Near North District School Board: 2015 - 2016

Project Title	Adaptive Technology to Support Success in Mathematics: Blended Learning in the Primary Math Classroom
Description	Our 2015-16 inquiry, with its focus on blended learning, adaptive technology and online pedagogical support, asked: "Is blended learning, featuring collaborative rich tasks and DI, supported by a digital adaptive technology, in particular DreamBox Learning (DBL), a successful model for math instruction and fostering spatial reasoning in primary classrooms?" Our research project looked closely at math learning tasks and how technology-enabled instruction can improve student achievement. We hoped to see increased ability of students to: • Select and use appropriate tools and strategies that will enable them to solve problems independently, and • Create visual representations to communicate their thinking and justify their solutions. The technology that was tested, DreamBox Learning (DBL), provides teachers with tools to regularly examine data and make evidence-based instructional choices. DBL also offers a wealth of embedded pedagogical support. We were looking for information and data on DBL's ability to deepen mathematical/ conceptual understanding using personalized tools that emphasize spatial reasoning, virtual manipulatives, etc. We measured: • Students' ability to transfer success from the digital environment of DBL to solve "unplugged" problems using paper, pencil and hands-on manipulatives. • Teachers' comfort level in using diagnostic information to inform instruction with real-time data.
Context	*Number of students:* 650 *Number of teachers:* 56 *Number of schools:* 28 *Grades/Program:* Gr.2, Mathematics
Impact on Students	Our research project looked closely at math learning tasks and how technology-enabled instruction can improve student achievement. The key 21st Century competencies being measured in this study are Critical Thinking and Communication. A random sample of our Grade 2 math students met with one of our research team members to solve two, two-part math problems using paper, pencil and their choice of manipulatives. Notes on observations were recorded, and audio and video artifacts were gathered. The resulting student work was assessed against the rubric, in moderated marking groups composed of team members. The students were tested twice, once in January and May, to provide

	pre- and post- data. **Student Engagement:** There were 12 questions, and here are some typical response levels. Over 80 per cent of all students chose symbols for Strongly Agree or Agree to respond to the statements: "I think working with numbers is fun," and "I believe there is more than one way to solve a problem." About 78 per cent chose symbols for Strongly Agree or Agree to respond to the statement: "I am able to talk or write about my math thinking." About 60 per cent chose symbols for Strongly Agree or Agree to respond to the statement: "At home I talk about the math work I do at school." Anecdotally, teachers reported that students were enthusiastic about using DBL in class, and the usage and growth rates would support this observation. In a few instances, teachers reported that students found the DBL environment confusing and questions too difficult. Support was provided to these teachers to address these issues. **Student Learning:** The use of DBL as part of the Grade 2 math program built teacher-to-student learning partnerships enabled by technology. Teachers had the opportunity to sit at the student's shoulder, to help clarify problems or figure out how a given activity "works." These partnerships were formed with single students or with small groups sharing common needs or goals. DreamBox Learning is an online learning environment, and therefore cloud, wireless and mobile technologies are fundamental to its use. Several times a week, when students used DBL for their math learning, they accessed it via laptops or tablets. In this way, the digital world of DBL combined with in-person classroom practices to form a blended learning approach to teaching math. Technology also fostered home access to this tool, opening the door to extended use of DBL, and its gamified approach to learning, beyond the school day. DBL data showed: Students in Grade 2 spent an average of 13.73 hours per week using DBL; finished an average of 4.7 lessons per week; 7 per cent of all students used DBL outside the regular school day; and students showed an average 45.46 per cent growth in the DBL online environment. **Student Achievement:** Student assessment was a key feature of our research and took two forms; **t**he "unplugged" assessment activities which formed part of our data collection, and **t**he DBL tools enabling teachers to obtain data on individual student progress from the DBL dashboard. When we met face-to-face with students and asked them to solve problems using paper, pencil and manipulatives. A *sample selection* of results when comparing our pre- data and our post- data is shown below.

	Selecting Tools and Computational Strategies (Question 2): • A 2% decrease in Below Level 1 • A 7% decrease in Level 1 • A 15% decrease in Level 2 • A 25% increase in Level 3 and 4 Communication (Question 1): • A 2% decrease in Below Level 1 • A 6% decrease in Level 1 • A 13% decrease in Level 2 • A 21% increase in Level 3 and 4 Representing (Question 1): • A 2% decrease in Below Level 1 • A 6% decrease in Level 1 • A 14% decrease in Level 2 • A 22% increase in Level 3 and 4 When we compared trend lines for success in face-to-face tasks and success in the DBL environment, we are able to see parallels in growth.
Impact on Instruction	The project has had an impact on teacher practice, both explicitly in building capacity in DBL and data-driven instruction opportunities, but also in the way it stimulated discussions across the board about teaching math. One of the main features of DBL that augmented assessment practices is the ability to see the progress of every student, every day, in a way not even the best teachers can manage when limited by the clock during the school day. Teachers made significant progress in developing this data-based insight into student work to inform their instruction, forming new teacher to student partnerships, one-to-one or in small groups. Extensive teacher PD occurred in connection with the project. Sessions involved hands-on learning in DBL and the teacher Dashboard, and discussions about pedagogical practices that might evolve through the use of DBL in a blended learning setting. Teachers met in their Families of Schools with their VPs to discuss the specific kinds of interventions they could make using to assist their students using DBL data. In-class Instructional supports were provided on an ongoing basis. Teachers completed a survey to gauge teachers' comfort levels with the blended learning model, the use of DreamBox, the use of DBL data to meet individual needs, and to guide instruction. The vast majority of responses placed themselves on a continuum towards more intentional use of data to drive instruction, and a balanced math program that incorporates adaptive technology.

Impact on System	Leadership Development - Concurrent with the start of this study, the board established the role of Family of Schools vice-principal. Among their other duties, the FOS VPs play a strong role as instructional coaches. As such, they provided continuity and consistency across the board with this study. System Plans - Having a system-wide study led to opportunities for different kinds of observations and analyses, as compared to individual school CIs, for example. It allowed us to look for commonalities, to set goals and to compare results from school to school, and class to class. Scaling and Sustaining – As a critical mass of teachers at each school grows, we anticipate that scaling these approaches to Grade 1 and 4 would become easier and the initiative therefore more sustainable.