

# The Knowledge Building Network Pilot Project: An Exploration of Emergent Designs to Enhance Collective Teacher Efficacy

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**Abstract:** Ontario's Leading Student Achievement Project aims to foster professional collaboration among principals, vice-principals, and teachers in order to build capacity for improving student achievement and well-being. During the 2017-2018 school year, a multi-level, multi-district KB network was initiated to spread Knowledge Building in elementary schools across the province. This study traces the evolution of KB and KF practices in relation to changes in teacher efficacy and positive student outcomes. Over the span of a school year, teachers co-designed principle-based practices with their students to foster collective discourse, idea improvement, community norms, and meta-cognition/meta-talk in their classrooms. Results indicate that the initiative was a success, with the majority of educators reporting professional growth through collaboration, as well as willingness to lead their own KB network the next year.

## Introduction

Teacher efficacy is defined as “teachers’ perceptions of their own ability to bring about desired student outcomes” (Takahashi, 2011). Research has consistently demonstrated a strong relationship between teacher efficacy, classroom practices, and student achievement (e.g., Hattie, 2012; Goddard, Hoy, & Woolfolk Hoy, 2000). Teachers with high efficacy set more challenging goals, show greater effort and persistence, and are more willing to try new teaching approaches (Tschannen-Moran & Woolfolk Hoy, 2001). Studies also indicate that teachers’ individual efficacy is interlinked with collective efficacy (Schunk & DiBenedetto, 2006), where collective teacher efficacy refers to the collective perception that “teachers in a given school make an educational difference to their students” (Tschannen-Moran & Barr, 2004). Enabling conditions of collective teacher efficacy include shared goals (Kurz & Knight, 2003), group mastery experiences (Goddard, 2001), and opportunities for teacher leadership (Derrington & Angelle, 2013). Thus, school administrators (i.e., principals and vice-principals) play a vital role in fostering collective teacher efficacy (Ross & Gray, 2006; Leithwood & Jantzi, 2008). Taken together, this line of work suggests that teacher efficacy, both at the individual and collective levels, are important for enhancing teaching practices and student achievement.

Over the past 13 years, the Ontario Principals’ Associations (1), in partnership with the Ministry of Education, have been fostering professional collaboration among principals, vice-principals, and teachers in order to build their collective capacity for improving student achievement through the Leading Student Achievement: Networks for Learning project (LSA). The project is guided by the evolving “LSA Theory of Action” (Leithwood, 2018), which highlights conditions for school success along the rational path (e.g., Knowledge Building), the emotional path (e.g., collective efficacy), the organizational path (e.g., professional learning communities), and the family path. As such, one key priority for the LSA project is to create professional learning networks for Knowledge Building/knowledge creation. This study explores supports for implementing Knowledge Building at scale by tracing the evolution of classroom practices in relation to changes in teacher efficacy and positive student outcomes.

## The LSA Knowledge Building network pilot project

During the 2017-2018 school year, a pilot project was created for educators to learn, share, co-design, and refine Knowledge Building practices that supported student learning and well-being. 32 teachers and 8 administrators from 17 elementary schools across 8 boards were brought together to create a multi-level, multi-district network to promote the cross-fertilization of ideas and spread of classroom innovations across the province. Each teacher was committed to implementing Knowledge Building (KB) pedagogy and Knowledge Forum (KF) technology in at least one subject area, such as math, science, or social studies. Members of the network met five times between September and May to engage in collaborative design of KB and KF practices. Throughout the year, teachers were provided with customized capacity-building sessions and on-site KF support as often as needed to help advance their design work. Data sources for this study include: teachers’ KB practices presented at bi-monthly

meetings and teachers' responses to end-of-term surveys, including their reflections about the design process and observations of how their practices impacted their students.

### Knowledge Building practices

One of the initial challenges of the pilot project is introducing Knowledge Building (Scardamalia & Bereiter, 2014), which, unlike other pedagogical approaches, adopts a principle-based approach to classroom design. Many teachers found the conceptual complexity of the 12 KB principles (Scardamalia, 2002) to be less than intuitive and struggled with translating them into practice. To help scaffold the development of their understanding, teachers were encouraged to study the KB Gallery (Resendes & Dobbie, 2017), as well as multimedia resources on <http://thelearningexchange.ca>, including: descriptions of the 12 KB principles, concrete tools and strategies for getting started in the classroom, video series featuring teacher, student, and parent testimonials, and podcast series to provoke reflection and classroom planning. The bi-monthly meetings served as opportunities to discuss their attempts at principle-based classroom design (both successful and failed ones), ask questions and troubleshoot, receive feedback from peers, and plan for their next iteration.

