which students take collective responsibility not only for their learning but also for everyone in their community sets a substantial groundwork for supporting the process of democratizing knowledge. In such a community, students consider the diversity and divisional differences as their strengths. Claudia also agreed that all of the principles are intertwined. She stated, “You can't have one without the other in some instances.”
Amelie mentioned that while she was teaching units on the human body (which is based in the *real ideas, authentic problems* principle), students might get different ideas from the content not just about systems of the body but perhaps environmental factors students would want to know or the idea of air quality affecting respiration (such a notion suggests the *idea diversity* principle). She underlined that with this approach, students could find the answers for the things they find interesting in real life.

### 5.2.2. Stage 2: Persuasion

In this stage of innovation-decision making various attitudes from participant teachers and principals appeared (e.g. enthusiasm, frustration, indifference etc.). To exemplify, the innovator teacher Andrew started to use Knowledge Building in his class in 2009. He thought at the time: “OK, it's good enough for our graduate class and what I saw happening in that graduate class. So I thought this should be good enough for my students.” Then he decided to implement it in his grade-twelve physics class in the area of modern physics. He was highly enthusiastic toward both Knowledge Building pedagogy and Knowledge Forum (technology built specifically to support Knowledge Building) on the one hand but he also felt nervous. He indicated benefits of Knowledge Forum by saying that the online interface makes everything so visible and people can literally see the conversations growing. He stated, “as a result that's the tool that I use and as long as it's working properly, I've got no trouble using it. It's easy; it really is quite straightforward and easy.”

When the four school principals first mentioned LSA’s Knowledge Building initiative in their schools, some of the teachers were curious about new teaching/learning methods
and pedagogies and seemed interested in attending workshops and similar events to learn more. Justin expressed that “I wanted to find out what it was about to begin with. I had heard about it before and then Mr. Porter [Conner] had asked me if I wanted to come in and learn a little bit more about it.”

A noteworthy thought was articulated by the elementary school principal, Conner in the interview; where he suggested that preconceived opinions and attitudes of the teachers toward Knowledge Building affected the results of their efforts. According to him, it becomes more difficult and risky because teachers are trying something new and different and they do not know if it is going to work or not. But if a teacher persists, and is resilient, and continues to learn about Knowledge Building then positive outcomes occur.

He also mentioned something he termed a “negative slide”,

If teachers get nervous halfway through and do not see the kids engaging, has not developed the research techniques, or does not have the resources available then there can be a negative slide because then classrooms are not as organized. Those sorts of things happen where classrooms break down and kids are floundering instead of being very focused and purposeful, they are all of a sudden all over the place and they have no real focus, so that could be the negative. And we have seen a sample or two of that. But that is the outlier, that's not the normal path. (Conner, Interview)

The general perception toward the innovation is developed through the perceived attributes of an innovation so that selective exposure influences individuals’ next steps. Five perceived attributes of an innovation -relative advantage, compatibility, complexity, triability, and observability- have strong effects on the formation of attitudes toward the new idea and eventually on the adoption behavior.
5.2.2.1. Perceived attributes of an innovation

5.2.2.1.1. Relative advantage.

The relative advantages of Knowledge Building were investigated through the interview questions that explored what changes—either positive or negative—might be attributed to the exposure to Knowledge Building pedagogy. As a result of the thematic analysis on the participants’ responses, four categories were identified:

i. Increased student agency toward their own learning

Most teachers expressed the idea that Knowledge Building encourages students to have a voice in the classroom and to take an active role in the learning process. Similarly, Morgan stated that his students are aware of “their work more as peers together on developing the knowledge” and they are “separating themselves from dependency upon the teacher for that knowledge, so they become a little bit more independent in some ways than what they used to be.” Andrew indicated,

(…) the power of student curiosity and the trust that you place in them, which I think is the important part that they will actually learn about something even without you, being there so to speak, you're certainly in classroom but without you having to guide them and direct them. (Andrew, Interview)

In the students’ panel, Miranda (student) expressed that “In my opinion it's really up to you where you want to take it. So it's -- it relies on your passion and what you are capable of doing” (Miranda-LE-V11). Arya (student) also explained that Knowledge Building gave them freedom to research and explore for their community. She defined a regular school day in the past as they took the lesson, did work sheets according to the lessons, had a practice test and assessment test, and then moved on to the next unit. She reflected
on their current practice as “we had freedom to learn what we really wanted to learn. And also we had the freedom to explore different ideas in different parts of the world, which could help our community” (Arya, LE-V6). She continued with examples of freedom to explore. She mentioned that when they were exploring on the Internet or through different books, they saw what different countries do to save water. For instance, in specific regions of a country they have roofs where they can take their containers and collect the water and they are also UV-filtered. She claimed that it would be great to use that idea in the parks. She also mentioned that this wouldn't be necessarily a good idea because in their country they get little rain every day. She expressed her pleasure not to be limited by only teacher recommended resources.

ii. Increased engagement and motivation

As the principal of School-C, Conner predicated, there was positive change in student engagement and motivation with Knowledge Building. Oliver attributed increased enrollment in history classes each year to their departmental switch to Knowledge Building. Miranda (student) explained how the welcoming environment in Knowledge Building classroom increased her motivation to learn and share, “So I think that's what really was -- that hit me. Because everybody is very important, because they all come from diverse backgrounds, and everybody can find acceptance.” She mentioned that everyone was equal in the Knowledge Building circle by telling “no one is made to feel small because they can't do a certain thing or no one is made to feel better because they can do a certain thing” (Miranda, LE-V1).
Vincent pointed that as a result of working with Knowledge Building, students’ expectations from the teachers and departments also changed.

If we talked about something in the year that we didn't covered fully people go back to it and look at things we didn't cover. Instead of getting in to the end of a semester and be like ‘oh I took ancient history because I want to learn about Greek fire. Now students take it and they go like ‘oh I got to learn about what I wanted’. And so it's just that opportunity and now that it's become part of the culture of the Humanities and Canadian World Studies. It's something that the students look forward to and certainly students expect from our department (Vincent, Interview).

Vincent’s words showed that students feel more responsible for their learning and they are more willing to collaborate with the teachers. Andrew reported increased student’ motivation and excitement in his physics class as,

I've gotten written feedback is that they really enjoy asking questions and learning together. I think those are the two big takeaways from it. So in that regard I think they enjoy the freedom. Not all of them, the vast majority though. A couple of them still really wanted answers and wanted me to be the teacher at the front but that was very rare. But the idea that kids can come up with these questions that the experts are thinking about that keeps them up at night. I think really thrills them, especially when it comes to that type of content that I played with and that's in modern physics (Andrew, Interview).

He also explained that he received emails from his previous students who told him that they always remember his classroom and their Knowledge Building work. Andrew said, “I do not know if they remember anything else but they definitely remember the Knowledge Building so.”

Amelie mentioned the changes in her elementary students’ learning practices from passive listener to active learner over time:

Well they were at first reluctant, they didn't really think about, they needed to be taught how to be active listeners and active listening means you think about what someone is saying and then you have think about anything what you can add to it,
or a connection, or a question. So at first they weren't giving each other too much feedback. Towards the end, they were able, they got it. So I just looked up something about Space and this has something to do with what they're sharing. I wonder if they know and they would then be able to share more openly. So it's good. (Amelie, Interview)

Similarly, Claudia reported an evolution in the attitudes of her high school students,

Right now I have a grade-ten applied history and at the beginning of the semester, they weren't engaged at all because they didn't see relevance to history. They didn't understand what was the purpose of it because it doesn't impact them according to them. So, that was their level engagement at the beginning. Now I would say it's significantly more just because they're having success with looking at questions and how it relates to them and they have an interest in the questions that they create. So I'd say it's definitely increased exponentially in comparison to when I started this semester. (Claudia, Interview)

In a webinar, one of the teachers expressed that "If the initial questions are created by students, we eliminate the "why are we learning this?" question” (Lucy, VLS-C, 12.06.2015).

iii. Changes in teaching style

Justin defined the changes in his teaching style in his social studies and science classes at elementary level as including explanations to students about how to research properly on the Internet and how to use information effectively. He also allowed them to explore more online. He explained that he encourages them to learn themselves: “Now I kind of model and share and then let them go and see what happens. Let them learn on their own and then come back and have to answer questions afterwards about what they did.”

As Kathy mentioned, the biggest change in her elementary classroom was the shift of the roles between teacher and students. She explained that she asked students what they
wanted to know about the topic and told them that she would not be the only one who provided information anymore.

Amelie also indicated that teachers have different roles in Knowledge Building classroom compared to traditional methods of teaching (i.e. teachers standing at the front of the class giving their knowledge and everyone else writing down the answers). She went on “(...) with Knowledge Building, you show them how to find things, not what the thing is”. She specified that Knowledge Building allowed her to be a more explicit teacher and active listener and communicator. Amelie also disclosed how she gradually turns the control or agency over to the student:

So not only do, you can't as a teacher say, ‘go off and these are your questions.’ ‘Great go on the Internet and learn it and come back and share your ideas.’ You have to teach them how to go on the Internet, teach them how to find appropriate sources, you have to teach them how to share by talking and listening and act, asking more questions. So in grade five and grade six, that's September and October is guiding them through what it looks like before they go and actually do it. So it's a total gradual release model. I'm with them right away. Eventually in June, they have more independence with it. But at first it's very much me and them working on how does it look like, how do I do this? (Amelie, Interview)

Similarly, Justin emphasized the importance of teaching independent research skills to students. He mentioned that they have at least twenty computers in their classroom, which they are able to use for research. However, he stressed the limitations of technology itself if students do not have the necessary research skills. Justin remarked that he wants to teach them to look at different perspectives and how to do that.

iv. Time demanding but deeper learning

Edward brought up complaints from a couple of teachers: ‘Knowledge Building takes too much time’. However he added that “(...) they say it’s time consuming but they have also
seen their students have a deeper understandings and when it’s done well and the right question is asked, the time yields deeper learning”. He recalled feedback from a teacher, “kids were so engaged in evolution, they have discussion and research evolution, and what they learned about evolution. The whole process was much deeper than he could have ever done in two-weeks of regular teaching.” As a principal, he commented on this feedback as, “if you hit that sweet spot of the right question or the right topic, the time become so positive because you can do way more in much less time, just based on kids’ own energy.”

5.2.2.1.2. Compatibility.

When Knowledge Building conforms to school improvement plans and teaching and learning goals, teachers’ and principals’ comfortably embrace it. For instance, Rosie indicated,

We let the teachers chose the focus for their professional learning community, we ask them to fit under the umbrella for the school improvement plan but our goal one is around that 21st century learning skills and teaching students to think critically, problem solve and so Knowledge Building fits under that premise so the social science department, that is their focus for their professional learning community so they get regular times to meet through the day, throughout the school year to work on that. (Rosie, Interview)

Aiden mentioned that before he started to work with Knowledge Building he was getting sick of regurgitation of information and looking more towards students’ understanding deeply. He expressed his goal for teaching and students’ learning as,

I want them to feel like they have some say in what they’re doing for better buy-in, but also to have them look deeper into a question, look deeper into a problem. That way, we can kind of get pass just Googling things and finding out making lists and what not. We're actually looking at how and why things work can be able to compare and contrast and make opinions on things. (Aiden, Interview)
Similarly, Oliver explained his aim as teaching as,

(...) to allow kids to go beyond the obvious, build their critical thinking skills, build their inquiry skills, stuff that they can use in life that they're going to be in situations whatever job they're in, whatever profession they go into, whatever family life they go into that they're going to need to work on and have those critical thinking skills with them along the way. (Oliver, Interview)

Vincent also explained his goal of community ownership of knowledge by saying, “so that a student doesn't feel left behind because the group is producing an understanding as opposed to an individual producing understanding. Students can take advantage of each other's strengths and kind of can compensate for weaknesses that they possess.”

5.2.2.1.3. Complexity.

Some of the participants reported the only complexity they encountered stemmed from technological issues. While some of the participants think that Knowledge Forum is a neat and substantial tool in supporting Knowledge Building, some of them have major struggles with it.

Since there was no technical or conceptual support for Knowledge Forum (technology built specifically to support Knowledge Building--see Scardamalia, 2003) teachers were not expected to show understanding of ways in which Knowledge Forum can reduce complexity. Instead it was seen by several teachers as adding complexity, especially if not supported by the school’s IT unit. Some teachers played with Knowledge Forum in their classroom but they were more likely to create low-tech imitations (e.g., sticky notes on boards) or use technology they were already familiar with (i.e. Google Doc., Padlet) It is only in newer work not reported as part of this thesis that support for Knowledge
Forum is being provided for teachers and starting to facilitate uptake of Knowledge Building while lowering complexity.

5.2.2.1.4. Observability.

Aiden mentioned that teachers have conceptual tensions around an unfamiliar pedagogy “unless they go to a workshop by someone who's more seasoned like Andrew.” He also added, “what you need is someone who's teaching a course along with you to kind of mentor you along”. Some teachers’ testimonials confirm Aiden’s claims. In the workshops, most of the teachers decided to try Knowledge Building because they were inspired by Andrew’s passion and excitement for Knowledge Building as well as the examples from his classroom practices. Kathy admitted that listening to his talk about how his students use Knowledge Building, how his students really grew and enjoyed learning physics inspired her to say, “Hey! I want my students to feel like I ought to go to school too”.

Sophie explained that Andrew was teaching in the classroom next to hers. When she saw his Knowledge Building work she started a conversation with him about it. Then she recognized its benefits and decided to try it out in her history classroom. He clearly influenced her to start. She gave him credit for not only being so enthusiastic but also demonstrating the benefit of Knowledge Building. Similar to Kathy, Andrew prompted Sophie to think, “Well what would that look like in my history classroom or my law classroom, that was interesting.”

In the diffusion process, Andrew is not the only inspiring teacher. Justin explained that he was influenced by a secondary school teacher, Vincent, to start implementing Knowledge
Building with his elementary students. Justin met Vincent in a workshop and saw his work with grade ten students. He said “Wow, you could actually do that with kids?” Then he expressed that 15-16 years old students generally are able and expected to be more independent in their learning, and wondered whether he could do the same kind of process with 11-12 year olds, and whether students of this age could have full independence. Then he decided to try to incorporate the approach in his elementary class.

Knowledge Building pedagogy has been disseminated not only within schools but across different schools. Teachers might be inspired by teachers either from other schools (i.e. Kathy and Justin) or in the same school as in Sofie’s case. Another situation that influences the spread of innovative pedagogy happens when teachers transfer from one school to another (e.g., Oliver and Aiden).

Oliver found more colleagues interested in this novel pedagogy when he transferred to his current school. At that point, both Oliver and Vincent started to explicitly seed Knowledge Building in their department. He explained their effort to spread Knowledge Building among the departments in his school,

At this school I find that myself, Vincent does it a lot, Luke [another teacher at the same school] is now involved in it, Scott is doing some Knowledge Building, and then we're spreading it out. And there's some math teachers now getting on board with it, which is kind of cool to see (Oliver, Interview).

Oliver underscored that even though Andrew got him involved in Knowledge Building, the key to his motivation and effort to expand its use to other teachers resulted from being a part of a group of teachers interested in Knowledge Building at School-B.
Aiden’s experience with Knowledge Building is also based on two different high schools. As he explained, there was only one other teacher in his previous school who tried it after she heard Aiden talking about it. Similarly in his current school, School-B, one of the teachers was interested in Knowledge Building and started talking to him about his experiences. He stressed the positive influence of having other teachers who already implemented Knowledge Building in your specific subject area. He stated that “It might not inspire you but it definitely is a person that can help you out a little bit more.”

Rosie clarified that they provide “observability” opportunities in her school by describing intentional design of departmental offices to support teachers learning from each other. She stated,

One of the other things that is unique about School-B is we don’t have department offices so we don’t have a math office or science office. We have three workrooms and the workrooms are inter-mixed. So if you go up on the third floor the work room will have some History teachers and some math teachers and some Art teachers and some tech teachers so there’s a lot of cross sharing across departments. So if social science is doing something neat everybody in the building knows about it. It’s not kept in social science because they overlap in their workrooms. So it adds to the enthusiasm and excitement. (Rosie, Interview)

Teachers invited others into their schools and/or classrooms to allow them to see how Knowledge Building positively impacts students. A webinar example comes from School-4: “We are inviting them to visit Antonio’s and Florence’s [another teacher at the same school] classroom and see the students engaged in KB and witness first hand the engagement of the students” (School-4, VLS-C, 12.06.2015).
5.2.2.1.5. Triability.

Aiden stated that “In the end I was the only one who took him [Andrew] up on the offer to actually try the software.” Accordingly, when he met the early adopters (e.g. Vincent) and saw their excitement, he decided to try this pedagogy in his classroom.

(... since then just seeing other people doing it --Vincent really likes to jump in with both feet when he hears something that he's in--. I'm not quite as far in as he will be right away but if I see something that I would like to try, I'm definitely willing to try it, and find the right situation for it. So just seeing some other teachers has helped, and coming to the school and seeing that, lot of teachers were doing it. (Aiden, Interview)

Edward indicated that some elementary schools in the board are also in a trial stage: “We have got some elementary schools that are flirting with it but now with the big math focus across the province like we really can’t pull them into other directions. So… that’s the challenge that we have had.”

5.2.2.2. Sources of uncertainty

All innovations, more or less, produce uncertainty for individuals. The participants in this research had different levels of uncertainty about Knowledge Building. For example, as Claudia stated, “I think it's a scary thing when you're starting from scratch on Knowledge Building because you're letting go of a lot of control of your classroom. The kids drive the learning to where they want to go.” Dylan also explained that “Some people get kind of scared away with maybe a lack of control that they feel, they're kind of giving more of the direction to the kids or the kids are determined by the direction of the teacher” (Dylan, Interview). He clarified that even though he liked and stuck with it, it would be uncomfortable for some other people.
Andrew commented on some of the teachers’ unfavorable attitudes toward an unfamiliar concept. He justified this conceptual tension for students too. He emphasized that teachers would not change their attitudes toward Knowledge Building unless they somehow practiced some forms of idea improvement or demonstrated that concept. He also pointed out that students would get comfortable over time with taking someone's idea or somebody's knowledge that they posted, and making it deeper and richer with more practice. He shared his multi-year observations,

The only thing that I saw that was kind of nice when the kids went to the next year or the year after and they kind of knew what Knowledge Building was. And then you could still work with them a bit more do around the concept of idea improvement. (Andrew, Interview)

There are of course other teachers who value a growth mentality and want to experience and test new pedagogies as Vincent mentioned. He mentioned, “if you have a conversation with a teacher like that it's very beneficial but if they are set in the way that they deliver content then it's probably not a very beneficial conversation.” Vincent described Claudia as an example of the first type of teacher he mentioned above. As he explained it, Claudia would walk into the class and ask what students were doing and they would have discussions and “thoughts surrounding how like I look better or maybe there's a fault here or there.” Likewise, Oliver gave another example of teachers who were curious and excited to discover new methods in their school. Some of the math teachers heard what they were talking and doing with Knowledge Building and they asked some questions. For example, Jamie was really interested in trying Knowledge Building with his 3M (math class). Last year Jamie was not sure how it would go and then they planned a Knowledge Building lesson in collaboration with Oliver.
As discussed earlier, one of the issues that teachers worried about was time related to covering curriculum expectations. In webinars, the Upper Grand District School Board group asked, “Do you worry about addressing all of the expectations in the curriculum in your process? and how do you manage those expectations?” (UGDSB, VLC-QC-M, 10.03.2015). The principal of School-21 from School Board-36 explained, “We have perpetuated the angst that teachers feel when it comes to assessing curriculum expectations. It will take time to shift this thinking and develop confidence in teachers to be able to do this systematically” (Lindsay Parker, VLS-C, 08.10.2015). A group of teachers from Toronto also replied as “We teach kids to the curriculum, NOT the curriculum to the kids - some of our thinking here!” (VLS-C, 12.06.2015).

Correspondingly, Rebecca Frey who is the principal of School-7 at School Board-25 also mentioned in a webinar how they have dealt with the curriculum expectations: “We see a place to facilitate the conversations with teachers about the Big Ideas and then move to making the connections to the curriculum expectations” (Rebecca Frey, VLS-C, 08.10.2015).

In order to reduce the doubts about the expected consequences of the innovation, people seek innovation-evaluation information mostly provided by scientific evaluations of the innovation and/or social reinforcement from others. The most convincing source is when their thinking is confirmed by peers’ subjective opinions. Thus, the potential adopters are inclined to discuss with those who already adopted the innovation.
5.2.2.3. Discussion of the new behavior with others

To cope with their uncertainties, teachers received feedback and reinforcement both from colleagues and the system. They regularly come together in local meetings such as workshops, learning fairs, or informal meetings as well as online learning sessions and symposiums across the province.

The innovator teacher, Andrew mentioned that in the workshops he specifically shared his “initial reservations with the teachers because to believe that kids could ask questions within a community and continually ask and build knowledge based on those questions” since he also thinks that “it’s kind of scary for a teacher because you think that they're not going to stay on task or they're going to learn wrong things and so forth.” Andrew elaborated what he had exactly tried to help teachers in the workshops or similar meetings to overcome uncertainty:

I just tried to alleviate the fears of the teachers that say what you know if your job was to make sure you look at the curriculum a little bit and make sure the questions that they're asking, the big questions are related to that curriculum then you are going to be fine. And I think what you're going to have to do is let go and let the kids do the heavy lifting. (Andrew, Interview)

Kathy found the discussions with her colleagues very useful for coping with her hesitation about turning control over to the students. They had amazingly detailed and involved discussions about where they started, where they were now, and how that looked different and so on. She elaborated on this by saying that it was valuable for her to hear someone else who has tried it before. It made her feel as “it is OK for it to kind of flop the first time or what we have done to work with different problems that have come up or things like that.” Kathy stressed the significance of a supportive environment and
sharing knowledge and experiences. She mentioned “it is nice to bounce ideas off other people or get ideas from other people, ‘Oh that is a great idea. I am going to use that, I am going to make it like this, and I am going to tweak it a little bit.’” In similar vein, Aiden described how he struggled with the feeling of isolation. He indicated that it was good to talk to other teachers about things going well and struggles. His dialogues with Andrew set an example of how the interactions with colleagues were useful to go over the concerns in the adoption process. Aiden also mentioned how his discussion with Andrew helped him address concerns in adoption. He stated,  

> Obviously, I would not have gotten into this if I had not talked to Andrew. Many years ago in the session that he put on, and I liked how he was very very open talking about, he was more interested in the deeper understanding and did not really care as much about the product and had no problem saying kind of do it in the dead end unit that does not go anywhere and what not. I liked how he was very open and vocal about whether they are administrators or whatever sitting in the room, he did not care. He was saying ‘this is what I am going to do for this reason because I think it is important to learn this way, and it is not as important about what the kids are writing down on a piece of paper’” (Aiden, Interview)  

In several distinctive events, with the participation of the principals, teachers had discussions about the implementation of Knowledge Building, shared and reflected on their own practices with others, worked on designing new units with Knowledge Building, had discussions how they can re-design the units across grade levels and subjects in addition to identifying different means of assessment. For instance, Kathy as an elementary teacher provided insight into how she took advantage of the meetings with the high school teachers that she attended. She was inspired by their organizational ideas. Hearing what was working for them made her to think about how she could make that work for elementary students. She also learned from their sharing about specific issues
such as assessment methods and marking schemes. She briefly stated, “it was helpful to share outside of the school also.”

Stanley alluded to avoiding talking about either success or failure with Knowledge Building and instead seeing opportunity for feedback from others to improve knowledge and practice. In preference to knowledge transfer from an expert, they learn by practicing as well as giving and receiving support from each other. He highlighted that in every single meeting more and more teachers were willing to speak up about what worked and what didn't work for them and to ask how to do something.

Throughout the LSA events, especially in the webinars, teachers and principals had many chances to expand understanding of theory and pedagogy and improve their practice. As an example, in one of the webinars, while a group of teacher participated from a School Board-25 expressed their expectation from this session as getting “More ideas about assessment and evaluation” (School-7, VLS-C-M, 10.03.2015), another teacher group from School Board-7 replied to the question that asked what do you hope to give in this session? as “We hope to share our experiences with how knowledge building supports assessment and evaluation” (School-4, VLS-C-M, 10.03.2015). The results of the thematic analysis of the virtual chat shows that the teachers and principals had conversations around nine categories; (a) asking questions to develop a better understanding of Knowledge Building; (b) asking for examples and materials; (c) asking for classroom strategies; (d) asking for help in the use of technology and Knowledge Forum; (e) discussing assessment and evaluation; (f) discussing curriculum expectations; (g) asking for strategies to implement Knowledge Building in special education; (h) sharing school improvement stories; and (i) asking for principals’ strategies. For instance
in a webinar, after the presentation by Antonio, the elementary teacher at School-4, teachers asked him to share his materials.

Rebecca Torres (an elementary teacher from School-9): Antonio, do you have visual examples of these? The students we are working with are LLD [Language Learning Disabilities Program] learners, so visual demonstration of their learning is often a go-to form of assessment.

Brenda Treadaway (the principal) and Antonio Harris (the teacher): Hi Rebecca, yes I do have samples of all components of my program that would support your LLD learners. Here is my email address please contact me and we can discuss further [e-mail address]

Lori Young and elementary teacher from School-10: Antonio, would you have any samples of student learning in their portfolios that you could show/share?

Brenda Treadaway: Hello Lori, please email Antonio at [e-mail address]. He has student samples and he would be more than happy to share them with you. (VLS-QC-A, 10.03.2015)

5.2.2.4. Support for the innovative behavior from the system

System support comes from either the LSA project or the school and school board. As mentioned before, LSA has provided support for the teachers and principals and time to address uncertainties and differences. For instance, Conner remarked that the LSA symposiums are essential to capture teachers’ initial attention and interest. According to him, despite the value of the symposia for the teachers to hear examples, successful stories, and topics, the audience is far away from the speaker and from actually making something happen. After this critique, he also made a point that symposia were highly significant as “It gets you motivated to try something new. It starts a conversation with the person beside you.”
Over and above LSA’s extensive resources in the Learning Exchange website were mentioned. Andrew pointed out the need for more classroom-based Knowledge Building resources:

(…) to actually have a website that's the devoted to the Knowledge Building and then you can go right there and find resources there and tips and tricks, and things in like for the practicing teacher not the theory (…) beyond the twelve principles, it's the execution of Knowledge Building in the classroom, you know what are the pitfalls? That type of thing I think is something that is probably needed in a way that is very accessible rather quickly for the teacher. (Andrew, Interview)

To identify ways in which teachers received supports from the schools and school boards, the principals were asked (1) how they enhance teachers’ interactions within the school and across the school board, and (2) how they support teachers in implementing Knowledge Building in their classrooms. Responses of the principals included 1) letting them create professional learning communities, regular staff meetings, and 2) providing professional development opportunities and experiences, and facilitating interactions between teachers on site. Additionally, Stanley described the school atmosphere they created for the teachers in his previous school as “(…) School-D was allowing teachers to take risks, allowing them to think outside the box, allowing them to be OK with, if it failed or didn't go well providing release time.” In School-B, different days of a week or month are allocated for special events to encourage teachers to come together. For instance, the first Friday of the month, they had ‘Friday Fruit’ to encourage people to come together, get a piece of fruit, and stop and talk, interact and dialogue. In similar fashion, they organized ‘Soup Tuesdays’. People came and get soup at lunch and then they stayed in the staff room and saw people that they may otherwise hardly interact with. Rosie clarified their aim as to create opportunities for teachers and staff to come together for other purposes but they benefit because they dialogue in those cross-disciplinary
workspaces which also facilitates many opportunities for people to share ideas and collaborate.

