

Final Report for the Literacy and Numeracy Secretariat:

Niagara Catholic District School Board's Junior Interventions
Project



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EXECUTIVE SUMMARY

Background

Teachers are in the unique position to create opportunities for students to learn with each other and co-construct knowledge. For example, research has found (Mercer & Sams, 2006) that teachers can support students in their use of talk as a tool for mathematical reasoning and problem solving. Yet, it is clear that teachers hold distinct beliefs about the autonomy of students to construct mathematics knowledge through language and their own autonomy to make instructional decisions. This highlights a need to support teachers' professional learning in mathematics problem-solving teaching methods while attending to their beliefs about mathematics instruction, as well as honouring their content knowledge and experience. When teachers engage in professional learning that focuses on how to pose effective mathematics problems, teachers' beliefs shift toward recognizing the impact of their mathematics instruction (Barlow & Cates, 2006). It is commonly held that supporting the practice and confidence of teachers to instruct mathematics through problem solving takes time and personnel.

In its second year of implementation, the Niagara Catholic District School Board (NCDSB) *Junior Math Interventions Project* focused on developing teachers' effective use of diagnostic assessment to identify student misconceptions and drive their instruction of mathematics. Using the principles of collaborative inquiry, this program of professional learning sought to build on junior level teachers' mathematics content and pedagogical knowledge while bearing in mind their beliefs and attitudes about mathematics instruction and how students learn mathematics.

Methodology

The NCSDB's intervention design drew on aspects of the "Seven Foundational Principles for Improvement in Mathematics K-12" document. Operationally, the intervention design included three key components: facilitated teacher professional learning sessions, collegial teacher professional learning, and student intervention tutoring. A facilitator led all professional learning sessions and worked with two math coaches to offer ongoing support for the individual needs of teachers throughout the project. There were two, full day plenary sessions that were attended by all teacher participants and were co-facilitated by the two math coaches and facilitator. There were four, half day sessions that were guided by one of the facilitators at each of the school sites and included the grade 3-6 teachers and their administrator. Each of the participating teachers was granted eight half days to engage in collegial professional learning with their same-grade/division colleagues. An interventionist was assigned to each school and was devoted to providing one-on-one mathematics tutoring in number sense and numeration for students targeted by their classroom teachers.

This research was an evaluative case study with the purpose to inquire into an educational program in order to determine its effectiveness. There were six research questions that related to teachers' practices and beliefs, a comparison between teachers participating for the first or second year, and students' achievement. Quantitative and qualitative data (surveys, interviews, fieldnotes, journals, report card scores) were collected from five sets of participants: teachers, facilitators, principals, interventionists and students. There were 21 teachers (grades 3 to 6) at five schools that participated in the program and their students indirectly participated as recipients of the teachers' professional learning and intervention tutoring. All participants (teachers, principals, interventionists, facilitators, parents/guardians of students) signed informed consent forms.

Findings

The findings from this research indicate that teacher participants who engaged in collaborative inquiry focused on enhancing their math instruction by teaching through problem solving, and experienced positive professional learning and growth. At each site, junior division and grade 3 teacher participants joined to create a collaborative inquiry question to focus their instruction. These questions reflected their experience in the JMI project and readiness to alter and hone their practices. All of the teachers perceived that their students' learning was significantly impacted by their co-planning and co-teaching. Some of the co-planning activities included curriculum mapping which elucidated mathematics skills across the grade levels. Teachers in their second year of the project also acted as effective models of instruction for those in their first year.

As teacher participants negotiated their relationship with the math content and their students' learning, they recognized that the entire dynamic of their classrooms and the roles within it were changing. Communication and collaboration became key indicators of productivity in the math problem solving environment. Teachers were challenged to pose provocative, open-ended and open-routed questions and students were challenged to express their thinking and critically analyze the thinking of their peers. Teachers worked to create a math-talk culture in their classrooms; here was the place where students became leaders of their mathematics learning and teachers learned alongside of them. As a result, the teachers were less likely to contend that their role is to transmit and verify mathematical knowledge. The teachers now appreciate the key role that students have in their own learning and that students are capable of much higher levels of mathematical thought.

Within the classrooms, teachers encouraged peer collaboration and consequently witnessed students working through problems together. A math-talk culture was founded on respect while listening to your peers and communicating your thinking in a variety of different ways. Teachers remarked on the need for their students to continue to hone the necessary skills to work in such collaborative groups and feel confident taking risks to express their thinking.

Using language and communication skills has taken on heightened importance in mathematics lessons that are based on problem solving and collaborative inquiry. The teachers are no longer relying on published textbooks as an instructional resource, rather, they are promoting students' understanding of math content with authentic, relevant problems. Many of the teachers expressed how they used the numeracy nets for differentiating instruction to support the learning of students with similar misconceptions in mathematics and to identify students that required additional intervention.

Intensive remedial instruction with an interventionist was among the various approaches employed in this second year to provide mathematics support for students. Since this was a new initiative, the interventionists had to define their role and delineate how to work with students. Unequivocally, teachers stated that the interventionists were providing integral support as targeted students were displaying more confidence in mathematics and participating actively in whole group mathematics activities.

Growth in students' achievement was evident in all strands of mathematics based on analyses of report card grades (Term 1 and Term 2) and for students who received tutoring. Statistically significant student achievement has been summarized for each school site and interpreted in a series of tables. Influential factors such as gender, grade, school and tutoring were calculated.

Implications

Based on the findings, implications for practice and future research are offered. It is apparent that teachers derive great benefit from release time for co-planning and co-teaching and two years of participation in this professional learning. Refinements might include beginning of the school year support in curriculum mapping, numeracy nets and building a math-talk culture. The continued deployment of mathematics interventionists and refinement of their role is integral.

Author Note:

Dr. Tiffany L. Gallagher is an educational researcher and Associate Professor in the Department of Teacher Education at Brock University. Her research expertise is in mixed methods research designs that investigate assessment and teaching strategies and students with exceptional learning needs. A request was made by NCDSB to the Research Officer at Brock University Faculty of Education for a researcher to investigate the *Junior Math Interventions Project* and Dr. Gallagher elected to assume this role. Throughout the 2011/12 and 2012/13 school years, Dr. Gallagher has remained at arms-length to the design and facilitation of this project. The research of this project was vetted through the Research Ethics Board at Brock University and NCDSB. Dr. Gallagher independently and confidentially collected and analyzed all of the data contained in this report. Dr. Gallagher has never been employed by Niagara Catholic District School Board and was not remunerated for the research or writing of this report; consequently she has remained an objective evaluator throughout this process.