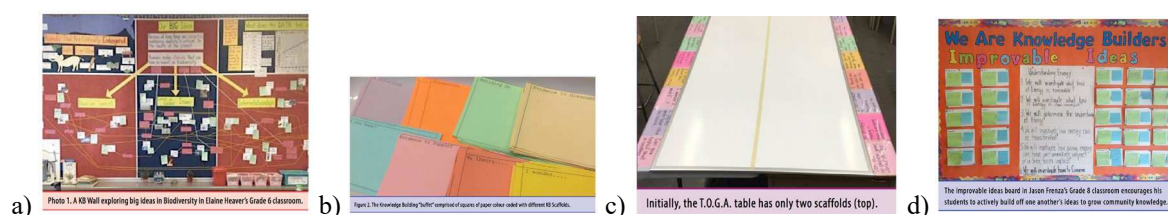


Figure 1. a) KB wall, b) KB scaffolds, c) KB table, and d) Improvable Ideas board.

Figure 1 shows some KB practices invented by Ontario teachers in the companion guide to the KB Gallery, including: a) KB walls, which visualizes connections in the community knowledge; b) KB scaffolds, which promotes diverse contributions to the community discourse; c) KB table, which makes student ideas visible to all members of the community; and d) Improvable Ideas board, which shows design iterations on student ideas. These practices have the shared goal of bringing student ideas to the center of classroom activities and fostering students' sense of collective responsibility for knowledge advancement (Scardamalia, 2002). Put differently, these practices help teachers realize various KB principles in their classroom, such as *community knowledge*, *collective responsibility*, *Knowledge Building discourse*, *democratizing knowledge*, and *improvable ideas*. The year-long challenge for network participants was to adopt these practices into their own classrooms and schools, refine them through deepening engagement with all 12 KB principles, as well as co-design new KB practices with their students.

### KB network meetings

During the KB network meetings, 3 teachers, 3 teaching teams, and 6 school teams presented their classroom designs and re-designs. Each presentation highlighted the implementation of KB practices in areas such as math, science, history, geography, health, and robotics. On average, each classroom design included 4 to 5 practices (Figure 2). The most commonly used practices were: KB scaffolds (9), KF community (9), KF analytic tools (8), KB walls (7) and community norms (6).



Figure 2. KB practices used by elementary network teachers.

It can be seen that neither face-to-face practices (e.g., KB walls, KB circles, KB table) nor online practices (e.g., KF community, KF analytic tools) alone could account for half of KB practices presented, suggesting that most teachers adopted a blended approach to their KB practices. In particular, KB scaffolds and community norms were used in both face-to-face and online contexts, which points to their importance in facilitating the integration of KF technology with KB practices in the classroom.

Given the fact that most teachers implemented multiple KB practices at once, the average classroom design reflected 8 KB principles. The most common KB principles translated into practice were: *idea diversity* (12), *KB discourse* (11), *democratizing knowledge* (11), *improvable ideas* (10), and *real ideas, authentic problems* (9). Whereas presentations at the beginning of the school year mostly focused on *real ideas, idea diversity*, and *KB discourse*, presentations toward the end of the school year focused more on *community knowledge*, *democratizing knowledge*, and *improvable ideas*. This supports the notion that while it is easy to engage students in idea generation, it is challenging to engage them in idea improvement (Scardamalia & Bereiter, 2003). One common practice that teachers consistently used to foster *improvable ideas* was the integration of KB scaffolds into day-to-day class discussions.