5.2.3. Stage 3: Decision

In the decision stage, the individuals engage in activities such as seeking additional information about the outcomes in case of full use of an innovation. This stage encourages individuals to end up making a choice to adopt or reject the innovation (Rogers, 1995).

5.2.3.1. Intention to try the innovation

Some of the teachers got a chance to try Knowledge Building in workshops while others were given a trial by their colleagues or innovator teachers. For instance, in Aiden’s case, he met the innovator teacher in a school board committee and became interested in the Knowledge Building ideas that were being talked about. Following this, Aiden attended a Knowledge Building session and at the end of this session he asked to try Knowledge Forum. Amelie also confirmed, “We were trying to figure out exactly how it works, so you can't learn about it until you actually try it.”

In School-B, the whole social science department adopted Knowledge Building and they further influenced the teachers from other departments to try this novel pedagogy:

We have one department in 100% and then we have pockets of teachers throughout the school who are trying different things related Knowledge Building. A lot of them are really trying to create inquiry questions with their students and have those student questions drive the learning. So those fundamental piece if Knowledge Building, whether their using the form or not, so we have lots of people trying that throughout the building, using Vincent as that sounding board or resource to help them. (Rosie, Interview)
5.2.3.2. Intention to seek additional information about the innovation

In the decision process, the potential adopters seek additional information about the innovation both from the system and their personal network. The LSA project provided support and resources for the participants mainly through three channels: (1) professional resources such as Principal Association Project Leaders, Steering Team, LSA District Facilitators, and Ministry of Education Officers; (2) a number of events and meetings such as provincial symposia, virtual and face-to-face learning sessions, speaker series; and (3) interactive technologies (e.g. LSA website, Learning Exchange web portal). The LSA team also provide more supports based on the emerging needs of participants.

District/System Leaders are responsible for promoting the LSA project within their districts and ensuring district representation at LSA sessions. They also collaborate with the LSA participants with the aim of creating and sustaining effective leadership networks as well as contributing to the project with research. The LSA District Facilitators are equivalent to change agents in the diffusion of innovation literature. The extent of change agents’ promotion efforts has a critical influence on the rate of adoption. Their primary aim is not only to achieve adoption decisions but also to speed up the innovation-process for individuals. To receive additional information about Knowledge Building, school boards had lots of in-school visits from LSA, Ministry, and OISE researchers as well as face-to-face sessions.

Kathy explained that she took advantage of the video resources published in the Learning Exchange web portal and she found them very useful. The resources helped her to identify where she was, how she was going to improve her practice or the problematic
issues that she cannot seem to solve. She mainly saw what other people were doing and
was able to improve her practice through those resources. Conner summarized materials
from the LSA web sites that he reviewed and used with his colleagues: twelve principles
of Knowledge Building, research papers, and the videos that include suggestions and
interviews. He also commented, “It is nice that they're stored there because when we
want them we can pull them out.” Edward explained that he used those resources in his
current principal position at the Board office too. When the teachers have said ‘oh I am
having a hard time getting kids engaged in a projects’, he recommended they take a look
at these resources and watch specific videos in order to get a better understanding of how
to get kids talking, how to lead discussions, and how to generate ideas. Similarly, Sofie
told how she referenced those resources to another principal at the Board office. She
found these resources very helpful. She mentioned a grade one or kindergarten teacher’s
video that Andrew had showed her before as an example; “like she was showing all the
different boards of how the kids were doing land ships. And I just think it's so cool
because it's so visually shows how to use Knowledge Building” and kept going as
clarifying that “it does not matter how old you are like you do not have to be in secondary
to do these concepts.” Sofie also referred those resources to the teachers in her personal
contacts:

When I was using the Knowledge Building I found it hard to find stuff that I
wanted on the website and difficult to find what I needed so. (…) Sometimes I
would send that video to someone if I were trying to talk about what Knowledge
Building looked like. It was an easy touchstone to like it was sent so to a couple
people actually I even sent it to my brother; my brother is a teacher. It is like a
totally different board. (Sofie, Interview)

In addition to recommending those materials to other teachers and individuals, the
principals used them in their presentations. For example, as Stanley told they [the
principal learning team] take clips off the website for their trainings that were made at his previous school. They have used Andrew’s videos in which he talked about his experience going through the process and some of the instructions about Knowledge Building. Likewise, Conner also admitted that as the group of principals they definitely used the materials in their presentations. Edward was another principal who has used a couple of the pieces just in his own presentation to his staff. He reported that he referred those videos and stuff to his staff with the aim of getting them thinking about how they could do things differently.

Moreover, in webinars, the Curriculum Services Canada Tech Support also provided help for the teachers’ requests and questions. For examples, at the end of each session, the downloadable versions of presentations and documents were shared with the participants. They also shared information about Knowledge Building when requested by participants. The thread of conversation below illustrates such interaction:

Brie: Is there a list of sentence starters that students can use to challenge other students’ ideas?

Sally: We'd love to see a list of sentence starters too!

Curriculum Services Canada Tech Support: There are five scaffolds (prompts) that are included in Knowledge Forum notes: "My theory", "I need to understand" / "I wonder", "Important information + source", "Putting our knowledge together", "Our improved theory", "this theory does not explain". However, there are also many others that people have found useful - for instance, Antonio often encourages his students to use "request for information" as well.

Curriculum Services Canada Tech Support: from Molly's card - "Evidence to support", "Evidence to discount" (VLS-QC-M, 10.03.2015).
In addition to sharing resources, teachers asked and received strategies in webinars on specific subjects. For example, assessment and evaluation one of the popular subject teachers and principals asked for suggestions:

- “How did assessment and evaluation work with this inquiry?” (The group from School-7, VLS-QC-M, 10.03.2015)
- “The connection between assessment, evaluation and inquiry learning is a focus and area of learning for us as well” (Elizabeth Davis from School-13, VLS-QC-M, 10.03.2015).
- “Love your intentional integration/teaching of critical thinking! Wondering about for and as assessment strategies for personalized next steps in the skills that come in service to these incredible intellectual pieces that are being uncovered” (The group from School-16, VLS-QC-M, 09.03.2016).

There are also some teachers who are looking for more information and examples about the implementation of Knowledge Building in special education. The example from one of the sessions is below:

School 23: How does Knowledge Building work in Special Education Classes?

School 23: Are there any challenges you have encountered in your LD [Learning Disability] class where the students might be at different learning levels and how do you address it?

LGY Tech Support: @ School 23: - We have a team sharing later in the webinar on KB in Special Education (VLS-C, 09.03.2016)

The decision stage might end with either acceptance or rejection of the innovation.

Acceptance of an innovation leads to the next stage ‘implementation’.
5.2.4. Stage 4: Implementation

In Upper Grand District School Board, most of the teachers had a trial as soon as they heard about Knowledge Building. The positive experiences they had led them to implement it on a regular basis.

5.2.4.1. Positive experiences

Teachers conveyed their satisfaction with this new pedagogy in their classroom. Based on personal observations and students’ feedback, teachers expressed the positive influences of Knowledge Building on their students. Kathy expressed her pleasure since every student that she worked with—even for the students with lower reading level—has engaged in Knowledge Building. As she reported, it was beyond her expectations. She clarified how they achieved this as,

We have a great base for them to kind of go and research on. So there was a place where there was just videos and they can go and research on videos and they were engaged because they do not have to read, all these all these Web sites and all this information to get information. They can watch a video, they were engaged, ‘yup that was what I need to know’. And then they can make jot notes and they can type up what they know. (Kathy, Interview)

Morgan also reported really good engagement with high school students overall. He said he received a lot of good feedback from students in his health care course and grade-twelve biology course including molecular course concepts that was a challenging one. Oliver’s reflection was based on his experiences in history course. He mentioned that students were more engaged because they were actually figuring out history as opposed to teacher telling them and just memorizing when things happened. He explained that students did not much concern with the knowledge of dates; instead they realized the
importance of the ideas, the significance what was going on, and making those connections. As he told, students were into it more, actually engaged, asked questions, and figured out the subject instead of teachers’ telling. He defined their accomplishment as “I have ever since we kind of moved to that and most of our social science classes around critical thinking and problem-solving.” Consistently, Vincent stated, “it was produced the greatest knowing, the greatest understanding, and the deepest understanding that have got to these students and it really does not depend… it really does not matter what level.” He related these outcomes with Knowledge Building that offered an opportunity for students to choose direction. He added on when they chose the direction that they became more invested.

5.2.4.2. Positive social influences

Edward mentioned how Knowledge Building created a positive environment in the schools both for teachers and students. He indicated that every time they introduced Knowledge Building and went through that process, teacher engagement and student engagement went up. He clarified that feedback from teachers were always super positive. As he reported, both students and teachers liked it and teachers always recorded a decrease in interruptions and behavior issues.

Moreover, as mentioned in the virtual chat in one of the webinars, “sharing knowledge building work on a class blog helps connect the learning to home environment; also posing a question for students to answer with families and come back to share findings” (Beth Robinson, VLS-C, 22.01.2015). In another session, a group of teachers from Toronto confirmed it by writing: “The Family Path is an essential part to student
engagement - confirmed by [School-12]" (VLS-C, 12.06.2015). One more example from virtual chat as following:

I can see school was inviting families in to provide information on how to bridge the learning environment with the "dinner table discussion" - I think sometimes parents are unsure about the right questions to ask their children and are turned off immediately when/if their children shut them down (i.e. "What did you do today at school," says Mom. Child responds, "Nothing much."). (Timothy Summer, VLS-C, 22.01.2015)

5.2.4.3. Use of the innovation on a regular basis

The best example of the implementation of Knowledge Building within the current research context is the School-B social science department not only because they adopted Knowledge Building across the whole department but also because they are continuing to invest in it to improve their own practice as well as contributing to its dissemination. Edward confirmed that the teachers in School-B are early adopters who had buy-in to Knowledge Building and they put it into use, like the history department, as an integral part of their practice. Edward also commented, based on a report, how in School-B they had seen huge increase in students’ performance and engagement, and a reduction in behavior problems.

Edward specifically mentioned two teachers from this department, Oliver and Vincent. According to Edward, they would be counted as actual Knowledge Builders like Andrew. Incidentally, in addition to the principal learning team, some of the teachers such as Vincent and Oliver were considered to be opinion leaders also since they created a great positive influence on other teachers both in their schools and the others schools in their neighborhood. For instance, the elementary teacher Justin explicated how he was
impressed by Vincent’s Knowledge Building practices. Aiden also mentioned some colleagues both in School-D and School-B came and talked to him about what he has been doing and they would like to try it in their classroom. However, in this study, Andrew was not counted as an opinion leader since he is the significant innovator in this current context.

As the head of social science department, Vincent explained the key for integrating Knowledge Building in his department:

> My department is full of individuals that trust each other and are willing to take risks on each other's ideas and so, because that relationship is kind of between each of us in the department, it allows us to jump on things when they happened so knowledgeable. (Vincent, Interview)

Vincent kept clarifying how this strong relationship among the teachers and trust culture was created in social science department:

> (...) the reason why Knowledge Building took root within our department and became such an everyday practice within our department was because (...) people were given the time to create they modeled that, opened their doors, people walked in and then we weren't afraid to say that this was a good job, this was a good idea. We were in an environment that it was safe to be OK with being, like this is good. We're doing this right. We didn't have to hide or worry about someone putting a judgment on what we were doing.” (Vincent-Interview)

5.2.5. Stage 5: Confirmation

As the fifth stage of the innovation-decision process, confirmation stage includes adopters’ support-seeking activity to receive confirmation of their adoption decision as well as to avoid conflicting messages and a state of dissonance. To explore the confirmation process, three adopter behaviors were used as the indicators of being in the confirmation stage: (1) Recognition of the benefits of using the innovation; (2)
integration of the innovation into one’s ongoing routine; and (3) promotion of the innovation to others.

5.2.5.1. Recognition of the benefits of using the innovation

The relative advantages of the innovation perceived by the participants (See Section 5.2.5.1.1) and positive experiences (See Section 5.2.5.4.1) and positive social influences (See Section 5.2.5.4.2) of Knowledge Building were mentioned in detail in the above sections.

5.2.5.2. Integration of the innovation into one’s ongoing routine

In the implementation stage, the use of Knowledge Building on a regular basis was supported by teachers’ testimonials. Here in this section, I present more evidence to show how teachers integrate Knowledge Building into their ongoing departmental teaching routines.

Currently, the teachers in School-B are working on redesigning all social science curriculum and aligning it to Knowledge Building principles. For example, three teachers, Oliver, Luke (another social science teacher at School-B who was not involved in this research as an interviewee), and Scott, who are all teaching grade nine geography decided to scrap their old course and together re-aligned the whole course to be done through Knowledge Building. As Oliver reported, they basically figured out twelve to fourteen key issues that they wanted the kids to investigate and each week gave them a new issue.
In addition to the principals and teachers in Upper Grand District School Board, there are also several schools from different school boards who integrated Knowledge Building as a part of their curriculum and made presentations both in webinars and face-to-face meetings. Some of them are listed below:

Table 8
List of teacher and principal presentations of classroom practices in webinars

<table>
<thead>
<tr>
<th>Presenters</th>
<th>Grade and Subject</th>
<th>Date of VLS session</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sherry Moffett &amp; Beth Robinson, elementary teachers, School 1 from School Board-8</td>
<td>Grade 1/2 and Grade 4, Biology, Animals</td>
<td>VLS - 09.03.2016</td>
</tr>
<tr>
<td>Molly Synder, Grade 6 Teacher</td>
<td>Grade 6 - Science, Astronomy</td>
<td>VLS - 10.03.2015</td>
</tr>
<tr>
<td>Melissa Perez, the principal, School 3 from School Board-8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dennise Lee, the teacher Librarian, School 2 from School Board-47</td>
<td>Grade 6 Science/Electricity</td>
<td>VLS - 09.03.2016</td>
</tr>
<tr>
<td>Brenda Treadaway, the principal and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antonio Harris Gr. 5 teacher, School 4 from School Board-7</td>
<td>Grade 5, Assessment and Evaluation</td>
<td>VLS - 10.03.2015</td>
</tr>
<tr>
<td>Rosa Baskerville, student success teacher;</td>
<td>Grade One, Math</td>
<td>VLS - 10.03.2015</td>
</tr>
<tr>
<td>Judith Armstrong, the principal; and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Virginia Savega, Gr.1/2 teacher, School 5 from School Board-44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freya Hudson, School 6 from School Board-10</td>
<td>Grade 3, Math</td>
<td>VLS - 26.02.2016</td>
</tr>
<tr>
<td>Rebecca Frey, the principals and her teacher team, School 7 from School Board-25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.2.5.3. Promotion of the innovation to others

In order to effectively promote to others one needs to feel the power and value the idea and/or the products. Andrew confirmed the impact of Knowledge Building in his class after a few trials; “once I started seeing it happening these three times I thought ‘OK this is working!’ The kids are curious they are willing to put in the effort to learn about something that really interests them.” He appreciated the effect of Knowledge Building on students and himself as a teacher and he would like to introduce it to others. He mentioned what he basically did was just showing students’ notes posted in Knowledge Forum to some teachers. He stated,

And then one day I showed a teacher ‘hey take a look at this!’ And I said ‘this is something called Knowledge Building and all of these little squares you see, those are notes that the kids are posting and they're building on each other's work. And let me show you a couple of them. (Andrew, Interview)

In addition to his informal talks with teachers in and out of his school, Andrew made five presentations and four workshops in Upper Grand District School Board, two international presentations, one presentation and four workshops in different Ontario School Boards, in addition to a workshop at the Theoretical Physics Institute and a
presentation at Ontario Association of Physics Teachers about teaching with Knowledge Building between 2013 and 2016.

As noted before, the four principals participated in several LSA events across the province as well as the local workshops and working groups. In those events, they promoted Knowledge Building; they told their stories including motivations and challenges, success and failures, and the processes they used as administrators. Except the elementary school principal, all others positively responded to the interview questions that asked if they want to continue to present their work and share their resources and materials with others. The elementary school principal, Conner, conveyed his reservations for right now as: “I would not personally be interested in sharing any more information because I do not know if I have things to contribute like, if I felt I had more to contribute that's not there, then yes but not right now.” Obviously, he prefers to wait to mature Knowledge Building in their school and then share more substantial experiences.

Two elementary teachers Kathy and Amelie also presented their work in a learning fair that was organized in Upper Grand District School Board before. Kathy additionally did a workshop at Association of Ontario conference with science teachers last year. Kathy and Justin (who is the other elementary school teacher), expressed their intention and motivation to promote Knowledge Building by sharing their experiences with it even though they have not yet done any long presentations at LSA -except Kathy’s short talk in a webinar-. Amelie gave an indecisive response to this question by saying “perhaps”.

Rosie, the high school principal, mentioned that her teachers are already working on some materials to share, specifically, a how-to guide. The teachers got together to teach
Knowledge Building and Vincent, Oliver, and Claudia are currently writing a section together while the social science departments rolled it out. They were invited by the Student Achievement Officer to put a resource together to teach Knowledge Building to the other teachers for their program and to provide some case studies. Vincent corroborated his principal’s words and expressed his excitement for this work by saying that “Currently we are writing a chapter of a book for someone regarding Knowledge Building and how our approach as a department works. We have always gone to LSA to try and show how we do it and share materials there”.

Another high school teacher Sofie specified the importance of promoting their work and sharing experiences with other teachers since she thought “teachers are also learners”. She underlined that when teachers get to share their learning, it is a good chance for others to learn. She added, “I think what even when you watch those little videos, they are like you pick up nuggets from people and thought about that situation or what they mention or come up and what kind of audience.” On the other hand, the high school teacher Dylan also expressed his willingness to share his experiences with Knowledge Building while his departmental colleague Morgan thought that he was not yet at the stage of sharing.

5.2.5.4. Rejection or non-adoption

As mentioned earlier in the awareness-knowledge section, Andrew and Oliver expressed the first type of dissonance where they felt a need for developing their teaching further and started information seeking to meet this need. Andrew reported that he was already in search of a pedagogy that would help him to understand the nature of expertise in human
learning and Oliver mentioned how much he got bored with teaching with inefficient ways and felt a need of “switching it up” when they first heard of Knowledge Building.

As an example of second type of dissonance, Oliver mentioned that some teachers showed resistance toward the change: “Some teachers here do not really want to change or do not care to try it or whatever (...) If it does not work out, you need to change things, and then they try it and that's what it's all about.”

Stanley provided examples for the third type of dissonance from his previous school. He stated, “some teachers at School-D would have been ‘yes, this is great and it worked very well’ and other teachers would have had struggled with it and would have been for various reasons.” He explained,

All of my teachers enjoyed it. There would be one of them and that wouldn't have continued it. They really struggled with how he/she could use it in her/his classroom and didn't feel like they could do it. But the other four did and when we did, we spread it out to the other thirty in the following year with the one to one project. We had more teachers who saw the value in it and said ‘Yes this I can see how this really would work. I just need more time with it.’(Stanley, Interview)

Dylan and Morgan cited two teachers in their school discontinued after they tried it. Unfortunately, we do not know the reason for their discontinuance. Conner also confirmed the difficulty of keeping teachers using a new pedagogy in the transition period: “People who have stuck with Knowledge Building, we see a large increase but it is difficult to stay in that transition period between what I was doing before and trying something new.”
In the confirmation stage providing reinforcement and feedback for the adopters is essential. If the social environment does not encourage the adopter, the risk of discontinues raises. For instance, Aiden mentioned,

At School-D where there were not a lot of teachers myself. [name of a colleague] tried it once. You said there have been a few teachers that have tried it since. But there really were not any at the time that I could. So I just kind of felt like I was doing this weird thing that nobody else was. So you kind of feel like you are the outsider or maybe I should not be doing this or what not, so to come to school where a lot of people are doing it was, was encouraging. (Aiden, Interview)

Stanley underlined that there were lots of different variables that explain why a teacher may or may not continue with Knowledge Building. He clarified potential reasons as, “Whether it be the class and classroom management issues or the pedagogy. There's other portions to the pedagogy you’ve got to understand. There is control issues you have got like, there is all sorts of lists of things that make an effective teacher” (Stanley, Interview). He also added, “Teachers would be more comfortable using Knowledge Building whether they used the Knowledge Forum or whether they use their own sort of Knowledge Building technique.” He also thinks that there is a connection between good practices and positive perspective to the tool and pedagogy. He stated,

Depending on how effective that teacher was in different areas would affect that perspective. I think if it worked well in their class their perspective would have been yes, this is a very valuable tool and that I can facilitate and I can see kids going deeper we got lots of feedback on that. (Stanley, Interview)

5.3. Chapter Summary

This chapter provides results of the descriptive and instrumental case study that explores diffusion of Knowledge Building in Ontario schools as part of LSA’s Knowledge Building initiative. Findings from content and thematic analysis were applied to
qualitative data using the five-stage model of innovation decision making as an analytic framework to reveal factors that influenced adoption decisions at each stage.

Overall, findings from the in-depth analysis showed the project succeeded well in the diffusion of Knowledge Building. Data illustrated the great variety of information sources from which participants heard of and learned about the innovation. In agreement with findings in the diffusion of innovation literature, an innovator teacher, LSA District Facilitators, principal learning teams, and specific teachers with leadership characteristics all influenced early adopters at the knowledge stage. Distinct from the literature, participants additionally made use of interpersonal communication and local sources for awareness knowledge and mass-media and local sources and change agents to gain how-to knowledge. The literature indicates that principle-knowledge is highly complex for change agents and not one of their responsibilities; however, the change agents in this study developed principles knowledge in support of the innovator teacher and the resources provided by the system.

The analysis also revealed the factors that were effective in the persuasion stage. Thematic analysis revealed the following favorable behaviors: students’ engagement, agency, and motivation increased, the teaching style of the teachers became more explicit, and students started to develop deeper understanding. Findings also confirmed the literature regarding a positive relation between school improvement plans and goals and the objectives of Knowledge Building. The analysis uncovered motivations, hesitations, sources of indecision and complications, as well as factors that helped them cope with these negative factors. Participants also reported their positive experiences and positive social effects on their learning and teaching, factors that allowed them to put
Knowledge Building into regular use. As one of the significant findings, the need for systematic support was as important as the need for peer support. The chapter concluded with findings about the confirmation stage; participants acknowledged the benefits of Knowledge Building integrated into ongoing practice. This led teachers and principals to promote Knowledge Building in both professional and personal networks. Overall, findings showed diffusion of Knowledge Building in the Ontario context and uncovered effective and ineffective practices to better inform others wishing to embark on a Knowledge Building journey.
CHAPTER 6

6. Results Part (2): The Case of Upper Grand District School Board

6.1. Chapter Overview

This chapter presents the case study of Upper Grand District School Board to illustrate a sustainable model for growing Knowledge Building Communities within and across schools. Addressing the second research question, this chapter aims to provide insight into principal learning team support for teachers implementing effective Knowledge Building practices in their classrooms. Major challenges addressed include how collaboration across principal learning teams and professional learning communities affects implementation; motives for building a board-wide collaboration culture; cross-curricular and cross-panel development of strategies; and creating an environment and conditions for success. This chapter addresses the second research question regarding specific learning practices in the adoption process. Qualitative analysis includes (1) interviews with teachers and principals, (2) transcriptions of webinars including presentations, questions and comments from the chat windows, (3) LSA “More Real Stories”, and (4) analysis of principals and teachers’ presentation documents used in events to provide examples of effective practice grounded in Knowledge Building pedagogy by teachers and administrators. This chapter begins with an account of Upper Grand District School Board motivation for building a board-wide collaboration culture, their framework for cultivating a collaborative culture between schools, challenges encountered during their collaborative learning process, and accomplishments. I conclude with descriptions by principals of teachers’ and students’ perspectives toward Knowledge Building.
6.2. The motivation for building a board-wide collaboration culture

The journey of Upper Grand District School Board with Knowledge Building started before LSA’s Knowledge Building initiative, but the LSA initiative gave it new life. Four principals from one elementary and three secondary schools have been involved in the LSA projects together since 2010 (MRS-Ch.13, p.73). Their initial work with LSA was around the use of the Teaching-Learning Critical Pathway process to improve teachers’ instructional practice in math classes. However, the proposal with the title “Re-Engaging Students Using Knowledge Building”, which was submitted by Edward and Andrew through a grant called “Great to Excellent – Innovative Programs and Practices” in the 2012–2013 school year, started a new chapter of their LSA journey. The focus of this proposal was on the introduction of Knowledge Building to a group of teachers at three secondary schools and one elementary school. It also included the work with LSA that focused on collaborative inquiry and the use of technological tools to create sustained collaborative processes in the classrooms.

After these four principals worked on several projects mostly focused on math, Edward brought Knowledge Building pedagogy on the table as a new focus of their next project. As they saw the full potential of Knowledge Building as an innovative pedagogy to help in achieving 21st century learning goals, they decided to introduce it in their school board. Edward mentioned that

(…) so we got together and thought it would be really great if we could get some teachers on board to demonstrate this work in the classroom. So that’s where we started and just started bringing our teachers to the table to talk about how we can try to change and impact the traditional classroom experience. (Edward, VLS-P, 18.09.2014)
This endeavor was explained in the chapter written by the four principals for LSA More Real Stories in the following way: “Our work has included both cross-curricular and cross-panel development of strategies and supports for teachers to enhance practice, centered around asking students to explore deep and meaningful questions connected to curriculum and the world around us.” (p.73). Edward stated, “the common question and goal that we rallied around was how can we improve inquiry and teaching models, engage students and support students for preparation for life and a modern economy?”

