

# TEACHING MATHEMATICS TO STRUGGLING LEARNERS PROFESSIONAL DEVELOPMENT

## FINAL EVALUATION BRIEF

### What Happened

Teaching Math to Struggling Learners (TMSL) was designed to assist Waterloo Community School District's (WCS) special education teachers in increasing their content knowledge in mathematics, in learning or reinforcing mathematical pedagogy, in becoming confident in using the WCS supplemental mathematics series *Do the Math*, and in becoming comfortable with a diagnostic assessment in the Cognition-Based Assessment and Teaching series.

**2014-2017**



**CTL**M CENTER FOR TEACHING AND  
LEARNING MATHEMATICS  
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## TMSL's implementation phase was composed of the following five sessions:

1. **January 2015 to May 2015** – *Teaching Mathematics to Struggling Learners (TMSL): Building Your Confidence*;
2. **June 2015 to December 2016** – TMSL: *Addition, Subtraction and Place Value*;
3. **January 2016 to May 2016** – TMSL: *Multiplication and Division*;
4. **August 2016 to December 2016** – TMSL: *Fractions*;
5. **January 2017 to May 2017** – continue to implement *Do the Math* and diagnostic assessment, administer district-wide spring Iowa Assessments Mathematics test and spring student mathematics attitude survey.

During the first session, the experimental group, which consisted of mathematics coaches, a general education teacher, special education teachers, and a Title I mathematics teacher, were introduced to and provided guidance on the use of *Do the Math* and the diagnostic assessment. In addition, baseline information was collected on participants' content knowledge of number sense and operations, mathematics teaching efficacy, and user program confidence. There was no control group.

For sessions two through five, a voluntary group of educators from WCS served as a matching control group that enabled the evaluation plan to implement a quasi-experimental design. Using the Abt Associates Inc. baseline equivalence procedure, control versus experimental group comparisons were made on content knowledge and mathematics teaching efficacy. In addition, the evaluation plan was extended to investigate both student achievement and student attitude toward mathematics.

To provide feedback to the instructor, the Concerns-Based Adoption Models' (CBAM) Stages of Concern survey and a course evaluation survey were periodically administered to the experimental group. Several questions in the course evaluation survey asked about meeting professional learning needs. Finally, CBAM's Level of Use (LoU) interview procedure was used to monitor implementation of both *Do the Math* and the diagnostic assessment. LoU interview scores provided a way to measure usage confidence.

## How are the Results Reported?

The evaluation questions results are reported in two ways: for questions that are relevant to program implementation or course evaluation, the results will be reported for the actively engaged experimental participants,  $n = 15$ , and for questions that compare the control group versus the experimental group, such as in content knowledge, mathematics teaching efficacy, student achievement and student mathematics attitude, the results will be reported relative to the baseline equivalent groups per school year. Actively engaged experimental participants are WCS educators who partook in summer and school year sessions in 2015/16 and 2016/17.

### ①

#### DID THE EXPERIMENTAL GROUP CONFIDENTLY IMPLEMENT THE DO THE MATH PROGRAM?

**YES.** Fall 2016 Levels of Use interviews found that actively engaged participants were at least at the Routine level of use with 53.3% at the Refined level and 40.0% at the Integration level. Refined and Integration level users are able to vary a program to impact students. Further, the Integration level user is able to work with others to achieve a collective effect on students.

### ②

#### DID THE EXPERIMENTAL GROUP CONFIDENTLY IMPLEMENT THE DIAGNOSTIC ASSESSMENT?

**YES.** Fall 2016 Levels of Use interviews found that 53.3% of actively engaged participants were at the Routine level, and 46.7% of the engaged group were at the Refined level. The Routine level user is comfortable with administering the diagnostic assessment in accordance with the directions of administration.

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### DID THE EXPERIMENTAL GROUP INCREASE THEIR BELIEF IN THE EFFECT OF GOOD TEACHING ON STUDENT OUTCOMES AS MEASURED BY THE MATHEMATICS TEACHING EFFICACY BELIEFS INSTRUMENT'S OUTCOMES EXPECTANCY SCALE?

**YES.** When the control and experimental groups were initially compared in 2015/16, on the Outcomes Expectancy (OE) scale, there was no statistical differences. During the 2016/17 session, however, there was a statistical difference on the OE scale at the .01 level of statistical significance in favor of the experimental group. The experimental participants' OE scores increased while the control group's OE scores slightly decreased. The Partial Eta Squared for the OE scale was equal to .31 and is considered a large effect size.

