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Research Brief

The Math for Young Children (M4YC) Project: A No Ceiling Approach To Math Learning In An Urban School

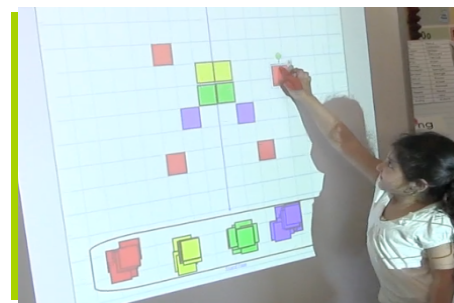
Bev Caswell Ph.D.



UNIVERSITY OF TORONTO
OISE | ONTARIO INSTITUTE
FOR STUDIES IN EDUCATION

Research indicates there is a strong need for high quality math instruction in the early years (Seo & Ginsburg, 2004; Duncan et al., 2007). In particular, the development of spatial skills are crucial for math performance (Verdine et al., 2013). Despite its importance, and the fact that it can be trained (Uttal et al., 2012), spatial reasoning is a

neglected area of instruction in early years classrooms (Clements & Sarama, 2011). Few research studies demonstrate actual activities that teachers might use to strengthen children's understanding in these areas. To address this gap our study focuses on strengthening young children's spatial reasoning and builds on the need to develop curricula to foster young children's mathematical and



spatial understanding.

Approach and Design

The Math for Young Children (M4YC) project works with teams of JK – Grade 2 educators in Ontario schools to investigate the assets that young children bring to math learning in the early years, and to design field-tested resources that build on students' strengths. We

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draw on Japanese Lesson Study for our teacher professional development process. This approach involves teachers jointly planning, observing, analyzing and refining actual classroom lessons called Research Lessons. Japanese Lesson Study pedagogy helps teachers focus on children’s mathematical thinking. One of the hallmarks of lesson study is the “teacher-led interview” which provides the framework foundation for designing lessons and resources for further development of children’s mathematical thinking.

The present study draws on findings from one of M4YC’s professional learning teams in a Toronto school whose student population mainly consists of Newcomers from Syria who are English language learners. The school has been identified as underperforming in provincial standardized literacy and math scores. The participants were four JK/SK

teachers and one Grade 1 teacher, the school principal, a numeracy facilitator from the school board, and a team of researchers from the Ontario Institute for Studies in Education at the University of Toronto. The research study took place over a 5-month period and during that time, teachers were provided with release for seven full days through funding from the Literacy and Numeracy Secretariat of the Ontario Ministry of Education. The research team, led by Dr. Joan Moss, and Dr. Bev Caswell, along with Zack Hawes, Sarah Naqvi and Diana Chang, facilitated teacher professional development. To investigate the effect of the professional development (PD) on the teachers’ development of content knowledge, the teachers completed a survey of their knowledge of geometry and spatial reasoning prior to the first PD session and then during the final PD meeting. To study change in the students’ knowledge and understanding of geometry and spatial reasoning, the students completed measures of math and geometry knowledge before and after the 5-month PD project.

Description of the PD

In the early sessions, the teachers explored different hands-on geometry activities and challenges that were new to them. Along with these explorations, they learned about current research in geometry. After reflecting on their experiences exploring curriculum and pedagogy of geometry, the teachers, in collaboration with the researchers, designed and administered one-on-one teacher-led interviews to learn the kind of spatial reasoning their children bring to school. Each of the teacher led interviews was videotaped to be shown in the next PD session. The research team reflected on the clinical interviews and subsequently designed “exploratory” lessons to build on the strengths that students revealed in the interviews.

Findings

Analysis of fieldnotes taken during the PD sessions and transcribed interviews following PD showed



This collaborative team of teachers and researchers are part of the ongoing Math for Young Children (M4YC) Project under the leadership of Dr. Joan Moss (University of Toronto) and Dr. Cathy Bruce (Trent University).

Research Team:

Dr. Bev Caswell, (Director, Robertson Program for Inquiry-Based Teaching in Mathematics and Science,
 Dr. Eric Jackman Institute of Child Study, OISE)
 Dr. Joan Moss (Associate Professor,
 Dr. Eric Jackman Institute of Child Study, OISE)
 Zack Hawes, Diana Chang, Sarah Naqvi (Robertson Program for Inquiry-Based Teaching in Mathematics and Science)

Teachers: Stefanie Martino, Nancy Valentini, Francesca Lisi, Eva Santianni, Julie Fiorucci,

Principal: Debby Culotta,

Vice Principal: Theresa Zavaglia

Math Resource Teacher:

Monica Rohel

Literacy and Numeracy

Secretariat: Jennipher Torney

that teachers gained substantial knowledge of geometry. The public testimonials that teacher participants offered during the public research lesson revealed how their expectations of students' abilities changed dramatically. The teachers admitted that prior to the study they held lower expectations for their students. At the end of the project they were thrilled to see their students as capable young mathematicians. Although our efforts as researchers were directed toward the teachers, analysis of pre- and post-test math reasoning assessments showed student gains in all areas of math. In contrast, a pilot control group showed no change in math reasoning during the same time period. This research project differed from other collaborative inquiry models through its use of a teacher-led "clinical" interview, in which teachers create research-based math tasks as the basis for interviewing children and listening to their mathematical ideas. This approach makes children's thinking visible.

Our research suggests that young children, irrespective of their entry points, are capable of engaging in transformational geometry not typically addressed in early years classrooms. Through a professional development approach that combines Japanese Lesson Study and adaptive lesson design (e.g., effective scaffolding and

differentiated instruction), teachers can create learning environments in which students of diverse backgrounds are given opportunities to demonstrate sophisticated mathematical thinking. Teachers' involvement in this type of professional development allowed them to develop and further strengthen their own understanding of geometry and spatial reasoning.

Implications for research, policy and/or practice

Our research challenges assumptions about of the kinds of mathematics young children are capable of and contributes to the growing awareness of the potential of young children to reason spatially. Our work addresses the important and often neglected topic in early years classrooms (National Council of Teachers of Mathematics, 2010; National Research Council, 2006). As well, teachers benefit from developing their math content knowledge through playful pedagogy in tandem with an asset-based approach to viewing their students. Our teacher professional development model disrupts hierarchical approaches to research, honours teachers' professional knowledge, and provides opportunities for teachers to truly contribute to educational research. This approach brings authenticity to the research and honours teachers as the professionals they are.

Citations

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CUS News

The William Waters Scholarships in Urban Education

OISE is offering two \$8,000 scholarships to promote excellence in teaching in the urban classroom. The successful candidates will be experienced teacher entering a full or part-time Master's program with an interest in questions of social justice and school success for students from economically disadvantaged neighborhoods attending underperforming schools.

In addition to the requirements set out by the graduate program, the successful scholarship recipients will be invited to join the Centre for Urban Schooling and participate in the wide variety of activities related to research, professional development, advocacy and teacher education promoted by the Centre over the course of the year.

Application deadline for 2014-2015 is January 17, 2014.

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The Centre for Urban Schooling Department of Curriculum, Teaching and Learning
Ontario Institute for Studies in Education of the University of Toronto