Drawing from Andrew’s presentation, he also explained that

(…) we often wonder why do we see kids in elementary school with this full of wonderful questions, full of curiosity and then overtime, through education, ask less and less questions, and from our perspective, it’s less and less engaged. So, building on an earlier slide, we tapped into that curiosity and common question related to engagement and pedagogy and looked at ways that we can try to improve and enhance an already strong education system. (Edward, VLS-P, 08.10.2015)

The members of this principal team had started to introduce Knowledge Building in their schools independently before it became LSA’s main focus in 2013. Then the time came when LSA officially started its Knowledge Building initiative, as Edward mentioned, the principal learning team decided to merge these two things together. He stated,

(…) all of us are supposed to be part of PLTs; Principal Learning Teams. And for the three of us, because we were involved in the LSA and doing this work together and we are interested in it, we thought well let’s make this our PLT. So let’s leverage the time we have been given, rather than creating another project or another new task, I think the challenge for schools, for principals and leader is that there is a lot of things to do. So how can we, how things complement each other? Or working in the same space so that’s what we did, we have to be part of a PLT, we're already doing this work together, let’s marry the two. (Edward, Interview)

It was also disclosed in a presentation made by the principals that their Knowledge Building effort was complemented by their previous work:
Our work with Knowledge Building complemented the work we were all doing connected to collaborative learning in mathematics and other subject areas. Developing our understanding of Knowledge Building strategies and through the use of the Knowledge Forum software was based on the concept that students are working to solve problems or answer questions connected to the world outside of school, that are current. (CBAQ:DKBC)

They decided to start small by initiating this cross-curricular and cross-subject effort in four schools. Edward stated, “So, we focused on small groups initially from four schools in both secondary and elementary panels focused on department and subject areas that lend themselves well to Knowledge Building” (VLS, 08.10.2015). He explained the selected areas for the beginning as, “those areas that tend to be related to social science, science, things that have not natural curiosity or natural controversy in terms of debate. We migrated to include more subject areas overtime.” Stanley’s words corroborated Edward’s statements about their initial efforts:

(…) once the teachers got an introduction and got a feel for what it was we talked about how that might look in those specific classrooms, from those teachers, from the cross panel whether it was in an elementary school where there was a science classroom, which Andrew was teaching in or how did that translate into maybe a math classroom or a history classroom or some more difficult subject areas that Knowledge Building hadn't been used before. (Stanley, Interview)

His statements about cross-curricular and cross-subject issue were also aligned with what Edward mentioned:

So that was our initial session was talking about how we might bring Knowledge Building to each individual subject area or classroom and how we might collaborate. As we walk through the process. So we went back and we attempted to try Knowledge Building to each one of our different states and the way that the project where we would come back and revisit it every time (Stanley, Interview).

Edward articulated that they had always applied the basic concepts such as the principles of Knowledge Building, asking students authentic questions, getting them to do research, work in groups and so on even from the beginning. However, he developed an
explanation for the acceleration in the adoption of Knowledge Building in their school as well as in the board, suggesting it was because of the initiation of a systemic project by the LSA team. He noted that Andrew was the only person who was doing Knowledge Building in his class and who had any capacity for this before the LSA project. Also, his first attempt to introduce it in his department before the LSA was not completely successful. Although some of the teachers were interested in trying it in their classroom, his department never adopted the full version of knowledge building. The LSA’s initiation of Knowledge Building in 2013 and the events to support teachers and principals in the Board provided a clearer message as well as systematic support for the potential adopters. He stated in the interview, “Once you start getting into one, I think the clearer the structure of Knowledge Building, a more purposeful kind of project management of the teachers and Knowledge Building becomes, and it was the LSA project that we started in the board.”

6.3. The framework to develop collaborative cultures between schools

The success of this principal learning team in creation of the environment and conditions for dissemination of Knowledge Building in the school board was appreciated by LSA colleagues who suggested it as a model for other schools and school boards. Drawing from the Upper Grand District School Board team’s presentation in a webinar, this higher uptake can be accounted for by five key factors (VLS-P, 12.06.2015):

1. A trust culture and creating a supportive environment
2. The professional learning process
3. Sustained teacher engagement
4. Participation of administrators; being a part of the learning culture
5. Overcoming obstacles together; the collaboration of professional learning communities
6.3.1. A trust culture and creating a supportive environment

As Edward clarified, one of the pillars in their effort is providing a culture of trust for everyone in the group:

I think one of the first things that happened for us was that the culture of trust and support, and the culture of trust and support started from our superintendent and principal program. (…) We all knew that if we didn’t quite work out the way we wanted, we had lots of tools in our back pocket to fix things and try again tomorrow. So, that culture of trust and support made it very safe for everybody to try something new and take a chance. (Edward, VLS-P, 12.06.2015)

As a result of the thematic analysis of the data from a variety of sources showed three major factors affected the creation of trust culture and support: (1) An encouraging environment; (b) involvement of the all parties into the process; and (c) accountability.

6.3.1.1. An encouraging environment

Edward stressed that they created an environment in which the teachers did not avoid making a mistake or talking about their ineffective trials. Controversially, they were allowed to develop strategies together, share with each other, and develop a new culture rather than refining the current one (LEKBT). He claimed,

All the way through to the classroom with the teachers and their students and we have created an environment where everybody felt safe to play, explore, try something different and there is that also, the safe feeling of safe place to fail. (VLS-P, 12.06.2015)

Stanley’s statements about the safe and low-risk environment are in accord with Edward’s claims:

The other one that was really key was safety for staff. Staffs need to feel like we, they can take risks and we created an environment where they were able to start in a low-risk environment, and as it progressed through time, we were able to see people taking more and more risks. There are teachers even standing up in front
of everybody saying, “I don’t even know where to start. Can you help me out here?” (Stanley, VLS-P, 08.10.2015)

6.3.1.2. Involvement of the all parties in the process

Edward stated that they created an environment for the participation of different parties in this learning process;

So, in essence, what we did from a cultural standpoint is try to mimic Knowledge Building environment for administrators, teachers and students right through the system. Perhaps, try to get people on board. In starting out our project, we felt it was really important to have the right teachers in place to help us create the environment, not only for the staff and people running the project, but for the students as well. (Edward, VLS-P, 08.10.2015)

In the same webinar, Stanley similarly highlighted how sharing this experience all together positively affected the results of the project: “I think part of what was successful is that all the administrators and everybody that was around the table was new to the Knowledge Building. So, we were all able to play and experience the process together.”

As it was underlined in the LSA More Real Stories chapter, the close connection among all the parties was another secret of their success. It was stated,

Productive collaboration across our school system has been fostered by the close connections we have developed in our principal learning team and through program leadership at the Board level with our superintendent and principal of program. Our open discussions and shared vision has allowed us to establish conditions for teachers to work together productively. (p.76)

In LSA More Real Stories chapter, in addition to the school principals’ participation, the contributions and supports of the system were also underlined.

With everyone’s enthusiasm and support, including OPC [Ontario Principals Council] and our LSA regional mentor, we have been able to bring all the teachers in the project together numerous times to collaborate on the project. [LSA regional mentor] has been at our meetings and training sessions, offering support, asking questions and sharing his insights to help us develop learning
activities for students (…) Andrew’s practical stories of using Knowledge Building in his classroom, the presence and support of our OPC [Ontario Principals Council] facilitator, the presence of the board senior administration, and the ongoing encouragement of school administration at each site has kept the project alive and moving forward. (p.76)

6.3.1.3. Accountability

The participation of the principals in the project as learning partners broke hierarchical structures and the group developed responsibility and accountability. Stanley underscored that the accountability of the teachers was not accountability to the administration; instead it was to each other. He stated, “There was accountability back to the group so there was a real, natural, real nature thing that had developed around teachers wanting to share with each other and learn from each other” (VLS-P, 08.10.2015). As one of the members of this community Stanley also developed a sense of belonging over time as an outcome of this trust culture. “One of the other things that was really successful was that the team overtime became more and more committed to make sure that we were going to reconnect and share our ideas and our failures and our successes.” He also explained that teachers in the professional learning communities increased each other’s likelihood of implementing Knowledge Building in their classrooms:

It also created accountability to all of the teachers in that that professional learning community that they saw that other teachers were coming back and were presenting what they had tried. So teachers I guess that you will call more keen or that were more ready to try it at that particular moment in time came back and sort of present ‘this is what I tried in my classroom.’ (Stanley, Interview)

He elaborated on this as,

So I noticed there were teachers in that group that hadn't really started the process. But what happened was because they saw everyone else trying it caused them to jump on board and they were doing more and more projects because I think there was an accountability to the group as we came back together which is what you
like to see in this wasn't it. (Stanley, Interview)

One more time, Stanley reminded that it is not hierarchical accountability:

It was not an admin push at all. It was that day from my perspective felt an accountability to the rest of their peers to make sure that they were trying Knowledge Building so they can bring back something to their classroom. (Stanley, Interview)

6.3.2. The professional learning process

In this specific case of Upper Grand District School Board, the professional learning process to create a Knowledge Building culture has three pillars; professional learning that models the Knowledge Building process; cross-curricular and cross-panel development of strategies; and ongoing support for teachers.

6.3.2.1. The Professional Development that models Knowledge Building process

The four principals clarified that through the professional development model they used to introduce Knowledge Building, they primarily aimed to form collaborative teacher teams and to empower the participant teachers to create better conditions for student learning in their classrooms by working with Knowledge Building (CBAQ-DKBC).

Stanley explained that they aimed to create a different design of professional development than they typically used. He stated, “We tried to model the Knowledge Building process that we followed a principal learning team sort of learning type design, providing a hook and some engagement for teachers to come in to initially discover what was going on with Knowledge Building” (VLS, 08.10.2015). To build on this, Edward pointed that

The second key piece for our condition for success is in our professional
development model and we really tried to base it on the Knowledge Building process, and without actually asking the question, we have all rallied around the idea of how can we help re-engage students at the secondary level or keep students engaged at the elementary level. (Edward, VLS, 12.06.2015)

He explained the main idea behind their professional development design based on Knowledge Building culture as follows:

So, the filtered down effect in the classroom in terms of the students, we have got teachers over the time of their training developed a natural ability to guide students in developing questions and create conditions where the same kind of success we saw with teachers was able to be duplicated with the students at the classroom level. So, we had teachers working with students on authentic ideas. They created an environment where kids felt comfortable to share with each other. So, we talked a lot about what we did at a professional level with the kids and they started to mimic that activity with students, and one of the big challenges is we have to come into the classroom where students do not naturally get a chance to ask deep, rich questions. (Edward, VLS, 08.10.2015)

6.3.2.2. Cross-curricular and cross-panel development of strategies

Rosie talked about possible strategies to connect teachers from different schools. As she explained, there are subject councils in the school boards where each school can send a representative and each of the subject areas has a representative like a math person and science person. The representatives come together with the other representatives from all the other schools and they get to further the conversation; they usually set a goal or a project for the year that they want to work together. For instance, Vincent is in one of those subject councils and he can talk about his connection to other people who are teaching social science at other schools and they are trying to come up with some idea that they can all work on during the year. Rosie brought an example from one of those meetings, which Vincent joined a few days ago. Rosie stated,

He [Vincent] said in their group they were talking about the mind set mathematics and the ability to for kids to want to be successful and to know that if they work
hard they can be successful and not to kind of quit and give up but to persevere and that Math is about hard work and practice and effort and trial and error and it is okay to make mistakes. (Rosie, Interview)

Rosie elaborated on this example by saying “that sort of mathematical mindset is what they want to work on across all the schools so they talked about what kinds of things they might do, they talked about a resource they wanted to read.” She explained that cross-school work is possible through such groups like Vincent has involved in and because the representatives make a bridge between their departments and schools and the others.

6.3.2.3. Ongoing support for teachers

The ongoing support for professional learning is provided by the system based on follow-up meetings and events as mentioned by Edward in a webinar: “Our next steps at the system level is to continue to support teachers in the professional development model that we have developed. It has been one based on regular meeting, regular sharing, regular collaborating” (VLS, 10.03.2015). He also talked about their effort to sustain and expand their capacity to include upwards teachers in all grade-levels. Within this effort, they intended to refine their practice by organizing sessions with experienced teachers where they can collect data and conduct analysis such as comparative analysis and/or action research. Therefore they intend to develop a further understanding of engagement of teachers and students in the Knowledge Building classrooms. Moreover, they aim to train new teachers who are enthusiastic with Knowledge Building to build foundational pedagogical practice in their schools. They defined another component of ongoing support as capacity building, which is simply providing release time for the participant school teams to identify supreme Knowledge Building cases (VLS-P, 26.02.2016; VLS-P, 10.03.2015).
Edward pointed the emerging need of focusing on more issues to improve their professional development meetings with the participation of new schools and teachers in to their group:

We have schools participating in the project that are beyond the LSA group, which has been a big thing for us and we want to expand it beyond that as well and start looking at exploring various assessment models; how can we really quantify student success and learning and using comparative analyses and action research models to support that collection of data? (Edward, VLS, 10.03.2015)

6.3.3. Engagement of teachers and collaboration across the system

The Knowledge Building approach was utilized to engage the teachers in purposeful learning that would make a difference for the students in their classrooms. They provided focused support and opportunity for collaboration within a community of learners for their teachers. As the principals briefly explained, the teachers were collaborating with each other and with teachers from other schools “to design and implement Knowledge Building communities in their classrooms and to enhance their own understanding of collaborative learning processes” (MRS-Ch.13, p.75). The main collaboration of this learning group was based planning and exploring together, demonstrating their success as well as pitches, and committing to the series of learning sessions that spread throughout the year(s) (LEKBT). The principal learning team simply defined the professional learning sessions they designed as,

In order to support successful implementation in the classroom, teachers and administrators have participated in a series of sessions that follow a Knowledge Building process, that started with a hook, a presentation by Andrew, an opportunity to generate questions and ideas and time to plan how they may use Knowledge Building in the classroom. After their initial training session, teachers are invited back to follow up sessions to share their experiences and learning. This allowed everyone to not only hear from peers, but provided an opportunity to reflect and refine planning for subsequent Knowledge Building sessions.
More details of the first and second professional learning sessions were provided in the LSA More Real Stories chapter:

The first meeting was to learn about Knowledge Building and to develop ideas for use in their classroom. The second was to test and experiment with Knowledge Forum. These two face-to-face sessions, largely facilitated by our Knowledge Building experienced teacher, Andrew, have been key to building teacher excitement to experiment with Knowledge Building. (p.76)

Edward stated that they had resources available to engage teachers but they did not have time to go through all of them. He also gave some of the examples of the initial activities in the workshops/sessions they had with teachers by stating,

We always start with a whole video or article and ask them to write down what was interesting, what did they have questions about and something that was controversial. So that was just like getting off the ground to get kids thinking about topics. Some teachers created an activity where they just put a word on the board and the kids would just brainstorm. Everything that comes to mind, use the words from there and develop questions from the words. (Edward, VLS, 08.10.2015)

In a variety of learning sessions, teachers were engaged around several issues (i.e. evoking students’ curiosity and admiring questions, teaching question-asking skills, authenticating learning, introducing collaborative environments, and so on) to develop a substantial understanding for Knowledge Building approach and fundamental principles. The principals stated, “Developing our understanding of Knowledge Building strategies and the use of the Knowledge Forum software has been a natural extension of our work in exploring collaborative learning structures.” (MRS-Ch.13, p.75).

Regarding Knowledge Building principals, they decided to divide this learning into small steps for teachers. They started to work with four of the twelve fundamental principles of
Knowledge Building including (1) real ideas and authentic questions, (2) constructive use of authoritative sources, (3) improvable ideas, and (4) community knowledge, collective responsibility (CBQ:KBA; CBAQ:DKBC; TWK). By paying attention to these four principles, they aimed to empower teachers and students working together to improve an idea about authentic real-world problems in addition to having an inquiry focus in the classrooms and classroom. As the principals said, thus the collaboration became the new norms in their schools as a part of the culture of learning for both teachers and students. Teachers provided opportunities for co-learning as professionals and also co-learning with their students (TWK).

Andrew explained that the first thing they did was to make sure the teachers gain a firm understanding of the main aspect of the Knowledge Building. As he mentioned in the interview, he constantly told the teachers “It is not just a matter of waiting for students to do; the teachers themselves need to understand the Knowledge Building principles. First, teachers were supposed to understand what the idea improvement and what collective responsibility were.” Andrew underlined, “They also needed to understand the need to leave further questions behind in order to keep the conversation going to more and more deeper levels.” Consistently, it was mentioned in the MRS chapter as,

> When they collaborate they need to follow a process which requires them to “work a question and leave a question,” as Andrew shared with us during his presentations. This pushes students to continually respond critically and look for further clarification or improvement on the ideas presented. (p.73)

As mentioned in the MRS chapter, another significant challenge for teachers in this effort is establishing conditions and frameworks for the students who would be engaged in an idea-centered environment where they would work to refine an idea to improve them in a
collaborative manner. Teachers and principals were expected to design a framework that guides how they pull students’ attention, and how they approach this principle-based pedagogy (MRS-Ch.13, p.75). Accordingly, they identified five stages to implement Knowledge Building in their classrooms:

- **Stage 1:** Selecting a Knowledge Building topic
- **Stage 2:** Formulating questions and generating ideas
- **Stage 3:** Selecting promising questions for Knowledge Building
- **Stage 4:** Building knowledge with Knowledge Forum
- **Stage 5:** Evaluating a Knowledge Building environment (CBQ:KBA)

A richer explanation for this was also explained by the principals: In the beginning of learning process, participant teachers were asked to select a unit, which includes topics that would be of interest to students, would generate a natural discussion or would have linked to a real local and current issues. As the principals indicated, the selected topics were ranging from the origins of the universe, aging, peer pressure, and population dynamics. The principals explained the next steps as,

The next step is “hook” the students by having them generate ideas and questions on the topic, usually stimulated through a field trip, video, article or guest speaker. Teachers work with their students to help them identify open and closed questions, refine their questions and prioritize them in small groups. Eventually, the most promising questions become the anchors or big ideas that drive the Knowledge Building process. They work the questions together sharing their ideas with building on each other’s ideas. Teachers are involved in guiding the students through the process and giving feedback along the way. (CBAQ-DKBC)

However, as it was emphasized earlier, Knowledge Building is a principle-based approach rather than a procedure-based. Therefore these stages should not be considered as an approved prescribed procedure. It was also underscored in one of the principal learning team’s presentations that a Knowledge Building teacher should be immersed to the Knowledge Building community as a co-learner, she/he is not a guidance or facilitator of the process at the side (CBQ:KBA).
Another important issue discussed in the learning sessions was about the importance of the “questions”. A Knowledge Building classroom can be basically defined as question-driven community. This professional learning group also devoted their time to understand open vs. closed questions and the significance of working with open questions in a Knowledge Building classroom (CBQ:KBA). Edward mentioned that

Andrew, one of our teachers uses quite heavily a resource from the Right Question Institute. I think it is called rightquestion.org. They have got a lot of really nice resources and structures to help students not only think about the questions and develop questions, but then have discussions amongst themselves to say, “Hey, what is a good question? What is a deep question? And then understanding the difference between open and closed, so the students start to learn about questioning. (Edward, VLS, 08.10.2015)

Andrew also pointed that the most effective activity for teacher engagement as,

(…) one of the things I think, that would be really beneficial, is to actually have a Knowledge Building Community like for teachers and not like the one that exists now but one where either teachers can go or there could be at a conference where one is just strictly for teachers on how they are implemented in the classroom and that is so missing and without stuff like that Knowledge Building will not take off. (Andrew, Interview)

Drawing from his years of teaching experience he clarified what exactly need to be addressed as,

After 27 years I've seen all of the different things tried in the classroom and brought down by the board. But you need to have teachers, talking with teachers, not teachers with researchers or anything like that but teachers saying ‘this is how I would do it in my class’ and have that kind of discussion that is hugely missing and something that I hope we get some attention at some point in time that the two. You have the research on one side but on the other side open up that avenue for teachers to be able to participate and not be overwhelmed with the research because not all teachers buy into it and it's sometimes it's a tough sell in that regard but yeah. (Andrew, Interview)

On the other hand, as Stanley clarified, there are lots of different factors, which affect the level of engagement. He mentioned a case from his previous school:
At School-D the level of engagement that is, at the start would have been I asked them, they trusted me so they thought ‘OK I will give this a shot.’ But I think by the end of that original-twenty the group of five teachers I had, were really engaged in what Knowledge Building was and using some particular form of knowledge building whether it be the software or whether it be a different method.

He also explained the subject area is another factor that affects the level of engagement of the teachers with examples.

And then depending on the subject area, subject area was very dependent on how well it got some uptake. So subjects like history or certain subjects in science had good uptake because it fit very well with what they were doing. Subjects like math still struggled with the uptake on that. We have talked about it with the math department at School-D and Vincent will talk about some of the success and we talked about those same ones but they still really had trouble with our Knowledge Building would transfer into math. (Stanley, Interview)

In addition to the specific activities of this larger team, each principal individually provided supports for their teachers. For instance, Rosie explained that she supported the teachers in her school to collaborate across the system through professional development days. She gave an example of an across the system collaboration by mentioning a professional development day in which they partnered with three different schools. As she said, this event brought everyone together under one roof and gave them opportunity to work together. In the afternoon session, her teachers connected with other teachers, talked about a whole variety of stuff, they preferred to work collaboratively with the other teachers from the other schools.

After the initial workshops with the core group, Stanley also invited Andrew in his school to extend Knowledge Building to other departments and initiated more teachers who were teaching at variety of grades and subjects. He described one of the professional development sessions with Andrew in his previous (School-D) school as,
So when we did the original grade-nine implementation part of the professional development session was having Andrew come and talk about Knowledge Building. So every grade nine teacher had some Knowledge Building experience or talk about that. So we were building the program there. And then in some people that were more comfortable who were in the project our Canadian World Studies group were actually doing it on their own. They found okay we feel comfortable and somebody in the department said ‘let's talk about how we do Knowledge Building in history’ and other teachers who weren't even involved in the project became involved in the project because they were interesting to the one person that was in there. So that's how Knowledge Building spread through School-D so we would have had initially on that grade-nine year there were thirty teachers then that would have been in addition to the five teachers that were on board. During the original cycle with twenty, we were different when we had different schools going on. (Stanley, Interview)

Conner clarified how they support teachers in their schools “By professionally learning with them and giving them time to do that.” He said that they also organize workshop and capacity days where they can release them for half a day with the support of the programming department and then they would talk about Knowledge Building and how to do it in a classroom.

6.3.4. Participation of administrators as co-learners in professional learning

The principal team emphasized the importance of their own presence as the administrators in professional development sessions and LSA events, not only as an instructional leader but also as a learning partner of the teachers. They mentioned the process of their learning with their teachers as

Our principal learning team has been working together to not only provide support for the teachers involved in the Knowledge Building project, but to better understand the tools ourselves and to try and demonstrate how it can be used to support our professional development as school leaders and to support our work in schools as instructional leaders. (MRS-Ch.13, p.75)

The excerpt below from Edward’s presentation in a webinar emphasizes the difference between presence in and participation in a community. He stated,
We have talked it at OPC [Ontario Principals Council] and principal groups and leader groups, how important it is for administrators to be at the table with their teachers and one key learning that I had in this project was the difference between ‘presence’ versus ‘participation’. I know personally, I have been present at a lot of professional development sessions and things were fairly good and fairly positive, but this time, here, I was really a participant. I had no idea what Knowledge Building was all about, and in talking to teachers, they seem to really appreciate the fact that we were all in this together, which led to our last key condition for success which is overcoming obstacles together. (Edward, VLS, 12.06.2015)

Below, another piece of evidence is quoted from Stanley’s presentation:

So, we came up with three key leadership qualities or factors that we thought made our process very successful. The first one I talked about is around presence. The leader not the leader, but the being there, but being the facilitator of the discussion, and learning with everyone as a participant. It was really key that we were part of the process and we were asking the same types of questions and able to try that doing our own Knowledge Building through our principal learning team.” (Stanley, VLS, 08.10.2015)

In the MRS chapter, the principal team detailed their supportive roles:

Within our Knowledge Building principal learning team, we are drawing on experiences of introducing the Teaching-Learning Critical Pathway cycle and collaborative learning to our schools to guide our practice today. As administrators our role has been to listen, encourage and be partners in learning with the teachers. We have sat and brainstormed one-on-one with teachers for ideas on how to introduce their topic and helped look for materials (articles, videos etc) to use to encourage student thinking. We have been observers in classrooms offering feedback on student responses. We have helped troubleshoot technical difficulties and probed students, and helped to facilitate small group discussions. We have been part of the journey learning with the teachers and responding to teacher and student needs along the way. As we have learned in past LSA projects, our involvement as participants has been an important part of the process of establishing momentum in the schools for teachers to continue on with Knowledge Building. (MRS-Ch.13, p.75-76)

In the same chapter, they also stated,

As administrators we not only are learning about the process, but also working with our staff, challenging them to move with us, outside of the traditional methods of teaching to reach students in manner that is supportive of skill development in relation to the “21st century learner.” We are learning how to use this process and refining our practice as instructional leaders to support teachers
in their professional development. (MRS-Ch.13, p.73-74)

As mentioned in Chapter 5, the members of the principal learning team as opinion leaders also provided additional information sources to teachers by organizing workshops and presenting their work in webinars. Edward mentioned that he and his colleagues in principal learning team had been guest speakers, presenters, as well as participants at regional symposium, provincial symposium, and workshops, additionally they had contributed to the international staff that happened at a couple years ago and to the volumes of LSA Real Stories. Edward summarized what he gained from participating and contributing those events and resources as following:

It gave me an opportunity to think about the process what we have done; the successes, the challenges, and the gaps in what we did. I think, I learned a lot about just project and task management when you’re trying to introduce change. So what is an effective way to introduce a change into a group of individuals or group of people and that’s still an ongoing process. (Edward, Interview)

6.3.5. Interaction with the innovator teacher

The innovator teacher, Andrew described his purpose in Knowledge Building Communities as more self-fulfilling. He emphasized that no one asked him to drive this process, neither in his classroom nor in the teacher community. Because he believed the potential of Knowledge Building and experienced its influence, he became a volunteer to support its promotion. He stated,

It is a self-driven purpose and it is one that I enjoy. It is a little bit lonely at times being the drumbeater and so forth. I wish there were other people involved with that and I am sure there will be at some point in the future. But like I said it is a self-purpose and I do not have to do this. I mean Marlene [Dr. Scardamalia] has never asked me, no one has ever asked me to do workshops on this stuff in the LSA team has supported me in doing these workshops, reaching more people, providing some financial support and I greatly appreciate that. So, I guess it's more self-fulfilling. (Andrew, Interview)
Undeniably, Andrew influenced both his school and school board as the innovator teacher. He not only initiated Knowledge Building in the school board, but also provided lots of supports, guidance, and motivation to the teachers. As it mentioned several times in different sources, his cooperation was highly appreciated by the principals. They stated,

Our work was guided by the expertise and experience provided by Andrew, who was working with Knowledge Building through his doctoral studies. Andrew is a teacher in our school board and through his connection and experience with knowledge building with Dr. Scardamalia from OISE, he has provided the schools with a local expert that teachers can regularly go to for support and insight. (CBAQ-DKBC)

Andrew expressed that after his initial presentations to other teachers, Knowledge Building has rapidly grown in the school board. He stated,

I think that I've shown people enough about what Knowledge Building can do to a classroom for them to at least consider it and therefore at least try it. And I think there's evidence in our board that shows that my initial push of Knowledge Building into our board made kind of like the innovation if you will start. And that's something I will always be proud of because there's little pockets of people doing Knowledge Building here, there, and everywhere and it would have never -- I have to be modest for a moment-- it would have never started if I did not say ‘Hey here is something that you want to try. This is something I have tried and it is fantastic and this is how you do it.’ (Andrew, Interview)

Correspondingly, he emphasized that he developed a procedural approach to support teachers for the implementation of Knowledge Building in their own classrooms. He explained,

I think one of the things that I have done is not just to bring the Knowledge Building in but I also --I am going to be bold here-- but I also innovated a procedural approach to it. So the bottom line is that OK this is Knowledge Building these are the twelve-principles but teachers need to know ‘OK how do you make this happen in the classroom” What do I need to do? And so that's what I did.’ Over the three or four years of working with it I refined the process and I thought OK, I see this as this happens, this happens, this happens, this happens,
and so forth. Once you have got duh, duh, duh, duh, duh then you can package it together and say ‘OK teachers, here is something really cool called Knowledge Building and here is the theory behind all building and why it works and so forth. But this is how you do it in your classroom.’ (Andrew, Interview)

On the other hand it was also an ongoing learning process for himself with other teachers:

(…) I was new at it as well. So it is not like, I had like ten years prior experience with Knowledge Building. So I am doing Knowledge Building, I have done it up to that time probably for about three years and all of a sudden I am starting to kind of train other people and then you know I do not say it was the blind leading the blind. But it was not really because that was part of my research, my Ph.D. thesis. So I was still learning as they were learning. I was just like three-four years ahead of them. (Andrew, Interview)

The principals touched on the positive effect of having a local expert in their school Board. They stated, “Andrew’s connection and experience with Knowledge Building through his work with Dr. Marlene Scardamalia has provided the school with a local expert who teachers can regularly go to for support and insight” (MRS-Ch.13, p.75).