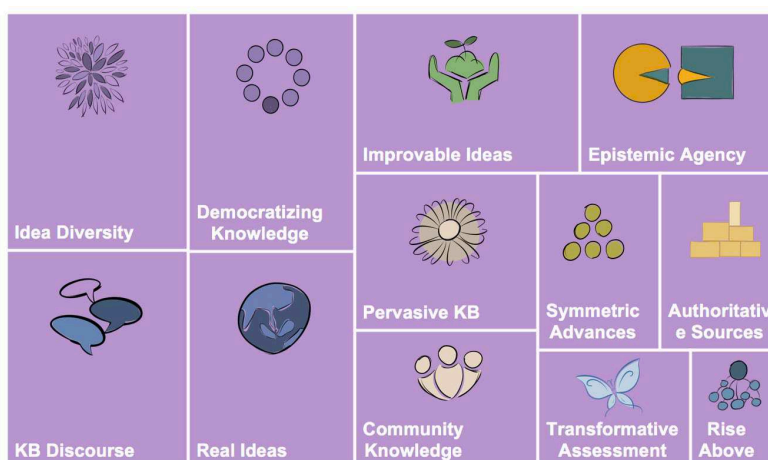


Figure 3. KB principles used by elementary network teachers.

Taken together, it appears that *KB discourse*, which aims to shift engagement norms of idea generation toward idea improvement, is a fundamental principle to fostering and sustaining a KB community regardless of students' grade or subject area.

It is also interesting to note that the least common KB principle in classroom designs was *rise above*, which reinforces the overarching challenge of seeking conceptual coherence among diverse ideas in the community knowledge. Indeed, one math teacher attempted to design for *rise above*. After studying formulae for area and perimeter of 2D shapes, students were encouraged to develop theories for how to calculate the surface area and volume of 3D shapes. The teacher provided students with a *real, authentic problem* of filling the volume of a sinkhole to see whether students could create formulae for rectangular prisms and cylinders. Students were so captivated with the problem that in addition to finding the formula for a cylinder (including seeking *authoritative sources* to learn about circumference of circles), they were creating formulae to calculate the cost of materials and labour to fix the hole! For another science teacher, *rise above* emerged naturally as students were studying biodiversity in science and climate change in social studies. After spending weeks exploring the relationships between predators, preys, and invasive species in various ecosystems, as well as discussing how humans have an impact the environment, students brought their *symmetric knowledge advances* together to develop the *rise above* theory that humans are an invasive species.

It can be seen that complex, interdisciplinary problems give rise to rich discussions in the classroom. Therefore, it comes as no surprise that deeper KB practices (i.e., involving multiple KB principles) are more likely to occur when teachers implement KB across multiple subject areas. Statistical analyses reveal a positive correlation between the number of subject areas a teacher used for KB and the number of KB principles reflected in their designs ( $r = 0.76$ ,  $p > 0.01$ ), as well as the number of KB practices a teacher used and the number of KB principles reflected in their designs ( $r = 0.74$ ,  $p > 0.01$ ). This appears to confirm the notion that Knowledge Building requires an enculturation approach to principle-based practice – the more opportunities teachers and students have to engage in sustained, creative work ideas, the deeper they go with KB, eventually unlocking all 12 principles (Scardamalia & Bereiter, 2003; Resendes & Dobbie, 2017).

### KB network surveys

At the end of the fall and winter terms, teachers reflected on their KB practices and completed surveys (27 responses were collected in fall, 25 responses were collected in winter). Using the KB progressions in the KB Gallery resource, teachers rated their progress along four dimensions of KB practice: fostering collective discourse (orange), community norms (yellow), developing ideas (green), and meta-cognition/meta-talk (blue). Figure 4 shows the proportion of teachers in early stages (light colours), developing stages (medium colours), and deepening stages (dark colours) for each dimension of practice. In the fall term, the majority of teachers were in early practice, whereas in the winter term, the majority of teachers were in developing practice. Change scores reveal a 55% decrease in early practices and 68% increase in developing practices between the two terms, suggesting that teachers were engaged in continual development of their KB practices throughout the year.