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### DID THE EXPERIMENTAL GROUP INCREASE THEIR BELIEF THAT THEY BECAME EFFECTIVE TEACHERS OF MATHEMATICS AS MEASURED BY THE MATHEMATICS TEACHING EFFICACY BELIEFS INSTRUMENT'S SELF-EFFICACY SCALE?

**YES.** When the control and experimental groups were initially compared in 2015/16, on the Self-Efficacy (SE) scale, there was a statistical difference at the .004 level of statistical significance in favor of the experimental group. The Partial Eta Squared for the SE scale was equal to .28 and is considered a large effect size. During the 2016/17 session, there was a statistically significant difference on the SE scale at the .08 level of statistical significance in favor of the experimental group. The experimental group's SE score increased while the control group's SE score slightly decreased. The Partial Eta Squared for the SE scale was equal to .16 and was between a medium and strong effect value.

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### DID THE EXPERIMENTAL GROUP INCREASE THEIR MATHEMATICAL CONTENT KNOWLEDGE AS MEASURED BY THE LEARNING MATHEMATICS FOR TEACHING (LMT) ASSESSMENTS OF NUMBER CONCEPTS AND OPERATIONS AND RATIONAL NUMBERS?

**YES.** When the control and experimental groups were compared in 2015/16 on the LMT Number Concepts and Operations (NCOP) assessment, there was a statistical difference at the .02 level of statistical significance in favor of the experimental group. The Partial Eta Squared for the NCOP assessment was equal to .18 and was between a medium and strong effect value. In 2016/17, the groups were compared on the LMT Rational Numbers (RN) assessment. Again, there is a statistically significant difference between groups at the .05 level of probability in favor of the experimental group. The Partial Eta Squared for the LMT Rational Numbers test was equal to .17 and was between a medium and strong effect. In both 2015/16 and 2016/17, the experimental group's LMT scores increased, and the control group's scores slightly decreased.

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### DID THE COURSES MEET THE LEARNING AND PROFESSIONAL NEEDS OF THE EXPERIMENTAL GROUP?

**YES.** For the actively engaged experimental participants, 97.8% of the group agreed that the courses either met or partially met their professional learning goals in content knowledge and pedagogy. In addition, **all** the Waterloo participants highly valued the face-to-face activities, discussions, and math tasks.

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### DID STUDENT ACHIEVEMENT INCREASE AS MEASURED BY THE IOWA ASSESSMENTS MATHEMATICS ASSESSMENT?

**NO.** When comparing baseline equivalent control and experimental special education student groups, there was no statistical differences between the groups for either 2015/16 or 2016/17. For the 2016/17 school year, the control group was limited to ten students. Other control group students were in experimental group classrooms in 2015/16 and were excluded from the 2016/17 statistical analysis. While experimental group participants reported that students successfully completed *Do the Math* lessons and demonstrated growth as measured by *Do the Math* pre/post assessments, student understanding of fundamental mathematical concepts did not transfer to the Iowa Assessments Mathematics achievement assessment.

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### DID STUDENT ATTITUDE TOWARD MATHEMATICS IMPROVE AS MEASURED BY THE TIMSS MATHEMATICS ATTITUDE SURVEY?

**MIXED RESULTS.** Mixed Results, student attitude toward mathematics was measured by an instrument developed by the International Association for the Evaluation of Education Achievement. This instrument is composed of two scales: Positive Affect Toward Mathematics (PATM) and Self-Confidence in Learning Mathematics (SCM). For 2015/16, the winter to spring comparison of only experimental group children found no statistical differences. However, there was a positive trend found on the SCM scale with 92.5% of the 53 children classifying themselves as either High or Medium. In 2016/17, baseline equivalent control and experimental groups' students were compared on spring PATM and SCM scale values. For both the PATM and SCM, the Fisher Exact Test probability value equated to .08. The score distributions favored the control group.

Unlike the Iowa Assessments Mathematics test, the TIMSS survey required parent permission for participation. For the 2016/17, control group students were younger than experimental group students. According to Ma and Kishor, students in grade levels 1 through 4 may not be able to express their attitudes as precisely as upper elementary or middle school students.