Edward’s words below are also admiring Andrew’s significant contribution to their endeavor:

Looking at the engagement of teacher again, linking back to the culture of trust to the support, the question that we are all battling with was the enthusiasm. We had the good fortune of having Andrew here with us in our board. The enthusiasm and success that he shared with us in his own classroom was really easy to get behind. So again, when we had our initial project of twenty teachers, all twenty of them were really engaged and keep trying with this project. (Edward, VLS, 12.06.2015)

6.3.6. Overcoming obstacles together: Building a culture of collaboration within and across the schools

As explicated in the MRS chapter, teachers and principals engaged in impressive collaborative activities. The four principals stated,
Although there have been collaborative efforts between schools and across panels in our past projects, our work in developing and implementing Knowledge Building Communities in schools over the last two years has been our most collaborative effort, with both administrators and teachers in both panels, working closely together to develop understanding of the Knowledge Building concepts and to develop an implementation strategy. (p.73)

They defined their professional learning communities as an “ultimate PLC” where they had teachers who were sharing ideas and brainstorming together, they came to the table and talked about the issues difficult to solve, they needed and wishing to learn more, they bravely asked for help from others in front of the other teachers who they met first. Edward said “that was a key factor in moving forward” (Edward, VLS, 12.06.2015).

For instance, in School-B the teachers started to collaborate within their professional learning community as soon as they identified a unit for their Knowledge Building practice. Their collaborative activities were explained in the MRS as,

> Working together in their subjects and across disciplines and schools, they have developed shared materials at a variety of grade levels, and are supporting each other through the process. Teachers are also paying close attention to key learning skills (such as self-regulation and organization) as some students may need assistance in further developing the capacities they need to be successful in the Knowledge Building environment. (p.74)

The teachers in School-A had a collaborative effort both in their school and with teachers from other schools. It was reported in the MRS chapter as, “They are collaborating with each other and with staff from other schools to design and implement Knowledge Building communities in their classrooms and to enhance their own understanding of collaborative learning processes” (p.75).

Stanley expressed his thoughts as “It was interesting to see it as more of like a professional learning community develop probably one of the best professional learning
I have been involved with, because you have teachers who are all trying something that was totally new to them.” Then he clarified what makes those professional learning communities special for them as,

> It was everyone was on the same playing field that even the administrator is the only person who had a little bit more knowledge believe at that point was really Andrew who had been trying it in his classroom. So as we got came back together it was evident that teachers were becoming more and more open about what they were doing and how things were working and how and more importantly how things were not working well in their classroom so that they could change their practice based on feedback from other teachers. Well ‘I tried this in my class’, ‘I tried this in my class’, and ‘this worked well’ and ‘this is how I structured it’. (Stanley, Interview)

Edward mentioned the professional learning communities collaboration to overcome difficulties together:

> Out of this whole process, we have seen a lot success around the support and building capacity within our schools and we’ve jumped in with both feet with administrators and teachers working together from day one in learning teams. We have teachers and principals collaborating consistently with each other on developing Knowledge Building Communities in the classroom, how to overcome challenges, and part of that success is also looking at having teams within schools to collaborate. So, there’s constantly a group of people that have an ongoing conversation. (Edward, VLS, 10.03.2015)

As the principals conveyed, the personal and professional characteristics of the teachers who involved in the professional learning communities play an important role for the engagement of the teachers and success of their work. Edward stated,

> We have looked for key characteristics in initial teachers or help drive the challenges to navigate the swamp if you will. So, some of the characteristics in teachers, we’re looking for are resilient, curious and flexible and willing to muddle through. Since that initial setup, we’ve really had a huge uptake in terms of; I think just natural curiosity of teachers. We have had a number of teachers and principal come to say, “Hey, how can we get into the game?” With over forty teachers and seven schools involved right now and another half dozen or so curious, decide to get involved down the road. (Edward, VLS, 08.10.2015)
Both in their presentations and MRS chapter the principals explained what they gave attention while forming the teacher team for this project. As they mentioned, be resilient and curious about how classrooms can be different (TWK-P). They stated, “Teachers who were selected to participate have shown an interest in collaborative learning structures or have been working with technology in the classroom to help students develop 21st century skills” (MRS-Ch.13, p.75). On the other hand, principals explained that although some of the participant teachers were curious about new methods and pedagogies, they were reluctant to use digital technologies or completely adopt collaborative learning structure. However, they had a shared interest to look for the ways to improve student engagement in the classroom and to support their students to develop their skills for our modern economy. They also took into consideration different disciplines including science, math, social sciences, physical education, and health.

6.4. Challenges and accomplishments

One of the challenges reported by the principals was timing. Principals explained that because they could start the projects in many of the schools and classrooms after the March break, students had struggled to understand some components of Knowledge Building and it took time for them to figure out how to make use of them in their postings in Knowledge Forum. They also mentioned that some of the existing scaffolds did not address for the grade level or course material and the teachers needed time to manage how they could create their own scaffolds. They overcame this challenge by developing new materials in collaboration among the teachers and administration.
Another challenge they encountered was in relation to technological issues. Initially, some technical problems with software and hardware caused delays in some classrooms. The principals have been working on those problems with system staff to provide a sustained technological support. On the other hand, they stated, “… but also by keeping in mind that the knowledge building process of collaborative learning, and working to develop an “improvable idea,” allows us to adapt when technology is not working at its optimal level” (MRS-Ch.13, p.76).

There are also conceptual tensions inherent in adopting a new pedagogy. As explained before (see Section 5.2.2.2), uncertainties are often related to fear factors surrounding meeting curriculum goals, doing well on assessments, and so on. Some teachers worried about their students competencies in asking good questions, reflected in statements such as “Oh, not my kids…, it is not appropriate my grade-level.” Indecision was also due to fear of turning control over to students. They feared doing something wrong and letting students learn something incorrect or developing misunderstandings. For a few teachers, abandoning the teaching tools they had been using was another source of uncertainty.

Nevertheless, the principals, in cooperation of Andrew and participant teachers, helped them overcome concerns.

Principals explained that one of the accomplishments of the project was integration across a variety of subjects and grade-levels. No one abandoned the process and with respect to students’ achievements, principals reported high student engagement and students’ voice honoured in the classrooms. Students developed a sense of belonging in their Knowledge Building Communities, acquiring skills for an information age and taking greater agency for their own knowledge advancement.
The other important gain of the project was the creation of a professional development model for Knowledge Building useable by other principals and teachers.

6.4.1. Insights from teachers and students

As indicated by the principals, teachers consistently showed enthusiasm and reported improvements of their students’ ability for deeper and more critical thinking, with greater student engagement (CBAQ:DKBC). The principals provided statements from teachers who shared their learning and success supported by ongoing professional development sessions. A few examples of teachers expressions are as following (TWK):

- “I am more thoughtful about how to involve students more in all parts of the learning process, how to focus on students doing and thinking and how I can facilitate learning.”

- “Perhaps the biggest bump is that it eliminates the question "Why are we learning this?" "When are we going to ever use this?" because the initial questions are created by students; and it is that investment/choice in the direction of their learning that creates immediate validation.”

- “I loved meeting with teachers from various schools because I got to learn from people I don't usually get a chance to work with, to get various perspectives.”

The principals provided statement by students from Upper Grand District School Board as well (CDQ):

- “Knowledge building (KB) was a great way to learn new subjects. Being able to research and leave notes for others to read, as well as ask questions about the
notes freely, was a good way to understand the topics better.” (grade-twelve student)

- “I felt that the KB assignment was a great way to get us thinking outside the box, and good practice of our collaborating skills.” (grade-twelve student)

- “To start working on KB you have to have an open mind and be ready to research. Its fun starting off with a few ideas and watching them turn into a huge amount of information.” (grade-twelve student, School-A)

6.5. Chapter Summary

At the meso-level of analysis, I focused on the endeavor of a single school board – Upper Grand District School Board —that achieved the diffusion of Knowledge Building across three secondary schools and one elementary school. Addressing the second research question, this chapter explored principals’ and teachers’ efforts to seed effective practices grounded in Knowledge Building pedagogy in those schools. Through narrative and thematic analysis, Upper Grand District School Board’s case was illustrated as a sustainable model for Knowledge Building Communities across the school board. The work began with the intention to nurture a board-wide collaborative Knowledge Building culture. Their framework for developing teachers’ learning and buy-in involved five keystones: (1) building a trust culture and safe environment to take risks and develop accountability to one another; (2) developing cross-curricular and cross-panel strategies to model Knowledge Building Communities; (3) sustaining engagement and supporting collaboration across teachers and principals in the board; (4) involving principals as co-learners and fostering interactions with the innovative teacher; and (5) collaborating within professional learning communities to overcome complications together. I
concluded with teacher and student statements that reflect their insights on key issues raised in the chapter.
CHAPTER 7

7. Results Part (3): Knowledge Building practices from classrooms

7.1. Chapter Overview

This chapter reports five short cases of teachers Knowledge Building practices from primary and elementary classrooms to provide evidence for the level of teachers’ and students’ engagement in Knowledge Building Communities. To investigate this third research question, teachers’ presentations in the webinars that include details of their classroom practices were analyzed. I used twelve Knowledge Building principles as the main indicators of Knowledge Building practices. In each cases, I introduce the teacher(s), grade-level, subject, and school and present a general description of classroom activities and Knowledge Building practices taken from teacher reports. I use these to reflect on successes and weaknesses of their implementation of Knowledge Building and to summarize for each how they use the twelve Knowledge Building principles.

The five cases were selected out of a total of 18 classroom stories told by teachers in the webinars and interviews. To select five cases I looked for examples of Knowledge Building principles in teachers’ accounts. Thus the selection criterion may reflect optimal use of principles as opposed to more functional or typical performance (Fischer, 1980; Fischer & Pipp 1984). Since the goal is to convey potential, optimal performance is preferred. At the same time, it is important to keep in mind that the examples may not represent typical cases.
7.2. Case #1: Knowledge Building in grade-one math class

7.2.1. Introduction

This case was provided by the two teachers Rosa Baskerville and Virginia Savega from School 5 in School Board-44, in the LSA webinar on March 10th, 2015 (see https://vimeo.com/135603916). Rosa Baskerville had been a student success teacher and Virginia Savega taught at School-5 in 2015. Rosa and Virginia shared their adventure on Knowledge Building with the focus on Grade 1 math. They chose to focus on the knowledge-based activities from the grade-one curriculum expectations.

7.2.2. Classroom activities and Knowledge Building practice

Their initial activity was primarily based on small talks and number talk in a Knowledge Building circle. Rosa reported the initial question they gave the students as, “take 20 counters and separate them in the three piles; one pile has to be double the other pile. What are the possibilities?” Rosa indicated that with this problem, young students had difficulty differentiating between the concepts of doubles vs. the OO (double O). Rosa and Virginia also identified several issues: the problem was not authentic for their students as suggested by the fact that some students were not involved or engaged, some students experienced language difficulties which may have distorted their understanding, the students were not building on each other’s ideas and thinking but rather seemed self-centered in the sense that they were not willing to explain their thinking to others.

Based on lessons learned from this initial experience they explained that they asked themselves “what could we do to get everyone involved in to the process?” These reflections led them to design a new activity requiring spatial reasoning, accountable talk
in the form of partner turn and talk, group sharing, gallery walks, and conversations and questions.

Virginia mentioned that they decided to start with geometry to focus on visualization of shapes as well as composing and the decomposing of shapes in an inquiry that lasted about five days, an hour each day with a “frontloading” task that consisted of children working with four cubes to engage interest and to practice as a whole group (see Figure 7). The teachers asked the students to build as many figures as they could using four multilink cubes and used a smart board to encourage students to communicate and model different possibilities.

*Figure 7. Student linking cubes, by LSA, 03.10.2015. Retrieved from [https://vimeo.com/135603916](https://vimeo.com/135603916).*

Using the smart board the students tried to move four shapes to build different figures where two sides were connected. Following this, teacher gave four toy cubes to the students to work with. Students sat beside each other on the floor meeting area and moved the cubes around to show different ways of placing cubes together and trying to describe how they did that. Then Rosa and Virginia divided the students into smaller groups and they continued to work on their models (see Figure 8). The students went
back to their desk to work with the linking cubes and they were asked again to build as many possibilities by using four cubes. While the students were on task, Rosa and Virginia observed how they built their figures.

As the teachers report, when the students got stuck and could not build a new figure, they made use of the gallery walk: teachers told all students to take a walk and look at other students’ structures. They also reminded students to discuss with each other how they had built different figures. As Virginia reported some students made the discovery that the cubes could be built in an upright 3D fashion.

![Image of students building figures with linking cubes]

*Figure 8. Students building different figures with cubes, by LSA, 03.10.2015. Retrieved from [https://vimeo.com/135603916](https://vimeo.com/135603916).*

After having the gallery walk, students went back to their own stations and tried the new ways they observed and discussed with their peers. Virginia emphasized the communication among the peers; students asked questions, refined their ideas, and modeled different possibilities through the conversation they had. As expressed by the teachers, in this process, the language emerged while students were describing how to place the cubes together; they would turn, move, flip, twirl, and so on.

The teachers reported initiating a new problem after students began working as a
community. The second problem involved work with 2-D tiles. The teachers presented the problem, which was to make some keys that fit the *tooth fairies’ treasure boxes*. The question was how many different keys they could make by using only five tiles.

According to Rosa and Virginia, the challenge of helping the tooth fairy to make keys was very appealing for the six-year-olds and the teachers considered it an authentic problem. They also set a working environment with a partner in a game situation. Each pair of students was given a set of frameworks in which keys were hidden. Taking turns, one partner made a key by using five tiles and the other duplicated it. Following this, they had to find the corresponding key in the ‘treasure box’, which was represented by the hidden pile. They then compared the master keys to their tiles to confirm that they had the right key. Students were engaged in this activity working and discussing until most of the twelve possible keys were assembled. Rosa and Virginia emphasized this activity was about partner talk as children compared their keys.

*Figure 9.* Grid paper and tiles for ‘Tooth fairies’ treasure boxes’ activity, by LSA, 03.10.2015. Retrieved from [https://vimeo.com/135603916](https://vimeo.com/135603916).

Virginia mentioned the emergence of math language at this point

As a group, we discussed the different formations of keys. One child was asked to show us a “key” using five tiles and as a group we each duplicated it with our set of five tiles. It was during this community sharing that discussions arose talking about keys being the same, but made in a different direction. As a result of this discovery, math language emerged to express the position of the tiles; turns, flips. (Virginia, VLS, 10.03.2015)
Then the teachers gave a large piece of grid paper and five tiles to each student and the children were asked to record on grid paper keys that they had made using the five tiles. Teachers reported that students expressed frustration as they felt the task too hard and wanted models to follow. Rosa and Virginia reported that it was hard to hold back on providing the direct support the students requested and instead encourage the students to look at the work of their peers to get ideas, to question their partners, to make a few keys and to reflect and share ideas. Virginia noted that as children who were at first experiencing frustration saw different ideas and revised their work they began to feel confident and to use math language in a very respectful manner in their discussions. They were ultimately pleased that they did not rush in and rescue the students and underscored that standing back was difficult—but using questions to provoke thinking and encouraging students to improve each other’s ideas proved especially rewarding. They said it was blessing for them to see these young students make connections, demonstrate perseverance and learning and take charge.

Moreover, teachers suggested that this open-ended activity allowed for different ways to solve the problem, providing and an entry point for every student. Virginia and Rosa thought this activity was highly productive for all of the students and provided for discussion of different math concepts.

Teachers noted Knowledge Building principles that guided their practice. For instance with respect to the *community knowledge collective responsibility* they reported that all students contributed to the math circle when they were working in groups. They emphasized the importance of students’ voices being heard and acknowledged and also noted that students were very respectful to each other’s ideas. Another principle they
emphasized is *democratizing knowledge* that was accomplished as all students were interested in and engaged with the materials and they were willing to share their ideas. Based on teachers’ observations, every student was enthusiastic to share their ideas, engaged with the activities and showed willingness to express their ideas and listen to peers respectfully. Based on their reflections on their own Knowledge Building journey, the teachers noted the second activity as a shift to authentic problems, giving students greater purpose. Considering the *pervasive Knowledge Building* Virginia provided an example from her classroom.

One of our little guys was sharing his work with the class. He was asked how he found all the keys by one of the kids and he looked at them and very gently just said, “I just could not get this idea out of my head that I had to find all those keys.” So, I think that looking back, that was just a really nice realization that it carried on at home and he was again thinking about it the whole time and could come back and share with the kids. (Virginia, VLS, 10.03.2015)

With regard to *concurrent transformative embedded assessment*, Virginia made use of conversations, students’ use of vocabulary, progressive language and its relation to math for ongoing assessment in her grade-one class. She told that the evidence was on the grid papers; how the students show their keys, how other children could walk around, compare and make references to it and with pictures that they took. She also used her observations for assessment. As she stated, it was so important at the primary end. She explained that through the game, students were able to see different shapes and different ideas on the floor when they were creating and sharing and when they were doing their gallery walk; students were looking and comparing different shapes of keys.

For their initial trial, Rosa and Virginia did not include any use of technology but Rosa noted that they would be using Knowledge Forum as they wanted students to contribute
drawings or pictures of their work to support discussion

7.2.3. Summary of Case #1

Rosa and Virginia reflected on their practice. After their first trial, they evaluated the effectiveness of their endeavor, identified what worked and did not work, and realized two essential component of Knowledge Building were missing; *collective responsibility, community knowledge* and *real ideas and authentic problems*. However they were not discouraged and they started to work on a new design—a more authentic activity to addresses grade-one student interest. They made use of gallery walk and math talk to support student discourse.

In line with *Real Ideas, Authentic Problems*, teachers made use of open-ended activities that helped engage *Idea Diversity*, supporting differentiated instruction so that activities could become meaningful and attractive to the students. These open-ended activities were also significant to provide problems to the students to work on the *Improvable Ideas*; according to teacher report, with the first problem students only focused on finding the solution; with the second problem there was more discourse and idea progression.

Teachers were more successful in relation to the principle of *Epistemic Agency* during this second initiative, with students taking higher levels of control of their own learning.

*Democratizing Knowledge Building and Collective Responsibility, Community Knowledge* were also visible in the classroom, with every student engaged and expressing their ideas and respectful in listening and trying to understand each other’s ideas. The use of *Pervasive Knowledge Building* was exemplified by Virginia as she conveyed in the quote above regarding reflection on possible solutions even out of the school.
Considering *Embedded, Concurrent and Transformative Assessment*, teachers collected evidences for formative assessment throughout the activity. They monitored the students’ conversations and use of vocabulary and evaluated the progressive language. They also used the activity sheets, students’ products like shapes they created, and also personal observations. The use of math language was helpful for the teachers to sustain the *Knowledge Building Discourse* among the students. Students consistently asked questions to peers and refined their ideas, they observed others’ models and listened each other different ideas, and finally tried them themselves. The emerging math concepts can be shown as evidence of discourse and the idea exchange among the peers for *Idea Diversity*. With everyone’s contributions and conversation with each other during the gallery walk and then back in their original groups to talk about and try other ideas provided *Symmetric Knowledge Advancement* in this grade-one Knowledge Building Community.

### 7.3. Case #2: Integrated Curriculum and Differentiated Instruction with Knowledge Building with grade-three students

#### 7.3.1. Introduction

This case is based on an analysis of Freya Carlson’s presentation in the LSA webinar on February 26\(^{th}\), 2016 (see http://www.curriculum.org/LSA/virtual-sessions-11.shtml#theroad). Freya taught a grade-three class at School Board-10 in 2015. Even though she had attended a few workshops on Knowledge Building and was feeling excited to get started, she did not know how to begin. The school improvement plan included improvements in math so she decided to begin her Knowledge Building journey
with math focus on March 2015. Freya expressed that she had a pretty strong feeling for her students by that time and she knew their likes and dislikes. As she expressed it, many of the students had a strong connection to animals because in the area they lived, there were many local farms of various kinds. She decided this might provide an authentic context. Since Freya was teaching grade-three with EQAO (Education Quality and Accountability Office) testing mandated, the math curriculum focus was important for her; she also wanted to engage students’ curiosity to support their work.

7.3.2. Classroom activities and Knowledge Building practice

Freya hung a picture of a barn door (see Figure 10) on the classroom wall. She gave each student a few sticky notes and asked them to write down what they knew about the farms thus leaving the question very open. The students were hesitant at first which she attributed to their concern about writing something wrong. They asked clarification questions like “Do you mean a farm?”, “Do you mean just the door?” and so on. After she reassured them that there was no wrong answer and all ideas were welcomed, students started to write down what they had already known about the subject. Therefore, Freya collected a variety of responses that demonstrated students’ knowledge about farming.
After students presented their ideas, Freya asked students what they were still curious about. Once again, she gave them sticky notes to write down their ideas on. Subsequently they had a discussion on both sides; their background knowledge and their wonderings.

Freya stated that when she looked at all comments and questions of the students, she noticed that some of the students had a lot of knowledge about farming, others almost none. Another thing she realized was that students’ questions fell roughly into three categories: 1) language, 2) science, and 3) math. Freya gave some example. Language: “Why are barns red and who invented them?”, “How do you make wool?”, “How many animals are on the farm?”, “Which eggs have babies?” Science: “How big are farmers’ crops?”, “How do you grow bean?”, “How do you turn wheat into bread?”, “How do they clean the milk?” Math: “Why do barn doors have that shape?”, “Why do they have “X’s” on them?”, “How do they sell the food they produce?”, “What Math would farmers need to know?”

Freya selected the last question as an example to use in her classroom. She put up chart paper posters around the class with this question “what math is used on the farm?” Then

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she broke the class into groups and gave each group a colored marker. Students recorded their answers on the chart paper first and then they had a walk around the classroom to see other groups’ answers. Each group left one member behind to explain the thinking of the group to the visitors. Students were encouraged to make comments on the other group’s posters and supported them in discussion for how this would be done and what kind of comments and conversations would be appropriate.

Freya then expressed that something fantastic happened in her classroom. One of the weaker students who lived in the country and had horses and whose grandmother owned a farm became one of the shining stars of the interchange. He had a great deal of background knowledge that he shared. Another thing that impressed her was increased student agency. As she explained, the students were asking questions, discussing their answers with each other, and writing down more questions based on what had not been answered yet. Their questions became more and more meaningful over time. The simple questions in the beginning were turned into more purposeful questions. For example, while students were asking “why is the barn red?” early on, over time they started to ask questions such as “how much milk can a cow produce?” and “what would happen if they did not produce enough?” The teacher was able to build on student interests for many lessons.

Freya found some videos and other sources on the Internet to help students and invited an expert into the classroom to make a presentation about working on a dairy farm; students identified questions they still had not answered.

Regarding math, Freya identified perimeter and area as concepts not covered yet in class
but relevant to their questions. She asked students to plan and build a miniature farm using large-sized grid paper to draw and plan. They discussed what kind of farm they wanted with Freya’s help considering, for instance, if it lodges a lot of animals it would need large pastures or if wheat is produced it would need large areas of land for crops, and so on. Soon after they started to draw their farm they discovered confusion about the squares on the page to plan out the size for each building. They looked at it together to examine how the lines could be useful if they were planning a fence in the area as well. As soon as they finished their farm plan they began to add the real things. Freya bought some materials such as large tin foil, barbeque trays, earth and Popsicle sticks and students also brought variety materials. As Freya explained, in this task, students were expected to make a model as close as possible to their plan by using their knowledge of perimeter and area. Freya could not hide her excitement: “Some children were grabbing rulers to measure lengths of sides of buildings, others cut out squares from their grids on their papers, others put sticks on their plan to cut the length” (Freya, VLS, 26.02.2016). Freya also mentioned that she gave seeds to her students to plant in trays in the classroom, extending the work easily into science. At the end of the year, they visited a dairy farm and students built more connections to what they had learned. As Freya told the story, they learned “a lot about milk, machinery, and use of a new calf that had been born that morning.

One of the impressive results was that even though Freya did not specifically teach perimeter and area students figured out how to measure both. This provided a context for her to introduce strategies and direct teaching based on ideas students were really engaged with.
When she looked back at the end of the unit, Freya discovered how much curriculum she had actually covered. While her focus was math there was a substantial science component. Next year she aims to incorporate language and health.

Freya reflected that young students were highly engaged, looking forward to continuing week to week and asking when they could work on their farm and discoveries again. Freya was pleased because even typically passive students were engaged.