The survey also provided opportunities for teachers to elaborate on their KB practices in open-ended questions. 20 out of 25 of teachers believed that the key community norm was fostering a sense of safety and community. This includes promoting a growth mindset, openness to different perspectives, respectful communication, celebrating risks, and valuing mistakes. Whereas in the fall term, more teacher-directed practices were reported to scaffold students into KB practices, in the winter term, many teachers were engaging students in co-design of KB practices. For example, in the fall, many teachers created posters and cue cards of KB scaffolds while modelling how to use them during class discussions. In the winter, they listened for students' use of the KB scaffolds while encouraging them to design new ones to advance the community discourse and expand the class's repertoire of KB scaffolds (e.g., "I wonder", "Another way of thinking...", "We should revise this..."). Some teachers were even beginning to recognize curricular connections, suggesting that they were shifting toward deeper practices. Halfway through winter term, one health teacher realized that implementing KB across the curriculum would have been less effortful on her part and more rewarding for the students than carving out their designated weekly KB time. Recall that in the teacher presentations, deeper KB practices involved implementing KB across multiple subject areas.

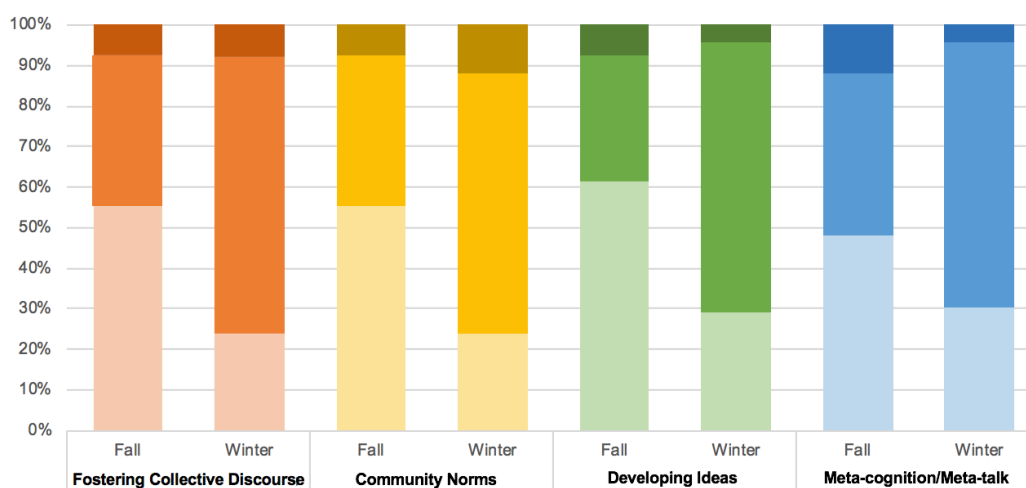


Figure 4. Teacher self-assessments on KB Progressions.

Regarding the most common practices used for fostering community discourse, developing ideas, and meta-cognition/meta-talk, KB scaffolds, KB circles and KB walls were most commonly used in fall, whereas KB scaffolds, KB circles and KF were most commonly used in winter. Given the considerable overlap in responses across the four dimensions, it is likely that the all-in-one nature of KF (i.e., KB scaffolds for collective discourse, endless KB walls for developing ideas, analytic tools for meta-cognition/meta-talk) helped teachers deepen their KB practices. For example, while teachers were encouraging students to use KB scaffolds across both terms, it was not until when students were using the KB scaffolds in KF notes that teachers were able to assess student contributions through the analytic tools. When students were provided with the opportunity to reflect on their contributions through the analytic tools, both the quality and quantity of student engagement was enhanced. Students were excited about the analytic tools and would self-initiate their use to regulate their own contributions. Put differently, the intentional integration of KF into KB practices reflects teachers' growing understanding of the KB principles and their increasing efficacy in balancing the face-to-face and online affordances for advancing community knowledge. Below are a few teachers' reflections on the impact of their KB practices on student learning and well-being:

“Through KB circles students are beginning to build on each other’s ideas while discussing our emotions and ways that we can regulate our emotions.”

“KF allowed students with anxiety to feel like an important, active member of the community by sharing important ideas that others actually read!”

“Students are more engaged – students have a voice and want to share their ideas and communicate their thinking. The students are gaining new tools for their tool belt... and are able to ask questions and reflect on their peers’ process as well as their own learning.”