Freya used direct teaching to fill in gaps and explained that it was extremely important for her to cover the curriculum in the year. Based on her experience she suggested teachers could take one topic at the beginning of the year and probably teach the entire curriculum around it.

She explained several difficulties she faced; namely, finding information suitable for her grade-level and not always knowing where she was going next. She considered these matters a knowledge building experience for herself.

Freya gave the students a test and found the results surprising; while students’ scores were high, they were not as high as she had expected. She analyzed students’ answers to questions she posed during class and from her observation thought everyone had a good understanding of the math concepts covered. She underscored the importance of differentiated instructions and assessment. She had an opportunity to meet with the same group that became grade-four in the school year in 2016. She planned a follow-up assessment. First she checked to be sure that their current classroom teacher had not taught area and perimeter and she designed a short activity for them; it was a crime case. Students were provided a series of clues in order to solve a crime. One of the clues was
telling them to find a room in the school with the perimeter of 37 meters. When she asked students if they knew what the perimeter was and there was only one hand raised. She expressed her disappointment at that time. But then she asked them if they remembered the farm unit they did last year and all of a sudden, everyone’s eyes lit up. All the groups grabbed the meter stick on their way out and they were able to come back with the correct answers to the room. She claimed that the vocabulary might not be as accessible as it should be, but the understanding was there. She again planned to integrate math and science (soil and plants).

7.3.3. Summary of case #2

In this case study, the teacher was inspired by the farm area where students lived to engage students in Real Ideas, Authentic Problems. She took advantage of and boosted students’ knowledge and ideas about farms, capturing all students’ interests and Democratizing Knowledge. The teacher was pleased because all of the students asked questions and discussed the answers with each other. Even though the students were tentative at the beginning they developed confidence after the teacher made sure that all ideas/questions were valuable. She encouraged them to discover strategies and ideas on their own, taking Epistemic Agency regarding their own knowledge advancement. Student posts ranging over language, math, and science conveyed Idea Diversity. Students’ questions and cross-curricular work progressed over time suggesting Improvable Ideas. The indicator of Symmetric Knowledge Advancement is suggested by students’ group work; even though students worked in small groups, they had a walk around the classroom and visited each group’s station where one of the group members explained their poster so everyone in the classroom learned about others’ work and ideas.
and had a chance to discuss with each other. Before starting this, students had a whole group discussion to identify how they would do this walk around the classroom and what kind of comments and conversations would be appropriate. In brief, they discussed how they could sustain *Knowledge Building Discourse*. Regarding *Constructive Use of Authoritative Sources*, they used several resources for research; books, videos clips, Internet, and expert talk. They also visited a farm to learn more about the farms. However, teacher noted that it was not always easy to find suitable information for that grade-level. As a part of assessment, Freya gave her students a test and she reported that she was not fully satisfied with the results since the scores were not as high as she expected. On the other hand, the students correctly answered all questions that she asked. This showed the significance of the *Embedded, Concurrent and Transformative Assessment* and the teacher’s commitment to improving her practice.

### 7.4. Case #3: Knowledge Building with elementary school student

#### 7.4.1. Introduction

This case study is developed through the experiences of Kathy Hudson that were shared in the LSA webinar on March 10th, 2015 (see https://vimeo.com/135603916) in addition to analysis of interview data. In 2015, Kathy was teaching grade-five/six at School-C, Upper Grand District School Board. She first tried Knowledge Building in her grade-five science and social studies classes.
7.4.2. Classroom activities and Knowledge Building practice

Kathy started a new line of inquiry by looking at the curriculum expectations with her students so that they could set learning goals together. She sometimes handed out these curriculum pages so the students could look at what the government expects them to learn and discuss. She asked, “What do you think our three goals should be?” She emphasized big ideas instead of trying to cover every little thing.

Kathy spent most of her planning time to find a hook as the way to introduce the topic so that students had something to ask questions about. As she explained, she tried many different things (e.g., picture book, video) and initiated a conversation about open versus closed questions during the first session. They had a discussion of ‘how do we make a close question more of an open question?’ After students posted their questions and talked about them, Kathy encouraged research and checked student plans. She allowed students to research and share before moving into Knowledge Building circles and the frequency of Knowledge Building circles increased.

Kathy did not use Knowledge Forum because of reservations of elementary school teachers mentioned in Chapter 5. Instead she used mural paper that she defined as their best friend to make ideas and idea improvement visible. She explained that mural papers in their classroom served as the community space in which they shared questions and worked on them back and forth. She also tried Google docs as a shared document for students to build more ideas.
Students shared the Google doc with Kathy, thus she could see what they were typing to each other. Kathy provided an example of a student idea that had impressed her in her Knowledge Building efforts. The idea was about a flying device and student discovery that the shape of the airfoil is significant. As Kathy explained, her student realized ‘why the wing is shaped like that [demonstrating by her hand] because it keeps it going right, you are reducing friction in that way, it is shaped like this outward [directing by her hand]’. She continued by saying that a couple of students thought more about it they talked, discussed and they finally understood the idea. Then students went and built their flying device but the wings went out like this [directing by her hand]. When the student flew it, she went ‘ohhh wait a minute!’ Kathy clarified what happened as “There was a misunderstanding, a misconception. The student was able to improve her idea and said ‘oh OK if I can make it like this then it will work’” (Kathy, Interview).

In her second year with Knowledge Building, Kathy started to think more about assessment and evaluation. She asked herself “How am I going to assess the students’ knowledge and what they’ve learned?” She started with a diagnostic assessment, trying to understand what students know about Canada’s identity or heritage and how much they engaged with ideas gained throughout the class. She noted that it was not necessarily to do a project in which students have something to show; she found sharing and talking
quite effective. She sometimes gave students an assessment with several open questions to see what they had learned, allowing each student to learn something a little different.

She also had students sharing their logs because she felt elementary school students need extended time to connect new information and make it their own. Therefore, she wanted to make sure that she was allowing lots of sharing time so they could question each other and explore a problem or theory and in other ways deepen their understanding.

She made sure that everyone has access to information to research and all students have computers and/or books. She also taught research skills and encouraged students to find reliable sources. Kathy described herself different from a teacher standing at the front of the classroom saying ‘Today we will be learning…’

She thinks that Knowledge Building worked very well in science and social studies where they could cover multiple ideas and deepen students’ understanding. She attributed the students’ success and engagement to Knowledge Building. She also referred to the increase in active learning in her classroom by explaining that students took control of their learning and they were interested in and enjoyed what they were doing. She also reported that students’ research skills improved greatly and they started to consider each other as co-teachers and co-learners having respect for each others’ ideas, accountability to each other, and becoming independent in their research.

She would like to introduce Knowledge Building to more teachers in her school and aims to go beyond just inquiry in social studies to engage a fuller knowledge creating process with multiple subjects or strands.
7.4.3. Summary of case #3

Kathy started an inquiry by reviewing curriculum expectations with her students and engaging them in identifying the big ideas in the unit. Students took responsibility for their own learning by setting learning goals and monitoring achievements. She turned high-level controls over to students, in line with the Epistemic Agency principle. She used a question, a video, or a picture book to provoke students’ interest and provide a hook to Real Ideas, Authentic Problems. Before starting to research and discuss, students spent time to understand ideas and pose open rather than closed questions, thereby fostering Knowledge Building Discourse. With respect to Democratizing Knowledge, the first year Kathy started to have Knowledge Building circles in her classroom and it worked well with her students. Every one had a voice; they shared their knowledge and supported and/or defended ideas and engaged in constructive criticism. Additionally, Kathy referred to Community Knowledge, Collective Responsibility by indicating that her students started to consider each other as co-learners/co-teachers and became more aware of accountability to each other. She also started to allocate more time for the students to share and deeply question the ideas and problems after she noticed that it took longer for elementary school students to make connections. In those sharing times, students were provided opportunity for Symmetric Knowledge Advancement. Kathy also emphasized the
Constructive Use of Authoritative Sources; she taught them how to reach reliable sources and helped them to develop their independent research skills. Regarding Embedded, Concurrent and Transformative Assessment, in addition to diagnostic assessment she also applied some assessment at the end of the unit. It might be either a project or just evaluating what they had learned in a Knowledge Building circle. Kathy also aims to include more teachers with multiple subjects or strands to build a culture of Pervasive Knowledge Building in her school.

7.5. Case #4: Using Knowledge Building and Knowledge Forum in grade-six science unit

7.5.1. Introduction

Denise is a teacher librarian at School-2 in School Board-47. She partnered with a grade-six teacher for science class. Her partner teacher was working as an occasional teacher as the regular classroom teacher was on leave. Denise shared her first experience in using Knowledge Building on March 10th, 2016 webinar (see http://www.curriculum.org/LSA/virtual-sessions-11.shtml#virtual). To begin, Denise introduced the Knowledge Forum and taught the students how to use the software and its tools. In order to make students familiar with the Knowledge Forum, Denise asked students to work on a biodiversity unit. She clarified that the unit was related to an electricity unit and her primary aim was to draw on students’ prior knowledge of biodiversity.

Denise showed students images of subway cars being dumped into the ocean and then they watched a video about biodiversity. Figure 13 shows a screen capture conveying the
level of dialogue and questions generated by her students. Once the students had managed the use the Knowledge Forum, she took them into the electricity view where they worked with the teacher to explore an electricity kit and to build circuits.

![Biodiversity View in Knowledge Forum](image)

*Figure 13. Screen capture of the level of dialogue and questions, by LSA, 03.09.2016. Retrieved from [http://www.curriculum.org/LSA/virtual-sessions-11.shtml#virtual](http://www.curriculum.org/LSA/virtual-sessions-11.shtml#virtual)*

7.5.2. Classroom activities and Knowledge Building practice

Denise asked students to complete a KWL (What I Know?, What I Want to know?, and What I Learned?) chart about what they knew, what they wanted to know and learn about electricity as a formative assessment. Her partner teacher initiated a question: “Where does electricity come from?” on the Knowledge Forum and Denise extended this question as “and why should you care about it?” As Denise conveyed, they aimed to extend a STEM (Science, Technology, Math, and Engineering) question to one that engages students at a personal level and incorporate thinking about sustainability. Using Knowledge Forum students asked questions and posted information about the history of electricity and inventions that were created which used electricity and many other ideas (see Figure 14).

As a whole class, they sat back and examined the ideas that surfaced and realized that there were contributions that identified sources of electricity used in our current day. Students also uploaded graphics and/or videos clips to accompany their posts. They further decided that these would be their “rise-above” ideas—ideas to carry over and examine in their next view. Denise pointed out that they had opportunities as the teachers and administrators to individually write back to the students by using remarks section in Knowledge Forum notes as a form of feedback (see Figure 16). She expressed that it was a great feature within Knowledge Forum.

In Figure 17, two different views are presented: one the second electricity view produced and the other the final view. Denise explained that in the second electricity view, students started with posting more questions and providing more information about the different energy sources used currently to generate electricity. Eventually, students selected a question considered most important, along with the best sources of electricity for the
future. These ideas were moved to the third and final electricity view. In this view the students evaluated the merits and drawbacks of each source and they reached their own conclusions to determine which of them would be best suited for the good of society.


As an aside, Denise decided at this point to integrate this unit with media literacy. She told her students to imagine themselves as famous Canadian scientists and environmentalists. She gave them a scenario in which their organization has been hired by the Canadian government to research and examine the different sources of electrical energy use today. Students were to provide advice to the government regarding use of one or two energy sources worth investing in for the future of all Canadians for generations to come. Denise also added that the environment is a great concern and money of taxpayers’ will be used, thus students should clearly justify their findings in a power point presentation.
With regard to assessment and evaluation, Denise collected a range of indicators for students’ engagement and learning during the term. As mentioned earlier, she made use of KWL charts to determine background knowledge, students’ learning logs (see Figure 18) to identify students questions, reflections, and new knowledge they gained, the discourse markers from Knowledge Forum and automated assessment tools, teacher’s constructive feedback, and a rubric.

For the discourse markers in Knowledge Forum, Denise looked at students’ posts such as their questions, how they build their ideas on to those of others, the level and quality of their contributions and participation. Based on her experience, she reflected that when she started once, some of the students were participating in a very big way, others in a limited way. She also noted lots of comments without much substance.
Figure 17. An example of students’ learning logs, by LSA, 03.09.2016. Retrieved from http://www.curriculum.org/LSA/virtual-sessions-11.shtml#virtual

![Learning Logs – Student Reflection](image)


She used the note-contribution feature of Knowledge Forum (see Figure 19) to pull up all comments or contributions made by each student. She used student contribution profiles for conferencing and feedback with students, showing them that they could monitor their own progress.

Denise used two stars and a wish in their learning logs, encouraging class discussions and conferences with her. She asked students to record what they were thinking and wondering, what fears they had, what they learned, and how their thinking had changed over time (see Figure 18). She considered this very important not only because she
wanted to learn what they know, but also she was trying to understand their thinking and how their knowledge changed over time. She thinks that being able to say “I now know this because of that”, addressing previous work and engaging graphical literacy helps a broad range of students. Digital citizenship was obviously important for her and as teacher librarian so was referencing source material.

The last component of her assessment is the rubric (see Figure 20) called “Imagine the Learning” from the School Board-47 resource documents. She adapted this rubric to her Knowledge Building, evaluating students in terms of their understanding, their thinking, their communication and application.

As Denise reported, this whole unit lasted about eight weeks, working on it two to three times a week. Because it was her first trial with Knowledge Building and Knowledge Forum she thought it took a little longer than it would otherwise.

![Knowledge Building Rubric](http://www.curriculum.org/LSA/virtual-sessions-11.shtml#virtual)


She also thought that if she would have students already familiar with norms of
Knowledge Building Communities and tools the experience would be richer and less time consuming as the needed to develop new skills and norms. For instance, at the beginning of the unit, she realized that some of the kids were communicating on Facebook and she needed to step back and engage them in academic discussion regarding community norms and responsibilities.

### 7.5.3. Summary of case #4

As the librarian teacher Denise started by letting students explore Knowledge Forum. She used a subject, which students had already worked on, to practice. Students quickly figured out Knowledge Forum affordances and tools so they were ready for the target unit –electricity. She touched on the principle *Real Ideas, Authentic Problems* by building a connection with real life. Later in the unit she gave students a scenario and asked them to behave as researchers in real life. This encouraged students to take more control of their learning, responsibility both for themselves and others, and cognitive agency. She also asked students to justify the findings from their research in a power point presentation and discuss them with their classmates thereby addressing the *Symmetric Knowledge Advancement* principle. For *Community Knowledge and Collective Responsibility*, all students and teachers sat together and worked on Knowledge Forum. The inherent design of Knowledge Forum empowered students to work as a community, share their knowledge and questions, discuss, refine and improve their ideas within a collective work. Students also used graphics and video clips and made a collective decision to create rise-above notes. As evidence of their collective work and decisions, they created new views as the discussion went deeper. Every single view provides evidence of the principle of *Improvable Ideas* as students focused on deeper and specific ideas. With the
contribution of everyone to idea improvement in this community workspace,

Democratizing Knowledge was evident. In addition to diversity of students’ question from the first view on, Denise also used a chart to encourage students to articulate what they already knew and what they wanted to know about electricity. In doing so, students had the opportunity to learn others’ ideas and work with them as suggested by the principle of Idea Diversity. In order to sustain Knowledge Building Discourse, Denise looked at discourse markers in Knowledge Forum. She read each student post and evaluated how their ideas build onto those of others, the level and quality of their contributions and participation. By using these different types of contributions for conferencing and feedback students were aware of their contributions and improvements.

Additionally, she used two stars and a wish in their learning logs to empower students for monitoring and defending their own learning. Students had Epistemic Agency through this; they explained how and why they learned something and made connections with their previous knowledge. Especially as a part of digital citizenship, Denise highly emphasized Constructive Use of Authoritative Sources. She made sure that students indicated the authoritative sources in their contributions. As Embedded, Concurrent and Transformative Assessment, Denise used a variety of indicators for students’ engagement in Knowledge Building. She used students’ reelections in learning logs, the discourse profile in Knowledge Forum, automated assessment tools, the quality of online contributions, a rubric adapted from “Imagine the Learning” from her school board website, and so on.
7.6. Case #5: Molly Synder’s grade-six science practices

7.6.1. Introduction

This case study is based on Molly Synder’s presentation, LSA webinar March 10th, 2015 (see https://vimeo.com/135603916). Molly shared her approach to Knowledge Building and examples of building and expanding knowledge in her grade-six class Astronomy unit.

7.6.2. Classroom activities and Knowledge Building practice

As the opening of this Knowledge Building initiative in Astronomy, Molly invited an astronomer to their classroom. After this visit, students had many questions about the universe that they posted on every bulletin board in their classroom. She clarified--she is a visual person and tried to record their thinking on bulletin boards whenever possible. (see Figure 21)

![Figure 20. Bulletin board with students’ questions and ideas, by LSA, 03.09.2016. Retrieved from https://vimeo.com/135603916](image-url)

The big question they started with was, “How did the universe begin?” The students were
asked to pose a theory on yellow slips of paper with a heading, “My Theory” on it and they posted their theories around the big question. Following this, students were encouraged to find evidence to support or discount the theories. The green papers were labeled as “Evidence to Support” and red papers as, “Evidence to Discount”. Molly said that this color-coding helped students to see at a glance which theories seem more promising to pursue. Other types of contributions that students could make were represented by blue slips; for instance new wonderings they had as a result of their findings, pink slips were for making a link or connection to other learning, and purple slips to build on an existing idea. To link the student contributions and show the progression of the ideas, they used strings. Molly indicated that having to select the appropriate colored slips forced students to think what kind of contribution they were making, helping them be more metacognitive.

Once they had an ongoing exchange of ideas and evidence on the bulletin board, Molly introduced students to Knowledge Forum. Students duplicated their contributions on the bulletin board on to the Knowledge Forum view. Thus, they selected the appropriate scaffolds, which were offered in Knowledge Forum, similar to selecting the colored slips of paper labeled “My Theory” or “Evidence to Support”. Molly mentioned that as the manager of the database in Knowledge Forum, she was authorized to create whatever scaffolds meet the classroom’s needs. She also expressed that it took no time for the students to switch to the Knowledge Forum format.
Figure 21. Discussion of students on the bulletin board (left). And screen capture of their discussion on a Knowledge Forum view (right), by LSA, 03.09.2016. Retrieved from https://vimeo.com/135603916

The next goal was to extend their contributions, emphasizing that their learning does not end at the classroom door. The school principal, Melissa, and other staff members as well as parents were invited to contribute. Families were given their own access codes and they were encouraged to share their questions or their knowledge or reflections. They also had grandparents and older siblings making contributions. Molly also plans to bring two classrooms together in a collaborative Knowledge Forum community as the next step, her grade-six and a grade-one French Immersion class in her school, to share their questions and seek answer each other’s questions.

According to Molly, one of the benefits of the Knowledge Forum is that it allowed them for monitoring their learning process. She said that it showed students’ thinking as it was happening, and she appreciated this as an important aspect of Knowledge Building. She also indicated that she sees building knowledge as a process rather than a product or a culminating event. Keeping this in mind, she explained that they were always looking for the ways to communicate and share their learning as it was happening.

In Figure 23 students’ questions are on white slips and the connections or “A-ha” moments are shown with green slips. The students kept an ongoing record of their
learning journeys by representing their journey as a road map showing detours and dead-ends. Their inquiries were visible on the right side of the image.

*Figure 22.* The learning journey of students made visible on a bulletin board, by LSA, 03.09.2016. Retrieved from [https://vimeo.com/135603916](https://vimeo.com/135603916)

The next figure (Figure 24) shows their thinking as they listed criteria to determine whether something was a living creature or not. Students brainstormed, posed theories, and designed experiments to test their theories. Molly mentioned a little plant (right in Figure 24) that gave up its life in the name of science.

*Figure 23.* Picture of the bulletin board with ideas about species and living things (left), plants for experiments (right), by LSA, 03.09.2016. Retrieved from [https://vimeo.com/135603916](https://vimeo.com/135603916)

To start their study each of the thirty-one students chose a focus to research as part of their study on biodiversity. Students wrote their topics on white paper on the bulletin board. From the beginning of the research they tried to find similarities between thirty-
one different contributions. Molly explained how contributions were tied together to form a bigger picture; students initially met with other students to see if they had things in common such as ‘Great Lakes’ or ‘insects of in forestation’. Molly indicated that this was an easy way for students to share information and more essentially to share their resources, ideas and research strategies. She gave some examples; the student who was looking at the decline of a honeybee population shared the name of a local beekeeper with the student who was looking into the interrelationship of bees to our food supply. Another example was that the student who was looking into the aquarium and asked about algae had questions for another student who was looking into oceanic certification. Then students met with classmates who did not share similarities or intent of sharing about how each learned. Molly mentioned six degrees of Kevin Bacon philosophy that ‘if you dig deep enough, you will find something in common’. She set aside time for these sharing sessions for students to circulate around the room. They discovered connections and linked their topics by using strings on the bulletin board. The red paper (see Figure 24) shows the actual connections that they made and a few things Molly noted during research time. Students kept digging deeper and deeper into their topics to find connections with other students. Molly explained this with an example:

A student would tell me that round gobies come to Canada from the Caspian Sea and a passing student suddenly interjected with, “Oh, Tom told me zebra mussels came from the Caspian Sea and he had the map to show where that is. Come on!” And both students disappeared. That passing student knew more about zebra mussels and she did and it wasn’t even that topic that was studying. (Molly, VLS,, 10.03.2015).

Molly indicated that it was hard to keep track of which student was researching which topic because she was always hearing them discussing each other’s topics and they seemed knowledgeable about them all. She was pleased because by the end of the study,
all topics were linked to another in some way. Her goal was to teach students that knowing what to do with knowledge make it meaningful. For that reason they were always trying to find ways to use knowledge in a meaningful way.

*Figure 24. Students’ ideas linked by strings on the bulletin board, by LSA, 03.09.2016. Retrieved from [https://vimeo.com/135603916](https://vimeo.com/135603916)*

In the biodiversity example, the main idea was that human-made choices impact biodiversity. Students’ research had uncovered issues that students found disconcerting like pesticides, oil spills, forest burning and so on. On the bulletin board, each student identified issues impacting their area on the little green slips of paper. They discussed their role as global citizens and how newfound knowledge could help them make a difference in the world. The students individually identified causes they felt strongly about and then they paired or grouped themselves with others with the same concern. Subsequently, Molly let students identify ways that they could make a difference. Some examples of students’ action plans were raising awareness of others by presenting to other classes and making morning announcements, being a volunteer by dedicating their time and/or talents, like performing jazz pieces while handing out flyers, and so on. Two students made and sold items to raise $175, which they used to adopt a tiger in their
school’s name, keeping it on a reserve safe from poachers. Molly mentioned that when these two students were discussing the plight of tigers with illegal poaching, a member of the School-3 community came forward to say that they knew a person who works in Africa on a tiger reserve. And then they started to Skype with the reserve worker to share their experience with tigers and poachers and she/he let them know how the money they raised would be used to make a difference. Molly also made a side note as none of the students in the class chose tigers or poaching as their original topic. She explained that these issues came to light through the students’ sharing and research and their quest for connections that tie to each other.

7.6.3. Summary of case #5

Molly started the Knowledge Building in her class by implementing the principle of Real Ideas, Authentic Problems. She invited a professional to give a talk in her classroom. She engaged students’ attention through real-life issues and students generated meaningful question about the beginning of the universe. Similarly, in the biodiversity unit, they had a chance to have an online connection with a professional who works in Africa on a tiger reserve. She imitated the general structure of Knowledge Forum on the bulletin boards by using different colored-paper, which were blank and some of them labeled with Knowledge Forum scaffolds, board markers, and strings. This helped students to understand the Knowledge Building Discourse with epistemic markers, Idea Diversity, connections of the ideas, and so on. Additionally, this low-tech practice taught them the basic tools and features of Knowledge Forum. Over time, students had an opportunity to have visual representation of their progress on the bulletin board. Thus, they identified the gaps between the ideas, came together to discuss them, and go deeper. Molly was
obviously able to support the principle of *Improvable Ideas*. When they later transferred their work from the bulletin board to Knowledge Forum they developed a better understanding of *Knowledge Building Discourse*. Molly transferred *Epistemic Agency* to her students by allowing them to monitor their own learning. She saw Knowledge Building as more about process than a final event. Referring to *Pervasive Knowledge Building*, Molly included different parties into their Knowledge Building classroom such as the school principal and other staff members and parents. They contributed to Knowledge Forum through their own online accounts. This also reflects *Community Knowledge and Collective Responsibility*. *Symmetric Knowledge Advancement* was evident in the biodiversity example, with thirty-one different ideas linked to form a bigger picture. With respect to *Constructive Use of Authoritative Sources*, students worked with the professionals in their project as in the example of asking for the reserve worker’s experience with tigers.

7.7. **Chapter Summary**

This chapter provided a micro-level analysis of teacher and student engagement across multiple topics and contexts. Through content and narrative analysis of teachers’ presentations regarding their Knowledge Building experiences I described five of the eighteen cases to indicate teacher and student engagement in Knowledge Building Communities. The main criterion for my selection of five cases was clarity in addressing Knowledge Building principles. As suggested above, these cases may represent “optimal” performance rather than “functional” performance. I introduced each with teacher information--- including subject, grade level, and school, followed by a brief presentation of their classroom activities and Knowledge Building practices. At the end of each case
study I summarized with an evaluation of those practices in light of twelve Knowledge Building principles. Findings indicate teachers’ effort, collectively to apply all twelve principles. Since they were new to Knowledge Building, they were not each expected to address all principles or to do so at progressively higher levels at this early stage. Nonetheless they consistently built a supportive collaboration culture in their classroom as suggested by their reports indicating involvement of all students joining discussions, asking questions, and addressing ideas in a respectful manner. Teachers mostly worked on the Knowledge Building discourse with their students either before or during the process. For instance, Freya’s students had a discussion to form a procedure for the conversations during the gallery walk. They decided what kind of comments and conversations would be appropriate. Some teachers took advantage of Knowledge Forum technology to sustain discourse. The inherent design of Knowledge Forum helped students understand basic concepts such as build on, reference, and scaffold high-level knowledge processes such as theory building. Additionally, teachers spent time teaching students to ask strong, purposeful questions. For example, Kathy used her first lesson to talk about open versus closed questions. Denise always provided feedback for students’ contributions and participation to establish the feeling of community and sustained discourse. Obviously it would be necessary to study these teacher practices over an extended period of time to determine the extent to which their practices continued to evolve with increasingly powerful examples of principled knowledge work.
CHAPTER 8

8. GENERAL DISCUSSION

8.1. Chapter Overview

Ontario’s uptake of Knowledge Building through the LSA project constitutes the research context of this thesis. The research aims to develop a deep understanding of the adoption process of Knowledge Building as an innovative pedagogy with buy-in at multiple levels—teachers, administrators, and students—of a school system in Ontario. Roger’s (1995) five stage model of innovation-decision making was used to characterize the diffusion process, including initial knowledge resources to learn and implement Knowledge Building, perceived attributes of this innovative pedagogy, factors that influenced the adoption-decision, and factors that sustained Knowledge Building. An effective model of diffusion and professional development was described by focusing on work within one school board—Upper Grand District School Board—with particular attention to supports for Knowledge Building Communities across the school board. Finally, five short cases of classroom practices were presented to give a micro-perspective of the various ways in which teachers and students take responsibility for developing and implementing effective practice grounded in Knowledge Building principles. Examples of means by which teachers gradually turn over to students greater agency for meeting curriculum goals, monitoring, planning, assessment and other processes typically the exclusive domain of the teacher are provided to convey efforts toward a Teacher C model of Knowledge Building.

In the following sections, I discuss the results in relation to the three research questions
set forth in Chapter 1, then I discuss broader implications for prospective KBC:PD research and contributions of this research.

8.2. Addressing the Research Questions

Qualitative analysis was conducted to investigate three overarching research questions. In this section I discuss each of the three research questions that guided this thesis research, research outcomes based on qualitative analyses, and broader implications for teacher learning and KBC:PD.

*Research question 1: What factors have affected diffusion of Knowledge Building as an innovative pedagogy within and across schools in Ontario? Does Everett Rogers’ five-stage model of diffusion of innovation help explain how and why Knowledge Building has spread in Ontario?*

Chapter 2 provided an overview of the LSA project that aims to increase students’ achievement in Ontario by investing in the leadership capacity of principals and vice-principals. The governing idea of this endeavor is that support for principals across Ontario in principal learning teams will help teachers incorporate effective teaching and learning strategies to improve students’ achievement and well-being.

Considering the multi-level structure of the LSA project with three planes — school, district, and province — different forms of data were included from each of the three levels. Responses of participants to interview questions, excerpts from webinars, and students’ testimonials in Learning Exchange videos aligned with the five stages of the adoption decision process defined by Rogers (1995) pointing to the success of the innovation-decision model for diffusion of Knowledge Building across Ontario. The
growth of participation in LSA over the last decade placed it in strong position to support
the Knowledge Building initiative at provincial and district level. As of 2016 63 districts,
approximately 3200 principals and vice principals, and 123 system leaders were involved
in LSA; considering LSA is an invitation- and voluntary-based project this provides great
potential for diffusion and successful implementation of innovation.

As suggested in the literature, LSA made use of many communication channels;
interpersonal communication (i.e. provincial symposiums), mass media (i.e. webinars),
local (i.e. regional LSA sessions), and cosmopolite sources. An original innovator teacher
along with LSA District Facilitators served as change agents; principal learning teams
and a growing number of Knowledge Building teachers served as opinion leaders, having
great influence on early adopters at the knowledge stage of the diffusion of innovation
model. In accord with the nature of Knowledge Building Communities, teachers were
learning from each other and building their knowledge together through local learning
sessions and sources provided by the larger system. Teachers and principals especially
appreciated seeing real classroom examples from each other along with virtual
presentations and videos. As explained in Chapter 3, the focus of Teacher-C model,
which is necessary for classroom based knowledge advancement, is a principle-based
innovation rather than a procedure-based implementation. The comprehension of key
principles is important to avoid “lethal mutations” (Brown & Campione, 1996). In line
with this approach, the diffusion of innovation literature states that adopters need
principle knowledge to solve complex problems or challenges. Without principle
knowledge to ground the innovation, the process may not evolve productively, leading to
weak implementation or to the innovation being abandoned. This study showed that
teachers developed at least rudimentary understanding of most of the principles and, importantly, they demonstrated commitment to continue to deepen their understanding. They actively worked to improve their implementation, they were aware of the embedded nature of the principles and the need to address all twelve principles to achieve Knowledge Building goals in their classroom. Nevertheless, while particular principles (community knowledge, collective responsibility; idea diversity; real ideas, authentic problems; democratizing knowledge; constructive uses of authoritative sources; and embedded and transformative assessment) were frequently mentioned in interviews by the teachers and practices they reported showed attention to them, understanding needs to be deepened. For example, community knowledge, collective responsibility was mentioned, although the reference may have simply been to collaboration, not collective responsibility for taking their work in new and more successful directions. Democratizing knowledge was used when all students were engaged in an activity, but this did not mean that the knowledge of each participant actually advanced. Also mention of some principles (“rise above” and “symmetric knowledge advancement”) was rare, reflecting the fact, perhaps, that it is especially difficult in early efforts to achieve explanatory coherence and work at the cutting edge of understanding involving outside as well as local communities. In recognition of these difficulties a next step in planning the LSA initiative is to build a Knowledge Building Innovation Network to keep knowledge practices and research results on a continual innovation and improvement path.

The findings of the attitudes toward Knowledge Building confirm that preconceived opinions and judgments of the teachers toward Knowledge Building effect the results of their efforts. Referring to selective exposure, the four participant schools ensured that
Knowledge Building inclusion conformed to each schools’ improvement plans and goals for teaching and students’ learning, and therefore, teachers comfortably embraced it. A difficulty mentioned by the teachers and principals was in relation to technological issues and these mostly stemmed either from conditions specific to each classroom, or teachers’ and students’ digital competencies and attitudes toward new technology, the technological infrastructure of the school, or limited class time and so on. Within the context of the new Knowledge Building Innovation Network these issues are being addressed through presentation of powerful examples of ways that technology can support the work and create virtual communities for continual improvement. Teams are also working with consultants in the school boards to address technology infrastructure issues. Other sources of apprehension about Knowledge Building were related to classroom management issues; issues of reduced teacher control when turning agency over the students and fear of not being able to address all of the expectations in the curriculum. In one case in Upper Grand District School Board, they attempted to address these issues by providing opportunities for teachers to practice idea improvement in a Knowledge Building Community so they could experience a more concrete instance of knowledge building activity. Additionally, LSA provided ongoing support for the participants in the form of professional groups (Principal Association Project Leaders, Steering Team, LSA District Facilitators, and Ministry of Education Officers); special events (provincial symposia, virtual and face-to-face learning sessions, speaker series), and interactive technologies (LSA website, Learning Exchange web portal, webinars, Curriculum Services Canada Tech Support). LSA additionally addressed the emerging needs of participants. Teachers and principals acknowledged the importance of LSA for
improving their practice through time for discussion and learning about other people’s practices.

Teachers gained positive experiences through their implementations of Knowledge Building; they found a number of areas of improvement including higher student engagement and motivation even for students who showed less interest or lower skills and for relatively difficult subjects. These were reflected in their reports of higher student agency, growth in students’ performance and reduction in behavior problems, and positive feedback from the students. The positive social influences of Knowledge Building on teachers and students was also reported and these included increased teacher and student engagement and positive feedback from teachers as well a decrease in interruptions and behavior issues. Furthermore, involvement of the parents in the Knowledge Building process improved positive relations with school and families. One of the strongest examples of the implementation of Knowledge Building was seen in the School-B social science department. In addition to adopting Knowledge Building Department-wide as a part of their departmental routine to improve their own practice, they contributed to its dissemination and worked to provide how-to knowledge for newcomers. They found that building culture of trust in their department was the key factor to successful adoption of Knowledge Building as an everyday practice. They had time to create and model new practices, they opened their doors and welcomed everyone to walk into their classrooms, and they lowered concerns about failure. Teachers in all four of the schools made several presentations about Knowledge Building in both formal and informal events as well as promoting it through personal contacts.
Research question 2: In what ways do principal learning teams (PLTs) support teachers in implementing effective Knowledge Building practice?

The journey of Upper Grand District School Board with Knowledge Building to cultivate a board-wide collaboration culture for teachers and students started seven years ago with the work of a principal learning team including four principals as a part of their LSA work, and with the contribution of the innovator teacher -- a science teacher from School-A-- who introduced Knowledge Building to this group. The core group, which involved the potential early adopters in the Upper Grand District School Board, was formed by inviting five teachers from each principal’s school. Through this group the work of the innovator teacher, principals, and change agents, and an extended network of teachers in the Upper Grand District School Board learned about the Knowledge Building enterprise and participated several formal and informal workshops. The analysis revealed five key factors of success of this professional development model:

1- Building a trust culture and creating a supportive environment. The principal learning team created an encouraging environment in which everybody felt safe to play with the ideas, was encouraged to try something new, and felt able to take risks and even make mistakes. The presence of the principals in this process as co-learners prevented teachers from feeling stress derived from a hierarchy or authority; instead they developed accountability to each other as co-learners.

2- The professional learning process. This professional development effort addressed one of the fundamental apprehensions of teachers which stemmed from their unfamiliarity with the Knowledge Building process. Since teachers needed to be immersed into
Knowledge Building processes in order to increase their understanding and confidence about it, the principal learning team decided to model it for this groups’ professional learning.

3- Engagement of teachers and collaboration across the system. Teachers were provided an opportunity to collaborate within a community to develop substantial understanding of the main aspects of Knowledge Building theory and pedagogy, to explore cross-curricular and cross-panel strategies together, to co-plan across grades and subjects, and to demonstrate their success cases as well as failures. Briefly, in the professional learning sessions, they devoted time to develop understanding of principles of Knowledge Building, to ask rich and probing questions, to authenticate learning, and so on. They discussed several issues such as evoking students’ curiosity and acknowledging questions of wonderment, developing question-asking skills, introducing collaborative environments, and so forth. Additionally they focused on the design of Knowledge Building units; participant teachers were asked to select a unit including topics that would be of interest to students that would generate a natural discussion or would have links to real life problems. After the initial training session and throughout the years, a series of follow-up sessions for sharing classroom experiences was organized. Teachers and principals not only heard different experiences from their colleagues but also had a chance to reflect their own practice. The principal learning team also worked on refining their practice by organizing sessions with experienced teachers in which they collected data and conducted analysis including comparative analysis and action research.

4- Participation of administrators as co-learners and interaction with the innovative teacher in professional learning. One of the fundamentals in the design of a Knowledge
Building Community is the legitimate contribution of everyone to idea improvement. The principals defined their participation in these events as being learning partners rather than instructional leaders. Since the principals were not very familiar with Knowledge Building, it became an authentic learning experience for them. Their participation established momentum. Through participating in this process instructional leaders advanced their understanding, teams developed strategies to cope with obstacles and participants developed skills such as project management, task management, and effective ways of introducing change.

The cooperation of the innovator teacher who served as the local expert was essential as originally he was the only person with experience in actually creating Knowledge Building Communities in Upper Grand District School Board. He thus played a crucial role in the rapid growth of Knowledge Building in the school board. His volunteer-based support, experience and enthusiasm provided inspiration, motivation, and guidance. Through reflecting and producing resources he consolidated his own knowledge and skills. Thus all parties benefited.

5- Overcoming obstacles together. This endeavor was characterized as ultimate PLC by the principal team. Teachers shared responsibility for learning together and constantly collaborated to overcome challenges. Motivation stemmed from teachers’ personal and professional characteristics and alignment of Knowledge Building with their current school improvement plans and programs. Teachers embraced it as a way of achieving teaching and learning of 21st century goals rather than perceiving it as additional work.
Challenges. Challenges included unfamiliar pedagogy, time, and technical problems. These were reflected in efforts to identify students’ needs and adjust scaffolds and materials to the specific grade level. In many cases there was insufficient technical infrastructure to support the technology specifically built to foster Knowledge Building. However, teachers consistently adjusted practices, created interdisciplinary structures, developed low-tech solutions, and continued their journey.

Accomplishments. The reported evidences of acceleration and expansion of the project by the principal learning team is reflected in adoption and integration of Knowledge Building in a variety of subjects and grade-levels in Upper Grand District School Board, commitment of teachers, reports of increase in student engagement and sense of belonging, and decrease in behavioral problems.

Research question 3: What do teacher practices convey regarding engagement of students in principle-based Knowledge Building Communities?

Five case studies were presented of teachers who reported on their practices in terms of knowledge building principles. These self-reports showed that all five teachers were aware of the need to pursue Real Ideas, Authentic Problems. In line with teacher innovator guidelines they provided a hook—a connect between the unit of study and real life issues—as a way to provoke students’ interests. Teachers selected hooks appropriate to the specific grade levels of their class. For instance, grade-one fairy-tale, grade-six advanced real-world problems of biodiversity and electricity. There was some suggestion of turning over to students agency for defining Real Ideas, Authentic Problems, but teachers were clearly just beginning to make this transition and a goal in design of new
Knowledge Building Innovation Networks will be to provide powerful models to support this practice.

As this challenge suggests, one of the major characteristics of a Knowledge Building classroom is turning high-level controls over to students so that they can take charge at the highest levels of socio-cognitive collective responsibility for knowledge advancement. Accordingly, students begin to deal with problems that teachers are typically responsible for such as identifying goals, motivating work, monitoring progress, evaluating idea coherence, and so forth (Scardamalia, 2002). Teachers in the five cases supported *Epistemic Agency* by stepping back and letting students take more control. They observed students and provided timely interventions by using questions to provoke thinking and encouraging them to improve ideas. Students found this new role difficult and as the Grade 1 example conveyed, asked for teacher direction and models. Teachers found it difficult to step back. However, in time, students started to turn to each other for help and to take responsibility for of their own and others’ knowledge advancement.

The main premise of classroom Knowledge Building Communities is sustaining students’ collective work with ideas of value to a community (Scardamalia, 2002). Teachers allowed students to work together in pairs and as small/large groups, and supported whole class Knowledge Building circles and in some cases use of Knowledge Forum technology to support collective responsibility for community knowledge. Students were pleased to have a voice, their ideas were acknowledged, and also they were very respectful to each other’s ideas. While students had difficulty at first in explaining their thinking to others they became legitimate contributors to shared goal by using accountable talk, group sharing and gallery walks, conversations and discussions.
Distributed expertise within and between communities and reciprocal advances of students’ based on receiving questions, building on, linking and referencing ideas led to early efforts at *Democratizing Knowledge Building and Symmetric Knowledge Advancement*.

Students worked as co-learners/co-teachers and became more aware of accountability to each other. One group discussed the idea “to give knowledge is to get knowledge” in a Knowledge Building circle; across the examples there was evidence of every one having a voice and openly sharing knowledge *Collective Responsibility, Community Knowledge* and *Idea Diversity* are evident in these practices.

In grade-one, teachers made use of math language to sustain discursive practices, which demands going beyond solely sharing ideas and opinions toward knowledge advancement and transformation among the students. Math concepts emerged in discussion and in a very respectful manner (see case #1) students progressively identified problems, going deeper into questions, building new conceptualizations by contrasting ideas, and providing explanatory coherence (Scardamalia, 2002). In the grade-three example, before visiting group posters, students discussed what kinds of comments and discussions would be appropriate and most helpful. In both grade-six classes, teachers used affordances of Knowledge Forum technology to foster sustained discourse through the rise above note and scaffolds (Scardamalia, 2002). Students used scaffolds as epistemic markers helped them to reflect and add posts to advance *Knowledge Building Discourse*.

In the five cases students were immersed in a Knowledge Building environment. In case #2 students started with simple questions (e.g. “why is the barn red?”) but moved to
questions such as “how much milk can a cow produce?” and “what would happen if they didn’t produce enough?” In case #4 students continuously generated ideas and identified promising ones to improve the quality, coherence, and utility of ideas to advance community knowledge (Scardamalia, 2002; Zhang, Hong, Scardamalia, Teo, & Morley, 2011), moving ideas to new, higher-level views in line with knowledge forum design for iterative refinement (Scardamalia, 2002).

In Knowledge Building Communities, students are not limited by particular subjects, space, and time for knowledge advancement but rather foster Pervasive Knowledge Building. The grade-one teacher noted a student contemplating an idea at home over night and returning to school with a “breakthrough” to share. This reflects the fact that knowledge building pervades mental life in and out of school (Scardamalia, 2002). Similarly two teachers included parents, principals, and other school staff to expand the boundaries of their learning.

All of the teachers collected evidence to support formative assessment. They monitored students’ conversations and vocabulary use to identify progressive language and transfer to new context, developed activity sheets, engaged in personal observations, applied diagnostic assessment, assessed learning in Knowledge Building circles and online contributions, checked standards and benchmarks to evaluate Knowledge Building discourse and build on, referencing, and rise-above activities.

Teachers in all five cases emphasized constructive use of authoritative sources and references for contributions. They additionally used a wide variety of resources, took
advantage of experts and used field trips to connect students to real-world knowledge building.

The *Rise Above* principle was not specifically mentioned by any teacher. However, in case #4 students created rise above notes, suggesting the power of embedding high-level processes in technological functions. The rise above tool helps students create historical accounts, bring their main idea forward, and create explanatory coherence (Scardamalia & Bereiter, 2006). “By moving to higher planes of understanding, knowledge builder transcend trivialities and over simplifications and move beyond current best practices” (Scardamalia & Bereiter, 2010). Of course simple use of Rise Above in case #4 was just a beginning, and since no professional development for Knowledge Forum was provided teachers had at best limited understanding of the theoretical connection between Knowledge Forum and Knowledge Building principles. This result revealed the need for greater integration of Knowledge Building theory, pedagogy, and technology.

Findings from analysis of teacher practice provide insights into the extent of understanding and implementation of the Knowledge Building principles. The teachers are at the very beginning of their Knowledge Building journey, yet accounts reflect a shift in the teacher’s role toward turning over agency to students for high level knowledge processes typically handled exclusively my teachers. I anticipate that their practice will continue to evolve to provide fuller accounts of Teacher-C practices. The five accounts of Knowledge Building practices reported in Chapter 7 were selected on the basis of teacher reports that they were intentionally implementing knowledge building principles. Accordingly we likely see in them optimum performance for engagement by newcomers in knowledge building. Of course, as increasingly powerful examples are
available in the literature, all teachers will have a stronger foundation for advancing their practices.

### 8.3. Implications for Knowledge Building Research

Findings allow us to state with some confidence that the LSA project has led to successful adoption of Knowledge Building through five stages (see Chapter 5): (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation, as set out in Rogers’ diffusion of innovation model. Further the professional development model presented in the Chapter 6 could be useful for other principal learning teams. As suggested by the findings of this research, success can be attributed to the following factors: compatibility of the school improvement plans and teachers’ teaching and learning goals and Knowledge Building pedagogy, self-motivated and diligent teachers and principals, contexts for sharing enthusiasm as well as challenges and evolving more powerful practices, and commitment to principle-based pedagogy.

Finally, the five cases outlined in Chapter 7 show how teachers utilized principles and how the students meaningfully engaged around them. Examples of successful Knowledge Building practices grounded in knowledge-building principles are invaluable not only for national but international initiatives.

### 8.4. Limitations of the study and suggestion for future studies

Regarding diffusion of Knowledge Building, it is important to note that the analysis is based exclusively on descriptive, qualitative data. Variance research with quantitative data would be helpful to further understand the variables related to innovativeness and
the extent of diffusion in different contexts. Since it is just the fourth year of Knowledge Building within the LSA project, the account is necessarily based on early-adopters. Future research needs to consider the evolution of Knowledge Building over a longer time span.

Results are based on teacher accounts—there is no actual classroom-based analysis of student performance to help disclose the connection between the teachers’ understanding of this innovative pedagogy and shifts in knowledge practices that impact student achievement.

8.5. Conclusions

This dissertation was situated in Ontario’s uptake of Knowledge Building through the LSA project. It investigated diffusion of Knowledge Building as an innovative pedagogy and principals’ effort to nurture a collaboration culture for teachers’ professional learning across schools and school boards in Ontario. The research was conducted at three levels. The first and broadest level explored the adoption-decision of teachers and principals in Ontario through a five-step diffusion of innovation model; results showed a close fit at each step reflecting effective diffusion of innovation. The second level involved in depth analysis of work within one school board, with detailed account of their model of professional learning for Knowledge Building. The last, micro level of analysis focused on classroom practices of teachers within the school board.

This study addressed a significant gap in Knowledge Building research. Most of the available research has focused on what students do in Knowledge Building Communities rather than on teachers’ practices. While it is recognized that fostering Knowledge
Building is challenging for teachers (Zhang et al., 2011), little empirical work exists that explores how teachers create Knowledge Building Communities in their classroom. This thesis research helps to rectify this imbalance in Knowledge Building research and informs the development of KBC: PDs. A close look at a provincial initiative to advance Knowledge Building provides a detailed account of how Knowledge Building evolves through practice and professional development and the extent and means of spread of Knowledge Building practices. Of particular interest are ways in which principals are engaged themselves as change agents and how teachers take on and turn over high-level socio-cognitive responsibility to students.

Because this study was conducted within an ongoing Ministry of Education sponsored LSA initiative it provides feedback to inform a Knowledge Building Theory of Action for educators and policy decision-makers for current and future Knowledge Building and professional development, both within and beyond Ontario.
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Internet Resources
http://www.curriculum.org/LSA/virtual-sessions.shtml
http://thelarningexchange.ca/project_category/knowledge-building/
## Appendices

### Appendix A: Interview Protocol and Questions for Teacher Interviews

<table>
<thead>
<tr>
<th>Q1</th>
<th>How long have you been teaching?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q2</td>
<td>Which subject(s) and grade are you currently teaching?</td>
</tr>
<tr>
<td>Q3</td>
<td>What are your goals for your teaching and student learning?</td>
</tr>
<tr>
<td>Q4</td>
<td>What do you consider the most significant challenge you face with your teaching?</td>
</tr>
<tr>
<td>Q5</td>
<td>Can you describe the nature of student engagement in your classroom? What is a current example? Any other? Continue until no more identified.</td>
</tr>
<tr>
<td>Q6</td>
<td>How did you hear about Knowledge Building?</td>
</tr>
<tr>
<td>Q7</td>
<td>When did you start to use Knowledge Building in your class?</td>
</tr>
</tbody>
</table>

### General Questions about their teaching

| Q8 | Have you ever participated in professional development specifically focused on Knowledge Building? If yes—please describe what you gained from the professional development |
| Q8a | Was it on-site (in your school) or off-site (out of school)? |
| Q8b | Do all teachers in your school participate in this professional development program? |
| Q8c | What kind of activity/activities were you engaged in? |
| Q8d | Can you recall active engagement activities used in this professional development program? Please provide an example? Another (until no more listed). |
| Q8e | How frequently have you participated them? |
| Q8f | How long did the professional development activities take? |
| Q8g | Has there been any follow-up activity and/or support? If so, what form did it take? |
| Q8h | How many times in a week have you received feedback on your teaching from other teachers or people involved in the program? Do you find this helpful? sufficient? |
| Q8i | Did the professional development program engage you in reflection on specific areas of your practice that need to be developed? If yes, to what extent? |
| Q8j | Do you think that professional development program gave you opportunities to test new teaching practices? If yes, what has changed as a result? |
| Q8k | Do you think that this professional development program is adequate to address your daily teaching practice? |

### Professional Development Activities

| Q8l | Is there any plan for ongoing professional development? |

* Q14**
<table>
<thead>
<tr>
<th>Question</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q9</td>
<td>Have you ever had any opportunity to collaborate with your colleagues in examining your own students’ work as well as that of other teachers’ in the professional development program?</td>
</tr>
<tr>
<td>Q17</td>
<td>Is there any other teacher/teachers in your school using Knowledge Building?</td>
</tr>
<tr>
<td>Q17a</td>
<td>If yes, do you collaborate with them?</td>
</tr>
<tr>
<td>Q18</td>
<td>What practices do you remember sharing? Any others? (Continue until no more remembered).</td>
</tr>
<tr>
<td>Q19</td>
<td>How many times was your Knowledge Building class observed by others involved in the program (e.g. from a mentor, or in a team teaching situation)? Who was the visitor/observer (e.g. a teacher who is teaching the same subject grade level etc)?</td>
</tr>
<tr>
<td>Q20*</td>
<td>Have you ever observed a Knowledge Building classroom? If yes, which class? (who was the teacher, which grade and subject?)</td>
</tr>
<tr>
<td>Q21*</td>
<td>Have you found it useful to share your experiences about implementation of Knowledge Building and Knowledge Forum with other teacher/s? If yes, can you provide an example? (Continue until no more examples.)</td>
</tr>
<tr>
<td>Q22</td>
<td>Have you been inspired by another Knowledge Building teacher? If yes, in what way? Any other? (Continue until no more.)</td>
</tr>
<tr>
<td>Q23</td>
<td>Do you think you have inspired any other teacher?</td>
</tr>
<tr>
<td>Q24</td>
<td>Do you use online materials, which are shared in LSA, LTL websites? If yes,</td>
</tr>
<tr>
<td>Q24a</td>
<td>What are these materials?</td>
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<tr>
<td>Q24b</td>
<td>Do you find them useful?</td>
</tr>
<tr>
<td>Q24c</td>
<td>How do you take advantages of them?</td>
</tr>
<tr>
<td>Q25</td>
<td>Would you consider sharing your experiences and materials on websites?</td>
</tr>
<tr>
<td>Q26*</td>
<td>In what ways has your teaching practice changed as a result of Knowledge Building professional development?</td>
</tr>
<tr>
<td>Q10*</td>
<td>What has been the effect on student learning?</td>
</tr>
<tr>
<td>Q11*</td>
<td>What is your goal in engaging students in Knowledge Building?</td>
</tr>
<tr>
<td>Q16</td>
<td>Does teaching with Knowledge Building change your perspective to teaching and knowledge? If yes, how?</td>
</tr>
<tr>
<td>Q26*</td>
<td>Do you think student perspectives regarding learning and knowledge is changed with Knowledge Building? If yes, how?</td>
</tr>
<tr>
<td>Q7</td>
<td>What does Knowledge Building mean to you?</td>
</tr>
<tr>
<td>Q27*</td>
<td>How do you view your purpose in Knowledge Building? (If no spontaneous response, ask…As a fellow participant in the Knowledge Building activities or as directors of the students’ activities, other?)</td>
</tr>
<tr>
<td>Q28</td>
<td>How do you observe or intervene over the course of particular Knowledge Building activities?</td>
</tr>
<tr>
<td>Q29</td>
<td>In what ways do you support students’ interactions?</td>
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<tr>
<td>Q30</td>
<td>How do you observe or intervene over the course of particular Knowledge Building activities?</td>
</tr>
<tr>
<td>Q31</td>
<td>Please provide an overview of your planning process in starting a new unit or line of inquiry? How do you engage students in new work? Continue to pursue details—what else would you do?</td>
</tr>
<tr>
<td>Q32</td>
<td>How do you help students engage in Knowledge Building?</td>
</tr>
<tr>
<td>Q33</td>
<td>Can you remember student ideas that have impressed you in your Knowledge Building efforts? What was one idea and what happened to it? Continue pursuing ideas as long as the teacher can recall ideas.</td>
</tr>
<tr>
<td>Q34</td>
<td>Do you divide the students into the groups for some tasks? If yes, how often and why? Do students also work individually and with the whole group? If yes, how often and why?</td>
</tr>
<tr>
<td>Q35</td>
<td>Can you provide an example of turning over increasing control to students? Continue pursuing examples until no more can be provided.</td>
</tr>
<tr>
<td>Q39</td>
<td>What is the relationship between classroom activities and Knowledge Forum activities?</td>
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<tr>
<td>Q40</td>
<td>Do you think students make connection between classroom activities and Knowledge Forum activities?</td>
</tr>
<tr>
<td>Q41</td>
<td>Here is a list of knowledge building principles. Please indicate those you have been engaged with or not. For those you have engaged can you provide an example of classroom work that reflects that?</td>
</tr>
<tr>
<td>Q42</td>
<td>How do you manage Knowledge Forum activities? Do you have computers in your classroom or do you have a computer lab?</td>
</tr>
<tr>
<td>Q43</td>
<td>Do students work separately, in pairs or in groups in Knowledge Forum?</td>
</tr>
<tr>
<td>Q44</td>
<td>How do you engage with your students around Knowledge Forum?</td>
</tr>
<tr>
<td>Q45</td>
<td>What resources do you use outside those available in the classroom?</td>
</tr>
<tr>
<td>Q46</td>
<td>What do you consider the best way to access such resources? / How do you access them?</td>
</tr>
<tr>
<td>Q12*</td>
<td>Do you know about Knowledge Forum? What is your general sense about Knowledge Forum? Anything else (continue until no more information provided).</td>
</tr>
<tr>
<td>Q13*</td>
<td>Do you think Knowledge Forum is helpful for supporting Knowledge Building?</td>
</tr>
<tr>
<td>Q36</td>
<td>Do you know about Knowledge Forum? If yes, how often have you used it? What is your general sense about Knowledge Forum? Anything else (continue until no more information provided).</td>
</tr>
<tr>
<td>Q37*</td>
<td>Do you think Knowledge Forum is helpful for carrying out learning objectives?</td>
</tr>
<tr>
<td>Q38</td>
<td>What is your goal in using Knowledge Forum?</td>
</tr>
</tbody>
</table>

* The questions were also used in the focus group interviews.
Appendix B: Interview Protocol and Questions for Principal Interviews

Interview Questions

1. How long have you been the principal of this school?
2. What is your primary goal as a manager?
3. What are your goals for teaching and student learning in your school?
4. What do you consider the most significant challenge you face in your school?
5. Can you describe the nature of student and teacher engagement in your school?
   What is a current example? Any other? Continue until no more identified.
6. How did you hear about Knowledge Building?
7. What does Knowledge Building mean to you?
8. Have you ever participated in LSA events (e.g. workshops, symposia, webinars etc.)? If yes, which events? Did you find it useful? Please describe what you gained
9. When did you start to use Knowledge Building in your school?
10. How many teachers have been using Knowledge Building in your school?
11. How do you support them to implement Knowledge Building in their classroom?
12. What is your goal in implementing Knowledge Building?
13. Have teachers in your school participated in Knowledge Building professional development? If so, what sessions? How many?
14. Is there any plan for ongoing professional development?
15. What do you expect in terms of teacher engagement and student achievement?
16. What changes—both positive and negative—have you noted that you would attribute to Knowledge Building?