Overall, responses in the end-of-year survey indicate that both teachers and administrators found the network sessions immensely helpful for: deprivatizing classroom practices; troubleshooting and advancing their designs; hearing from different school boards, roles, and perspectives; exposing them to new ideas and strategies; and opening new opportunities for collaboration. Educators at all levels almost unanimously (all except one who was unsure) expressed interest in continuing participation in the multi-district KB network the following year, with 20 out of 25 willing to start a smaller KB network in their schools and/or school boards. Below are some additional insights and reflections from network participants:

“It is always great to hear ideas from other schools and boards, and different perspectives (teacher, admin, students). It is inspiring to learn with educators from other areas. This session gave me the opportunity to reflect on my classroom and program and consider how to further develop student thinking and deepen practice.”

“Being able to talk to other teachers and having discussions around how to approach some of my challenges. Learning new ways to use KB in my classroom. It validates my pedagogy and has helped to re-invent myself as an educator.”

“I’d like to continue having teachers, students, and administrators share what is happening inside our classrooms and provide time for us to pair up and work together across the regions when working on like ideas.”

“Interesting to hear where other schools and other boards are in this journey. Different schools/boards are strong in different areas and it is great to share our information to help the teaching/learning community as a whole develop and grow together.”

It can be seen that teachers were taking ownership of their classroom practices. Furthermore, the network sessions helped them see their own practices as improvable, and over time, they were assuming collective responsibility for advancing the design work of their community. In other words, members of the KB network demonstrated intentional efforts to raise their individual efficacy and collective efficacy. As an outcome of this pilot project, 16 teachers and administrators attended the KB Summer Institute to share their advances and explore possibilities for the 2018-2019 school year. This experience helped them reframe their practices around less commonly targeted KB principles over the past year, such as *community knowledge*, *pervasive KB*, and *symmetric knowledge advancement*. They are now linking with international KB communities and building their own networks to deepen their practices and grow capacity in their classrooms, schools, and boards. In the words of one teacher:

“My goal is to continue to have my students... participate in this network universally by having them make effective contributions during online discourse (Pervasive KB) on the existing global issues that prevail today. It’s phenomenal observing what solutions/innovations these students come up with that could potentially one day benefit the Public Good!”

## Conclusions and implications

Multi-level networks and partnerships are powerful mechanisms for building capacity as well as spreading Knowledge Building within a system (Laferriere, et al., 2010; Chan, 2011). After the success of the KB Tri-Board Project (Resendes et al., 2016), Knowledge Building has spread across the province to involve more than 11 districts. The purpose of the 2017-2018 KB Network pilot project was to create opportunities and supports for teacher collaboration and design within and across districts in Ontario. Over the span of one school year, teachers

adapted existing KB practices – such as KB scaffolds, KB walls, KB circles, KB walls, and KF communities – into their classrooms and refined those practices with their students.

In working toward translating the 12 KB principles into meaningful classroom designs, teachers were engaged in the conceptual work of shifting the relations between ideas, students, and themselves in the classroom (Teo, 2014; Toth & Ma, 2018). The more KB principles they integrated into their designs, the deeper they went with their KB practices, the more engaged their students. At the same time, the bi-monthly network sessions allowed teachers to deepen their understanding of the KB principles by discussing concrete practices from other teachers' classrooms and reflecting on the adaptability of their classroom designs. Studies on KB in professional learning communities indicate that collaborative design helps teachers become more open and proactive toward their practices (Vokatis & Zhang, 2016), as well as orient towards more innovative practices (Hong, Chai, & Hung, 2015).

This study suggests that the LSA KB network pilot project successfully provided enabling conditions for teachers to engage in collaborative design as means to improve their KB practices. Consistent with past research in professional development (Hoy, 2000), both direct experiences and vicarious experiences were conducive to enhancing teacher efficacy. Recall that teacher efficacy is key to improving teaching and student learning (Takahashi, 2011) while simultaneously enhancing professional commitment (Ware & Kitsantas, 2007). This study suggests that Knowledge Building goes beyond fostering teacher efficacy to igniting both teachers' and students' epistemic agency. While teacher reports indicate that their practices have a positive effect on students' engagement, learning, and well-being, additional analyses are underway to further understand the effects of sustained participation in dynamic multi-level, multi-district KB networks on student achievement outcomes.

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## Endnotes

- (1) l’Association des directions et directions adjointes des écoles franco-ontariennes, Catholic Principals’ Council | Ontario, and Ontario Principals’ Council

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