17. Do you use online materials, shared in LSA, LTL websites to make practice better in your school? If yes,
   a. What materials have you used?
   b. Do you find them useful?
   c. How do you take advantages of them?
   d. What do you recommend to make these resources more valuable or to provide forms of support that are not available now?

18. Would you consider sharing your experiences and materials in developing Knowledge Building on websites?

19. Do you know any other principal/principals in your school board who supports Knowledge Building in her/his school?
   a. If yes, do you collaborate with them?
   b. What practices do you remember sharing? Any others? (Continue until no more remembered).

20. Do you think students’ perspectives regarding learning and knowledge are changed with Knowledge Building? If yes, how?

21. Do you think teachers’ perspectives in your school regarding teaching and learning and knowledge are changed with Knowledge Building? If yes, how?

22. In what ways do you support teachers’ interactions in your school and/or between your school and other schools?
23. What level of engagement do you have in implementation of Knowledge Building in your school? Please provide examples.

24. Do you know about Knowledge Forum? What is your general sense about Knowledge Forum? Anything else (continue until no more information provided).

25. Do you think Knowledge Forum is helpful for supporting Knowledge Building?

26. Have you experienced successes or problems related to Knowledge Forum?
Appendix C: Ethical Approval

PROTOCOL REFERENCE # 32744

April 18, 2016

Dr. Marlene Scardamalia
DEPT OF CURRICULUM, TEACHING & LEARNING
OISE/UT

Ms. Derya Kici
DEPT OF CURRICULUM, TEACHING & LEARNING
OISE/UT

Dear Dr. Scardamalia and Ms. Derya Kici,

Re: Your research protocol entitled, “Evolution of knowledge building teacher professional development communities”

ETHICS APPROVAL

Original Approval Date: April 18, 2016
Expiry Date: April 17, 2017
Continuing Review Level: 1

We are writing to advise you that the Social Sciences, Humanities, and Education Research Ethics Board (REB) has granted approval to the above-named research protocol under the REB’s delegated review process. Your protocol has been approved for a period of one year and ongoing research under this protocol must be renewed prior to the expiry date.

Any changes to the approved protocol or consent materials must be reviewed and approved through the amendment process prior to its implementation. Any adverse or unanticipated events in the research should be reported to the Office of Research Ethics as soon as possible.

Please ensure that you submit an Annual Renewal Form or a Study Completion Report 15 to 30 days prior to the expiry date of your current ethics approval. Note that annual renewals for studies cannot be accepted more than 30 days prior to the date of expiry.

If your research is funded by a third party, please contact the assigned Research Funding Officer in Research Services to ensure that your funds are released.

Best wishes for the successful completion of your research.

Yours sincerely,

Matthew Brower, Ph.D.
REB Chair

Research Oversight and Compliance Office - Human Research Ethics Program
McMurich Building, 12 Queen's Park Crescent West, 2nd Floor, Toronto, ON M5S 1S8 Canada
Tel. +1 416 946-3273 Fax: +1 416 946-5763 ethics.review@utoronto.ca http://www.research.utoronto.ca/for-researchers-administrators/ethics/
Appendix D: Consent Form for Teachers and Principals

Dear <name of teacher or school principal>,

My name is Derya Kici and I am a doctoral student in the Department of Curriculum, Teaching, and Learning at the Ontario Institute for Studies in Education, University of Toronto, Canada. I work under the supervision of Professor Marlene Scardamalia who is the Principal Investigator of research your school is engaged in already titled “Digitally-Mediated Group Knowledge Processes to Enhance Individual Achievement in Literacy and Numeracy.” This research is funded by the Social Sciences and Humanities Research Council and conducted in collaboration with the Ontario Ministry of Education, the Ontario principals’ associations’ Leading Student Achievement project, and the Education Quality and Accountability Office. The broad goal of this collaborative research is to enhance student literacy and numeracy through Knowledge Building pedagogy. My PhD research will extend that work by focusing on professional development and curriculum design.

I am requesting that you sign an additional consent form because I seek your participation in an series of interviews to shed light on our understanding of how schools, teachers, administrators, and students take more responsibility for developing and implementing effective practice grounded in Knowledge Building principles.

If the participant is a principal: You will be asked to participate in a semi-structured interview with the researcher regarding implementation of Knowledge Building in your school. This interview will take approximately 90 minutes.

If the participant is a teacher: You will be asked to participate in three semi-structured interviews with the researcher. The first interview will focus on your teaching and learning goals and professional development activities and programs. This interview will take approximately one hour. The second interview will focus more explicitly on your implementation of Knowledge Building in the classroom and collaboration with other Knowledge Building teachers. This interview will take approximately 90 minutes. And, in the third interview, you will be asked to discuss more about technology use and other resources in your classroom. This interview will take approximately one hour.

The interviews will be conducted in conformity with participant rights assured by the University of Toronto, Office of Research Ethics. Participation is voluntary and you may at any time refuse to answer any question or withdraw from the interview process. Each interview will be video taped and later transcribed. The research has no foreseeable risks or harm to the participants. The identities of the participants will be confidential and pseudonyms will be used to protect privacy and confidentiality both in the thesis and in subsequent research presentations and articles.

All data and forms of the study such as audio/video tapes, transcripts, consent forms will remain confidential and will be stored in a secure location in an OISE researcher’s office and be made available only to researchers granted with the approval of Dr. Marlene Scardamalia who is the principal investigator of “Digitally-Mediated Group Knowledge Processes to Enhance Individual Achievement in Literacy and Numeracy” research, and fully informed in advance of the Ethics Review Board’s documents relevant to this study. The data will eventually be destroyed after the completion of the research study, but there is no definite date for this. Upon your request I will be happy to provide a copy of the research report when it has been written.

The findings of this study will contribute to the professional development literature and will assist educators, Ministry of Education, and Knowledge Building teachers and principals who would like to support knowledge creation in their schools. Your help is greatly appreciated. If you agree to participate in the study, please sign this letter and return it to me in the envelope provided or contact me at the e-mail
04/18/2018 or at derya.kici@mail.utoronto.ca. You may also contact my supervisor, Dr. Marlene Scardamalia at 1.416.978.0370 or at marlene.scardamalia@utoronto.ca. Finally, you may also contact the University of Toronto, Office of Research Ethics for questions about your rights as a research participant at ethics.review@utoronto.ca or 1-416-946-3273.

Thank you in advance for your cooperation and support.

Sincerely,

Derya Kici
PhD Candidate
Dep. of Curriculum, Teaching, and Learning
OISE, University of Toronto
M5S1V6, Toronto, ON, Canada
Tel: 1-647-781-7077
e-mail: derya.kici@mail.utoronto.ca

Dr. Marlene Scardamalia
Professor
Dep. of Curriculum, Teaching, and Learning
OISE, University of Toronto
M5S1V6, Toronto, ON, Canada
Tel: 416-946-3273
e-mail: marlene.scardamalia@utoronto.ca

By signing below, you are indicating that you are willing to participate in the study, you give consent for your interview to be video recorded and transcribed, you have received a copy of this letter, and you are fully aware of the conditions of the study.

Name: ___________________________ School: ___________________________

Signed: ___________________________ Date (DD/MM/YYYY): ____________________

Please initial if you would like a summary of the findings of the study upon completion: _____

Please keep a copy of this form for your records.
Appendix E: List of LSA events

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 7(^{th}), 2013</td>
<td>KB Presentation at Upper Grand District School Board (UGDSB)</td>
<td>Andrew's Workshop</td>
</tr>
<tr>
<td>Oct-13</td>
<td>System Leader Session (afternoon)</td>
<td></td>
</tr>
<tr>
<td>Oct-13</td>
<td>Fall Provincial Symposium</td>
<td></td>
</tr>
<tr>
<td>May-13</td>
<td>System Leader Session</td>
<td></td>
</tr>
<tr>
<td>May-13</td>
<td>Spring Provincial Symposium</td>
<td></td>
</tr>
<tr>
<td>Feb-14</td>
<td>Constructing a Knowledge Building Community - UGDSB</td>
<td>Andrew's Presentation</td>
</tr>
<tr>
<td>Apr-14</td>
<td>Knowledge Building in the 21st Century Classroom at School Board-34</td>
<td>Andrew's Presentation</td>
</tr>
<tr>
<td>May-14</td>
<td>System Leader Session (afternoon)</td>
<td></td>
</tr>
<tr>
<td>May-14</td>
<td>Spring Provincial Symposium</td>
<td></td>
</tr>
<tr>
<td>Jul-14</td>
<td>Knowledge Building in the 21st Century Classroom – Washington D.C.</td>
<td>Andrew's Presentation</td>
</tr>
<tr>
<td>Aug-14</td>
<td>Knowledge Building in the 21st Century Classroom – UGDSB Learning Fair</td>
<td>Andrew's Presentation</td>
</tr>
<tr>
<td>Sep-14</td>
<td>Knowledge Building in the 21st Century Classroom-Ontario</td>
<td>Andrew's Workshop</td>
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<tr>
<td>September 18, 2014</td>
<td>Setting Directions for Year 10 2014–2015</td>
<td>Virtual Learning Session</td>
</tr>
<tr>
<td>September 25, 2014</td>
<td>LSA 101: Virtual Sessions for New Participants to the Project</td>
<td>Virtual Session</td>
</tr>
<tr>
<td>Oct-14</td>
<td>Knowledge Building in the 21st Century Classroom - UGDSB</td>
<td>Andrew's Presentation</td>
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<tr>
<td>Nov-14</td>
<td>Constructing a KB Community - UGDSB</td>
<td>Andrew's Workshop</td>
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<tr>
<td>Nov-14</td>
<td>System Leader Session (afternoon) Gloria Taylor and Brenda Treadaway</td>
<td></td>
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<td>Nov-14</td>
<td>Fall Provincial Symposium</td>
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<td>Dec-14</td>
<td>What is Knowledge Building? - UGDSB</td>
<td>Andrew's Workshop</td>
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<tr>
<td>Jan-15</td>
<td>Starting a KB Community in your Classroom - UGDSB</td>
<td>Andrew's Workshop</td>
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<tr>
<td>January 22, 2015</td>
<td>Digging Deeper into Knowledge Building with Dr. Marlene Scardamalia and Dr. Ken Leithwood</td>
<td>Virtual Learning Session</td>
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<tr>
<td>February 11, 2015</td>
<td>Digging Deeper into Leading Math Success</td>
<td>Virtual Learning Session</td>
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<tr>
<td>February 17, 2015</td>
<td>Speaker Series with Dr. Ken Leithwood and Dr. Marlene Scardamalia</td>
<td>Virtual Speaker Series</td>
</tr>
<tr>
<td>Date</td>
<td>Event</td>
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<td>Mar-15</td>
<td>Classrooms Built on Questions: A Knowledge Building Approach at Schoo-4</td>
<td>Andrew's Workshop</td>
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<td>Mar-15</td>
<td>Knowledge Building in the 21st Century – National Science Teachers Association - Chicago</td>
<td>Andrew's Presentation</td>
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<tr>
<td>March 10, 2015</td>
<td>Knowledge Building/Knowledge Forum: Getting Started and Picking up Speed</td>
<td>Virtual Learning Session</td>
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<td>May-15</td>
<td>System Leader Session (afternoon)</td>
<td></td>
</tr>
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<td>May-15</td>
<td>Spring Provincial Symposium</td>
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<tr>
<td>May-15</td>
<td>Knowledge Building in Modern Physics – Ontario Association of Physics Teachers</td>
<td>Andrew's Presentation</td>
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<tr>
<td>June 12, 2015</td>
<td>LSA/Tri-Board Share the Excitement: Knowledge Building Innovations Around the World</td>
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<tr>
<td>September 15, 2015</td>
<td>Executive Team Meeting / 1:30</td>
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<td>September 16, 2015</td>
<td>Executive Team Meeting (all day)</td>
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<td>September 17, 2015</td>
<td>Steering Team Meeting</td>
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<tr>
<td>September 25, 2015</td>
<td>LSA Powering Up for 2015–2016</td>
<td>Virtual Learning Session</td>
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<td>September 30, 2015</td>
<td>Executive Team Meeting</td>
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<td>October 1, 2015</td>
<td>Steering Team Meeting</td>
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</tr>
<tr>
<td>October 8, 2015</td>
<td>LSA/Tri-Board Virtual Learning Session</td>
<td>Virtual Learning Session</td>
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<tr>
<td>October 14, 2015</td>
<td>Leading and Supporting LSA District Priorities</td>
<td>a.m. virtual session and p.m. face-to-face district teams</td>
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<td>October 20, 2015</td>
<td>Leading and Supporting LSA District Priorities (repeat)</td>
<td>a.m. virtual session and p.m. face-to-face district teams</td>
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<td>Leading and Supporting LSA District Priorities (repeat)</td>
<td>a.m. virtual session and p.m. face-to-face district teams</td>
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<td>October 28-29, 2015</td>
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<td>October 28, 2015</td>
<td>Steering Team Meeting</td>
<td>Web Meeting 9:30-11:00 Symposium Planning</td>
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<td>The Process of Science: A Knowledge Building Approach to Teaching Modern Physics – Perimeter Institute, Waterloo,</td>
<td>Andrew's Workshop</td>
</tr>
<tr>
<td>Date</td>
<td>Event</td>
<td>Location</td>
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<td>Dec-15</td>
<td>Classrooms Driven by Questions: A 21st Century Approach to Learning - UGDSB</td>
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<td>November 5/6, 2015</td>
<td>Steering Team Meeting</td>
<td>Fall Symposium (CANCELLED)</td>
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<td>Executive Team Meeting</td>
<td>Fall Symposium (CANCELLED)</td>
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<td>December 10, 2015</td>
<td>Steering Team Meeting</td>
<td>Fall Symposium (CANCELLED)</td>
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<td>Steering Team Meeting</td>
<td>Fall Symposium (CANCELLED)</td>
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<td>February 3, 2016</td>
<td>Empowered by Design: Webinar One: Leadership: Setting the Conditions E-Conference</td>
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<td>Executive Team Meeting</td>
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<td>Steering Team Meeting</td>
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<td>February 17, 2016</td>
<td>A Conversation with Dr. Ken Leithwood and Dr. Marlene Scardamalia</td>
<td>Virtual Speaker Series</td>
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<td>Empowered by Design: Webinar Two: Getting Started</td>
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<td>LSA: &quot;On the Road Again&quot;</td>
<td>Virtual Learning Session</td>
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<td>March 2, 2016</td>
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<td>Virtual Learning Session</td>
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<td>March 3, 2016</td>
<td>Steering Team Meeting</td>
<td>Virtual Learning Session</td>
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<td>Face-to-Face Speaker Series with Garfield Gini-Newman of the Critical Thinking Consortium - Creating Thinking Classrooms</td>
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<tr>
<td>March 9, 2016</td>
<td>LSA/Tri-Board Virtual Learning Session</td>
<td>Virtual Learning Session</td>
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<tr>
<td>March 10th, 2016</td>
<td>Classrooms Driven by Questions: A Knowledge Building Approach to 21st Century Learning – School Board-33</td>
<td>Andrew's Workshop</td>
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<td>March 22, 2016</td>
<td>Empowered by Design: Webinar Three: Experiment and Reflect</td>
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<td>March 23, 2016</td>
<td>LSA: Leading for Deep Understanding</td>
<td>Virtual Learning Session</td>
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<tr>
<td>April 2016</td>
<td>Spring Provincial Symposium</td>
<td>Virtual Learning Session</td>
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<tr>
<td>October 7 and 18, 2016</td>
<td>LSA Powering Up for 2016–2017</td>
<td>Virtual Learning Session</td>
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257
<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>November 9 2016</td>
<td>Fall Provincial Symposium</td>
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<td>December 14, 2016</td>
<td>A Conversation with Dr. Ken Leithwood and Dr. Marlene Scardamalia Virtual Speaker Series</td>
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<td>March 7, 2017</td>
<td>Math Focus Virtual Learning Session</td>
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<td>Spring Provincial Symposium</td>
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<td>April 24, 2017</td>
<td>System Leader Session</td>
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</table>
### Appendix F: List of LSA Virtual Learning Sessions

**Type of data:** Presentation – P   Chat – C   Questions & Comments - QC  
**Session:** Morning – M   Afternoon – A

**Example:** VLS-C-M, 10.03.2015

<table>
<thead>
<tr>
<th>Year</th>
<th>Title</th>
<th>Date</th>
<th>video</th>
<th>Transcription</th>
<th>slides</th>
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<tr>
<td><strong>LSA Year 12: 2016–2017</strong></td>
<td>LSA: A Conversation with Dr. Ken Leithwood and Dr. Marlene Scardamalia</td>
<td>December 14, 2016</td>
<td>video-109:05</td>
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<td>LSA Powering Up for 2016–2017</td>
<td>October 7 and 18, 2016</td>
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<td>LSA/Tri-Board Virtual Learning Session</td>
<td>October 8, 2015</td>
<td>video-94:56</td>
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<td></td>
<td>LSA: A Conversation with Dr. Ken Leithwood and Dr. Marlene Scardamalia</td>
<td>February 17, 2016</td>
<td>video-81:23</td>
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<td></td>
<td>LSA: &quot;On the Road Again&quot;</td>
<td>February 26, 2016</td>
<td>video-80:55</td>
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<td></td>
<td>LSA/Tri-Board Virtual Learning Session</td>
<td>March 9, 2016</td>
<td>video-90:23</td>
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<td></td>
<td>LSA: Leading for Deep Understanding</td>
<td>March 23, 2016</td>
<td>Video-104:01</td>
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<td><strong>LSA Year 10: 2014–2015</strong></td>
<td>Setting Directions for Year 10</td>
<td>September 18, 2014</td>
<td>video-60:22</td>
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<td></td>
<td>LSA 101: Virtual Sessions for New Participants to the Project</td>
<td>September 25, 2014</td>
<td>video-60:19</td>
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<td>yes</td>
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<td></td>
<td>Digging Deeper into Knowledge Building with Dr. Marlene Scardamalia and Dr. Ken Leithwood</td>
<td>January 22, 2015</td>
<td>video-60:44</td>
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<td>Digging Deeper into Leading Math Success</td>
<td>February 11, 2015</td>
<td>video-98:51</td>
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<td></td>
<td>Knowledge Building/Knowledge Forum: Getting Started and Picking up Speed</td>
<td>March 10, 2015</td>
<td>video-60:49</td>
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<td>yes</td>
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<td></td>
<td>LSA/Tri-Board Share the Excitement: Knowledge Building Innovations Around the World</td>
<td>June 12, 2015</td>
<td>video-120:56</td>
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<td>No</td>
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</table>
### Appendix G: List of the Upper Grand District School Board Teacher and Principal presentations and proposals

<table>
<thead>
<tr>
<th>Title</th>
<th>Type of the document</th>
<th>Presenter(s)/Author(s)</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leading and Expanding Knowledge Building Teams/A conversation about challenges, success and next steps</td>
<td>presentation</td>
<td>Stanley Lloyd and Edward Thompson</td>
<td>LEKBT</td>
</tr>
<tr>
<td>Transforming Wonder into Knowledge</td>
<td>presentation</td>
<td>Brenda Treadaway and Edward Thompson</td>
<td>TWK</td>
</tr>
<tr>
<td>Principal learning team proposal 2015-2016</td>
<td>proposal</td>
<td>Stanley Lloyd, Edward Thompson, and Rosie Poole</td>
<td>PLTP</td>
</tr>
<tr>
<td>Re-Engaging Students Using Knowledge Building (Great to Excellent – Innovative Programs and Practices Funding Proposal 2012)</td>
<td>proposal</td>
<td>Andrew Marshall, Edward Thompson, and David Kane</td>
<td>RSUKB</td>
</tr>
<tr>
<td>Classrooms Built Around Questions: Developing Knowledge Building Communities in the Upper Grand District School Board</td>
<td>proposal</td>
<td>Edward Thompson, Rosie Poole, Stanley Lloyd, and Conner Porter</td>
<td>CBAQ:DKBC</td>
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<tr>
<td>Title of the video</td>
<td>Codes</td>
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<tr>
<td>Knowledge-Building Circles</td>
<td>LE:V1</td>
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<tr>
<td>Going Deeper with Ideas</td>
<td>LE:V2</td>
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<tr>
<td>Building a Strong Collaborative Group</td>
<td>LE:V3</td>
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<tr>
<td>Knowledge Forum</td>
<td>LE:V4</td>
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<tr>
<td>The Importance of Listening</td>
<td>LE:V5</td>
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<tr>
<td>Choice – The Freedom to Explore</td>
<td>LE:V6</td>
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<td></td>
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<tr>
<td>Communication and Collaboration</td>
<td>LE:V7</td>
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<tr>
<td>Real-life Problem-solving</td>
<td>LE:V8</td>
<td></td>
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<tr>
<td>Assessment of Knowledge-building</td>
<td>LE:V9</td>
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<tr>
<td>Scaffolding in Knowledge-building Forums</td>
<td>LE:V10</td>
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<tr>
<td>A Learning Community</td>
<td>LE:V11</td>
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<tr>
<td>Inspirations for Learning through Knowledge-building</td>
<td>LE:V12</td>
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<tr>
<td>Why Knowledge-building now?</td>
<td>LE:V13</td>
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</tbody>
</table>
## Appendix I: Coding scheme and example quotes

### Five stages of Diffusion of Innovation

<table>
<thead>
<tr>
<th>Stage</th>
<th>Code</th>
<th>Example quote</th>
<th>Participant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Knowledge Stage</strong></td>
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<tr>
<td>Awareness – knowledge</td>
<td>AK</td>
<td>couple years ago my principal mentioned I think it was an LSA initiative that we got connected with through Andrew Marshall I think and so I went to a symposium or a gathering of sorts and I saw a couple people talk about how they had kind of implemented in their class and why it would work. And then I just kind of bit on it.</td>
<td>Vincent</td>
</tr>
<tr>
<td>How-to knowledge</td>
<td>HK</td>
<td>Just wondering how you supported your students in learning to summarize and synthesize the overwhelming information when researching</td>
<td>Stacy</td>
</tr>
<tr>
<td>Principles knowledge</td>
<td>PK-CCKCR</td>
<td>Understanding what goes on students don't feel like it's me versus the question, it's an us thing that they can rely on the strengths of others and they can provide their own strengths and it doesn't have to be the same strengths because it's actually better for them to work as a community, to kind of have a universal approach.</td>
<td>Vincent</td>
</tr>
<tr>
<td>Improvable ideas</td>
<td>PK-Imprld</td>
<td>I think a lot of the early posts on the forum [Knowledge Forum] don't really get too deep into the answer. There's a little bit of surface learning or kind of undeveloped ideas. So the idea of a species it's easy to read that from a textbook. But what does it really mean? What are the challenges to that idea? So certainly, the kids improve their idea of what a concept is.</td>
<td>Dylan</td>
</tr>
<tr>
<td>Real ideas, authentic problems</td>
<td>PK-RIAP</td>
<td>Thus, those questions immediately become authentic for them and their ideas that are relevant to them and relevant to the world that they live in. Or else they wouldn't be asking those questions</td>
<td>Vincent</td>
</tr>
<tr>
<td>Pervasive knowledge building</td>
<td>PK-PKB</td>
<td>But sometimes yes it does have an end point because you know you need an evaluation but in essentially it's students could take the idea like what happened in my grade 12 biology class we just had a presentation on what's called epigenetics. The girl who did the presentation. Why did she do the project? Because she found the knowledge building experience last year. Student interest. So, there was an end point in the class because we had to move on but that didn't stop her Knowledge building.</td>
<td>Morgan</td>
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<tr>
<td>Constructive uses of authoritative sources</td>
<td>PK-CUAS</td>
<td>I mentioned earlier about providing resources especially for evolution and also for climate change. There's all kinds of strange web sites of kind of climate change deniers that they look like they're credible source of information but they're really kind of wacky. We spend a little bit of time talking about the different ways to know whether or not a source of information can be reliable. I kind of direct the kids towards the .org websites, for example, what do the experts say? I think that's a really important one for us.</td>
<td>Dylan</td>
</tr>
<tr>
<td>Idea diversity</td>
<td>PK-ID</td>
<td>we have one goal as in to reach and to further on to our ideas and to create this big project that will develop into different idea.... So when we diverge into different ideas, we have different paths ... But when we come together we share ideas because one project is not just one point.</td>
<td>Arya (Student)</td>
</tr>
<tr>
<td>Epistemic agency</td>
<td>PK-EA</td>
<td>But when I came to [the school name] and we started the Knowledge Building projects right away, I learned, ‘well, I don't necessarily have to ask for everything. I can explore. If it goes wrong, it goes wrong. I learn from my mistakes. I use those learning tools on another small another project, mini project. And I could build on from my mistakes. It's okay to make mistakes’ because I knew that. But I was afraid to use that in my learning. From when I did these Knowledge Building projects, I was</td>
<td>Arya (Student)</td>
</tr>
<tr>
<td>Role</td>
<td>Activity</td>
<td>Quote</td>
<td>Speaker</td>
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<tr>
<td>Democratizing knowledge</td>
<td>PK-DK</td>
<td>We have a circle where we discuss and no one is actually the head of the circle. No one is actually the person that facilitates the discussions. Our teacher, he doesn't last year, he didn't facilitate any discussion. We raised our hand, we looked at each other, and we said, ‘You go ahead’, ‘No, you go ahead.’</td>
<td>Miranda (Student)</td>
</tr>
<tr>
<td>Knowledge building discourse</td>
<td>PK-KBD</td>
<td>When there are two competing activities, they are given this problem that they need to solve and then build the equipment in order to show their understanding of how it works. That's where that discourse comes into play. They constantly have to say ‘OK what do we know?’, ‘What don't we know?’, and ‘How can we put this together?’</td>
<td>Andrew</td>
</tr>
<tr>
<td>Symmetric knowledge advancement</td>
<td>PK-SKA</td>
<td>(...) you know, the symmetric knowledge advancement, (...) work a question leave a question or to give knowledge is to get knowledge. But you know what the kids actually have to kind of practice that and that that's where it becomes interesting and how you actually do that, like demonstrate that, other than just sharing that with them.</td>
<td>Andrew</td>
</tr>
</tbody>
</table>
And for the transformative assessment, one of the things I've always had them do in their assessment at the end is post three questions that they still have about the topic showing that there doesn't necessarily have to be an end point. There, you don't have to have all the answers at this point, and it's okay to actually still either be engaged in the topic and go and look it up yourself or just have some even if you don't look them up. Because not all of it is going to be there. So I've always included that as part of an assessment as well.

<table>
<thead>
<tr>
<th>Persuasion Stage</th>
<th>Perceived attributes of an innovation</th>
<th>Relative advantage</th>
<th>Embedd and transformative assessment</th>
<th>PK-ETA</th>
<th>Aiden</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Increased student agency toward their own learning</td>
<td>P-RA-ISA</td>
<td>the power of student curiosity and the trust that you place in them, which I think is the important part that they will actually learn about something even without you, being there so to speak, you're certainly in classroom but without you having to guide them and direct them.</td>
<td></td>
<td>Andrew</td>
</tr>
<tr>
<td></td>
<td>Increased Engagement and Motivation</td>
<td>P-RA-IEM</td>
<td>They didn't understand what was the purpose of it because it doesn't impact them according to them. So, that was their level engagement at the beginning. Now I would say it's significantly more just because they're having success with looking at questions and how it relates to them and they have an interest in the questions that they create. So I'd say it's definitely increased exponentially in comparison to when I started this semester.</td>
<td></td>
<td>Claudia</td>
</tr>
<tr>
<td>Changes in teaching style</td>
<td></td>
<td>P-RA-CTS</td>
<td>Now I kind of model and share and then let them go and see what happens. Let them learn on their own and then come back and have to answer questions afterwards about what they did.”</td>
<td></td>
<td>Justin</td>
</tr>
<tr>
<td>Time demanding but deeper learning</td>
<td></td>
<td>P-RA-TDDL</td>
<td>they say it’s time consuming but they have also seen their students have a deeper understandings and when it’s done well and the right question is asked. The time yields deeper learning</td>
<td></td>
<td>Edward</td>
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<tr>
<td>Factor</td>
<td>Category</td>
<td>Description</td>
<td>Speaker</td>
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<tr>
<td>Compatibility</td>
<td>P-Cmpb</td>
<td>I want them to feel like they have some say in what they're doing for better buy-in, but also to have them look deeper into a question, look deeper into a problem. That way, we can kind of get pass just Googling things and finding out making lists and what not. We're actually looking at how and why things work can be able to compare and contrast and make opinions on things.</td>
<td>Aiden</td>
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<tr>
<td>Complexity</td>
<td>P-Cmplx</td>
<td>I’ve seen some of them use it really successfully and some of them really struggle. I think it depends on the students and the learners, and the environment that it’s in the classroom as to whether it works or it doesn’t work.</td>
<td>Rosie</td>
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<tr>
<td>Observability</td>
<td>P-Obs</td>
<td>I think when I went to those workshops and saw a gentleman from the high school doing it in grade 10, it was like wow, you could actually do that with kids. Now these are kids that are, he had a grade 10 class so these are kids that are 15 and 16 years old. So a little bit older, have more independence but can I do it with grade... sorry 11 and 12 year olds.</td>
<td>Justin</td>
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<tr>
<td>Triability</td>
<td>P-Tri</td>
<td>Well he (Andrew) was the one who introduced us to it, so I mean he is a wealth of information. So it was very interesting to see, because he had us actually doing it. The very first time that Kathy and I did the LSA seminar, he had us to do, and build knowledge based on, I think it was something to do with alzheimers. And we built knowledge on Knowledge Forum, just so that we could play with it, it was fantastic. So Yeah, he has some excellent ways to think about it as far as higher order thinking, physics, grade 12. It was good.</td>
<td>Amelie</td>
<td></td>
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<tr>
<td>Sources of uncertainty</td>
<td>P-SU</td>
<td>I think it's a scary thing when you're starting from scratch on Knowledge Building because you're letting go of a lot of control of your classroom. The kids drive the learning to where they want to go</td>
<td>Claudia</td>
<td></td>
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<tr>
<td>Stage</td>
<td>Category</td>
<td>Code</td>
<td>Description</td>
<td>Name</td>
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<tr>
<td>Decision Stage</td>
<td>Intention to try the innovation</td>
<td>D-ITI</td>
<td>We were trying to figure out exactly how it works, so you can't learn about it until you actually try it.”</td>
<td>Amelie</td>
<td></td>
</tr>
<tr>
<td>Decision Stage</td>
<td>Intention to seek additional information about the innovation</td>
<td>D-ISAI</td>
<td>Wondering about for and as assessment strategies for personalized next steps in the skills that come in service to these incredible intellectual pieces that are being uncovered</td>
<td>Sofie</td>
<td></td>
</tr>
<tr>
<td>Implementation Stage</td>
<td>Positive experiences</td>
<td>I-PE</td>
<td>I have ever since we kind of moved to that and most of our social science classes around critical thinking and problem-solving</td>
<td>Oliver</td>
<td></td>
</tr>
<tr>
<td>Implementation Stage</td>
<td>Positive social influences</td>
<td>I-PSI</td>
<td>sharing knowledge building work on a class blog helps connect the learning to home environment; also posing a question for students to answer with families and come back to share findings</td>
<td>Beth Robinson</td>
<td></td>
</tr>
<tr>
<td>Implementation Stage</td>
<td>Use of the innovation on a regular basis</td>
<td>I-UIRB</td>
<td>My department is full of individuals that trust each other and are willing to take risks on each other's ideas and so, because that relationship is kind of between each of us in the department, it allows us to jump on things when they happened so knowledgeable.</td>
<td>Vincent</td>
<td></td>
</tr>
<tr>
<td>Confirmation Stage</td>
<td>Recognition of the benefits of using the innovation</td>
<td>C-RBUI</td>
<td>Morgan</td>
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</tbody>
</table>
|-------------------|-------------------------------------------------|--------|--
|                   | Well it's student directed, it's generated, it starts with students having some ownership over there, over the questions. Hopefully this is something that connects to their interests and so that they can go and explore content according to those areas of interest or that they've taken ownership over and that there's no. There's no set point like they can still take it further if they wanted to even after. The learning period in the classroom is finish that they can still go forward with. So that it's not just about cramming it in the head for a purpose and doing tests. |
| Integration of the innovation into one’s ongoing routine | C-IOR | Vincent |
|                   | Currently we are writing a chapter of a book for someone regarding Knowledge Building and how our approach as a department works. We have always gone to LSA to try and show how we do it and share materials there |
| Promotion of the innovation to others | C-PIO | Vincent |
|                   | Currently we are writing a chapter of a book for someone regarding Knowledge Building and how our approach as a department works. We have always gone to LSA to try and show how we do it and share materials there |
| Rejection or non-adoption | C-RNA | Stanley |
|                   | yes, this is great and it worked very well’ and other teachers would have had struggled with it and would have been for various reasons. |
### Twelve principles of Knowledge Building

<table>
<thead>
<tr>
<th>Principle</th>
<th>Case #1: Knowledge Building in grade-one math class (Rosa Baskerville and Virginia Savega from School 5 in School Board-44)</th>
<th>Case #2: Integrated Curriculum and Differentiated Instruction with Knowledge Building with grade-three students (Freya Carlson - grade-three class at School Board-10)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Community Knowledge, Collective Responsibility</strong></td>
<td>every student was highly interested in and engaged with the activities and willing to express their ideas as well as they were so respectful in listening and trying to understand each other’s ideas.</td>
<td></td>
</tr>
<tr>
<td><strong>Real ideas and authentic problems</strong></td>
<td>teachers made use of open-ended activities that helped them to use differentiated instruction so that activities could become meaningful and attractive to the students.</td>
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<tr>
<td><strong>Improvable Ideas</strong></td>
<td>These open-ended activities were also significant to provide problems to the students to work on the Improvable Ideas.</td>
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<tr>
<td><strong>Epistemic Agency</strong></td>
<td>Teachers also clarified their own position in the classroom as the evidence of students’ higher control on their own learning.</td>
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<tr>
<td><strong>Democratizing Knowledge Building</strong></td>
<td>every student was highly interested in and engaged with the activities and willing to express their ideas as well as they were so respectful in listening and trying to understand each other’s ideas.</td>
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<tr>
<td><strong>Pervasive Knowledge Building</strong></td>
<td>was exemplified by Virginia above as how one of their students had kept the activity in his mind during the day and night and thought for the possible solutions even out of the school.</td>
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<tr>
<td><strong>Embedded, Concurrent and Transformative Assessment</strong></td>
<td>teachers collected evidences for formative assessment throughout the activity. They monitored the students’ conversations and use of vocabulary and evaluated the progressive language. They also used the activity sheets, students’ products like shapes they created, and also personal observations.</td>
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<tr>
<td><strong>Knowledge Building Discourse</strong></td>
<td>The use of math language was helpful for the teachers to sustain the Knowledge Building Discourse among the students. Students consistently asked questions to peers and refined their ideas, they observed others’ models and listened each other different ideas very carefully, and finally they tried them by themselves.</td>
<td>The emerging math concepts can be shown as evidence of discourse and the idea exchange among the peers for Idea Diversity.</td>
</tr>
<tr>
<td><strong>Idea Diversity.</strong></td>
<td></td>
<td>With everyone’s contributions and conversation with each other during the gallery walk and then came back their original groups to talk about and try other ideas provided Symmetric Knowledge Advancement in this Knowledge Building Community in grade-one class.</td>
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<tr>
<td><strong>Symmetric Knowledge Advancement</strong></td>
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<tr>
<td><strong>Real ideas and Authentic problems</strong></td>
<td>the teacher was inspired by the farm area where they have lived for the Real Ideas, Authentic Problems to start the inquiry process. Therefore the activities and problems were naturally appealing for the students. She boosted students’ knowledge and ideas in this way and asked them to generate questions about a farm. Through this authentic activity, the teacher could capture all students’ interests and attentions, even the weaker students’ in the classroom.</td>
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<tr>
<td><strong>Improvable Ideas.</strong></td>
<td>While the earlier questions were very simple, they turned more meaningful and useful questions over time. This is an evidence of Improvable Ideas.</td>
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<tr>
<td><strong>Epistemic Agency</strong></td>
<td>Even though the students were tentative for asking questions and making contribution at the beginning of this unit, they developed more confidence after the teacher made sure that all ideas/questions were valuable for them. Teacher encouraged them to discover strategies and ideas on their own and taking Epistemic Agency for their own learning.</td>
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</tr>
<tr>
<td><strong>Democratizing Knowledge Building</strong></td>
<td>she could also touch the principle of Democratizing Knowledge. The teacher was so pleased because all of the students contributed by asking questions and discussing the answers with each other.</td>
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</tr>
<tr>
<td><strong>Embedded, Concurrent and Transformative Assessment</strong></td>
<td>As a part of assessment, Freya gave her students a test and she reported that she was not fully satisfied with the results since the scores were not higher than she had expected. On the other hand, the students correctly answered all questions that she asked. This showed the significance of the Embedded, Concurrent and Transformative Assessment and confirmed that the summative assessment was not much accurate in a Knowledge Building classroom.</td>
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<tr>
<td><strong>Knowledge Building Discourse</strong></td>
<td>Before having a walk around the classroom students had a whole group discussion to identify how they would do this walk around the classroom and what kind of comments and conversations would be appropriate. In brief, they discussed how they could sustain Knowledge Building Discourse.</td>
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<tr>
<td><strong>Idea Diversity.</strong></td>
<td>Numbers of students’ posts that were divided in three categories (language, math, and science) can be shown as the evidence of Idea Diversity. Students’ questions also progressed over time.</td>
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<tr>
<td><strong>Symmetric Knowledge Advancement</strong></td>
<td>The indicator of Symmetric Knowledge Advancement is students’ group works. Even though students worked in small groups, they had a walk around the classroom and visited each group’s station where one of the group members waited them to explain their poster. Therefore, everyone in the classroom learned about others’ work and ideas and had a chance to discuss with each other.</td>
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<tr>
<td><strong>Constructive Use of Authoritative Sources</strong></td>
<td>they used several resources for research: books, videos clips, Internet, and expert talk. They also visited a farm to learn more about the farms. However, teacher noted that it was not always easy to find suitable information for that grade-level.</td>
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<tr>
<td><strong>Case #3: Knowledge Building with elementary school student (Kathy Hudson - grade-five/six class is at School-C at UGDSB)</strong></td>
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<tr>
<td><strong>Community Knowledge, Collective Responsibility</strong></td>
<td>Kathy referred to Community Knowledge, Collective Responsibility by indicating that her students started to consider each other as co-learners/co-teachers and became more aware of accountability to each other.</td>
<td></td>
</tr>
<tr>
<td><strong>Real ideas and authentic problems</strong></td>
<td>She used a question, a video, or a picture book to provoke students’ interest and provide a hook to Real Ideas, Authentic Problems.</td>
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<tr>
<td><strong>Epistemic Agency</strong></td>
<td>Kathy started an inquiry by browsing the curriculum expectations with her students and asked them to identify the big ideas about the unit. Students took the responsibility for their own learning by setting learning goals and monitoring the process whether they had been achieved or not. She turned the Epistemic Agency over the students in that way.</td>
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<tr>
<td><strong>Democratizing Knowledge Building</strong></td>
<td>it was just a year a go Kathy started to have Knowledge Building circles in her classroom and it worked well with her students. Every one had a voice; they shared their knowledge and objected, supported, and/or defended ideas.</td>
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<tr>
<td><strong>Pervasive Knowledge Building</strong></td>
<td>Kathy also aims to include more teachers with multiple subjects or strands to build an inquiry culture with Knowledge Building in her school. Her effort in that way refers to Pervasive Knowledge Building.</td>
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</tr>
<tr>
<td><strong>Embedded, Concurrent and Transformative Assessment</strong></td>
<td>in addition to diagnostic assessment she also applied some assessment at the end of the unit. It might be either a project or just evaluating what they had learned in a Knowledge Building circle.</td>
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<tr>
<td><strong>Knowledge Building Discourse</strong></td>
<td>Before starting to research and discussion, they had spent time to understand the idea behind working with open questions rather than closed ones in order to develop Knowledge Building Discourse in their community.</td>
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<tr>
<td><strong>Symmetric Knowledge Advancement</strong></td>
<td>She also started to allocate more time for the students to share and deeply question the ideas and problems after she noticed that it took longer for elementary school students to make connections. In those sharing times, students were provided opportunity for Symmetric Knowledge Advancement.</td>
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</tr>
<tr>
<td><strong>Constructive Use of Authoritative Sources</strong></td>
<td>she taught them how to reach reliable sources and helped them to develop their independent research skills.</td>
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<tr>
<td><strong>Case #4: Using Knowledge Building and Knowledge Forum in grade-six science unit (Denise is a teacher librarian at School-2 in School Board-47 and a grade-six teacher - science class)</strong></td>
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<tr>
<td><strong>Community Knowledge, Collective Responsibility</strong></td>
<td>all students and teachers sat together and worked on Knowledge Forum. The inherent design of Knowledge Forum empowered students to work as a community, share their knowledge and questions, discuss, refine and improve their ideas within a collective work.</td>
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<tr>
<td><strong>Real ideas and authentic problems</strong></td>
<td>She extended the question, which was initiated by her partner teacher to make it an authentic problem for everyone. Therefore, she touched on the principle of Real Ideas, Authentic Problems by building a connection with real life.</td>
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<tr>
<td><strong>Improvable Ideas</strong></td>
<td>As an evidence of their collective work and decisions, the creation of several views as the discussion was going deeper can be shown. Every single view also constitutes an evidence of the principle of Improvable Ideas as students focused on deeper and specific ideas. --She used two stars and a wish in their learning logs to empower students for monitoring and defending their own learning. Students had Epistemic Agency through this way and they could explain how and why they learned something and make connections with their previous knowledge.</td>
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</tr>
<tr>
<td><strong>Epistemic Agency</strong></td>
<td>Denise also gave student a scenario and asked them to behave as researchers in real life. This encouraged students to take more control of their learning, responsibility both for themselves and others, and cognitive agency.</td>
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</tr>
<tr>
<td><strong>Democratizing Knowledge Building</strong></td>
<td>With the contribution of everyone to idea improvement in this community workspace, Democratizing Knowledge was provided.</td>
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<tr>
<td><strong>Embedded, Concurrent and Transformative Assessment</strong></td>
<td>As Embedded, Concurrent and Transformative Assessment, Denise used a variety of indicators for students’ engagement in Knowledge Building process. She used students’ reelections in learning logs, the discourse tracking in Knowledge Forum and automated assessment tools, the quality of their online contribution, a rubric, and so on. She created a particular rubric for her Knowledge Building class by adapting from “Imagine the Learning” from her school board website.</td>
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<tr>
<td>Knowledge Building Discourse</td>
<td>In order to sustain Knowledge Building Discourse, Denise looked at discourse markers in Knowledge Forum. She read each posts of students such as their questions and evaluated how they build their ideas onto of those of others, the level and quality of their contributions and participation. By using these different types of contributions for conferencing and feedback to make students aware of their improvements.</td>
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<tr>
<td>Idea Diversity</td>
<td>In addition to diversity of students’ question at the first view, Denise also used a chart to encourage students to articulate what they already knew and what they wanted to know about electricity. In doing so, students had the opportunity to learn others’ ideas and work with them as it was suggested by the principle of Idea Diversity.</td>
<td></td>
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<tr>
<td>Symmetric Knowledge Advancement</td>
<td>She also asked students to clearly justify the findings from their research in a power point presentation and discuss them with their classmates. Therefore, they could address the Symmetric Knowledge Advancement.</td>
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</tr>
<tr>
<td>Constructive Use of Authoritative Sources</td>
<td>Especially as a part of digital citizenship, Denise highly emphasized the Constructive Use of Authoritative Sources. She made sure that students indicated the authoritative sources in their contributions.</td>
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<tr>
<td>Case #5: Molly Synder’s grade-six science practices (grade-six class Astronomy unit, School 3 from School Board-8)</td>
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<td>Community Knowledge, Collective Responsibility</td>
<td>Molly included different parties into their Knowledge Building classroom such as the school principal and other staff members, and parents. They contributed to Knowledge Forum through their own online accounts. This is also an evidence for the creation of a larger Community Knowledge and Collective Responsibility.</td>
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<tr>
<td>Real ideas and authentic problems</td>
<td>She invited a professional to give a talk in her classroom. Therefore, she caught students’ attention through real-life issues and students generated meaningful question about the beginning of the universe. Similarly, in the biodiversity unit, they had a chance to have an online connection with a professional who works in Africa on a tiger reserve.</td>
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<tr>
<td>Improvable Ideas.</td>
<td>Over time, students had an opportunity to have visual representation of their progress on the bulletin board. Thus, they identified the gaps between the ideas, came together and discuss about them, and had a deeper work on those points. Molly was obviously able to touch on the principle of Improvable Ideas in so.</td>
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<tr>
<td>Epistemic Agency</td>
<td>Molly transferred the Epistemic Agency to her students by allowing them to monitor their own learning process. As she expressed above, she is aware that Knowledge Building is more about a process instead of a product or a final event.</td>
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<tr>
<td><strong>Pervasive Knowledge Building</strong></td>
<td>Molly included different parties into their Knowledge Building classroom such as the school principal and other staff members, and parents.</td>
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<tr>
<td><strong>Knowledge Building Discourse</strong></td>
<td>She imitated the general structure of Knowledge Forum on the bulletin boards by using different colored-papers, which were blank and some of them labeled with Knowledge Forum scaffolds, board markers, and strings. This primarily helped students to understand the Knowledge Building Discourse with epistemic markers, Idea Diversity, connections of the ideas, and so on. --After a while, when they were transferring their work on the bulletin board to Knowledge Forum, they developed a better understanding of Knowledge Building Discourse.</td>
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<tr>
<td><strong>Idea Diversity.</strong></td>
<td>She imitated the general structure of Knowledge Forum on the bulletin boards by using different colored-papers, which were blank and some of them labeled with Knowledge Forum scaffolds, board markers, and strings. This primarily helped students to understand the Knowledge Building Discourse with epistemic markers, Idea Diversity, connections of the ideas, and so on.</td>
<td></td>
</tr>
<tr>
<td><strong>Symmetric Knowledge Advancement</strong></td>
<td>Molly explained in the biodiversity example, how thirty-one different ideas were linked to each other to form a bigger picture. Even though it was difficulty for Molly to keep track of each student’s topic, she always observed them discussing other topics and they became knowledgeable about them all.</td>
<td></td>
</tr>
<tr>
<td><strong>Constructive Use of Authoritative Sources</strong></td>
<td>With respect to Constructive Use of Authoritative Sources, students worked with the professionals in their project as in the example of asking for the reserve worker’s experience with tigers.</td>
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</tbody>
</table>
Appendix J: Twelve Knowledge Building principles

(Scardamalia, 2002, p.9-12)

REAL IDEAS, AUTHENTIC PROBLEMS: Knowledge problems arise from efforts to understand the world. Ideas produced or appropriated are as real as things touched and felt. Problems are ones that learners really care about—usually very different from textbook problems and puzzles.

IMPROVABLE IDEAS: All ideas are treated as improvable. Participants work continuously to improve the quality, coherence, and utility of ideas. For such work to prosper, the culture must be one of psychological safety, so that people feel safe in taking risks—revealing ignorance, voicing half-baked notions, giving and receiving criticism.

IDEA DIVERSITY: Idea diversity is essential to the development of knowledge advancement, just as biodiversity is essential to the success of an ecosystem. To understand an idea is to understand the ideas that surround it, including those that stand in contrast to it. Idea diversity creates a rich environment for ideas to evolve into new and more refined forms.

RISE ABOVE: Creative knowledge building entails working toward more inclusive principles and higher-level formulations of problems. It means learning to work with diversity, complexity and messiness, and out of that achieve new syntheses. By moving to higher planes of understanding knowledge builders transcend trivialities and oversimplifications and move beyond current best practices.

EPISTEMIC AGENCY: Participants set forth their ideas and negotiate a fit between personal ideas and ideas of others, using contrasts to spark and sustain knowledge advancement rather than depending on others to chart that course for them. They deal
with problems of goals, motivation, evaluation, and long-range planning that are normally left to teachers or managers.

COMMUNITY KNOWLEDGE, COLLECTIVE RESPONSIBILITY: Contributions to shared, top-level goals of the organization are prized and rewarded as much as individual achievements. Team members produce ideas of value to others and share responsibility for the overall advancement of knowledge in the community.

DEMOCRATIZING KNOWLEDGE: All participants are legitimate contributors to the shared goals of the community; all take pride in knowledge advances achieved by the group. The diversity and divisional differences represented in any organization do not lead to separations along knowledge have/have-not or innovator/non-innovator lines. All are empowered to engage in knowledge innovation.

SYMMETRIC KNOWLEDGE ADVANCEMENT: Expertise is distributed within and between communities. Symmetry in knowledge advancement results from knowledge exchange and from the fact that to give knowledge is to get knowledge.

PERVASIVE KNOWLEDGE BUILDING: Knowledge building is not confined to particular occasions or subjects but pervades mental life—in and out of school.

CONSTRUCTIVE USES OF AUTHORITATIVE SOURCES: To know a discipline is to be in touch with the present state and growing edge of knowledge in the field. This requires respect and understanding of authoritative sources, combined with a critical stance toward them.

KNOWLEDGE BUILDING DISCOURSE: The discourse of knowledge building communities results in more than the sharing of knowledge; the knowledge itself is refined and transformed through the discursive practices of the community—practices
that have the advancement of knowledge as their explicit goal.

EMBEDDED AND TRANSFORMATIVE ASSESSMENT: Assessment is part of the effort to advance knowledge—it is used to identify problems as the work proceeds and is embedded in the day-to-day workings of the organization. The community engages in its own internal assessment, which is both more fine-tuned and rigorous than external assessment, and serves to ensure that the community’s work will exceed the expectations of external assessors.