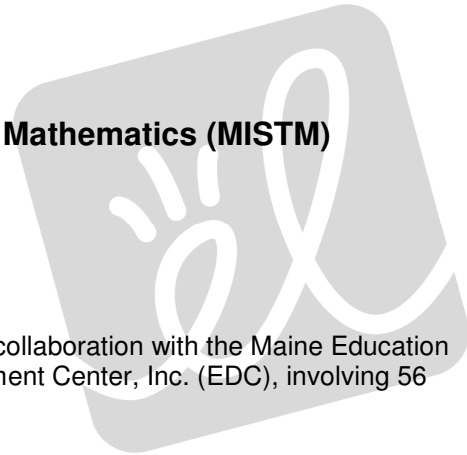


## Maine's Impact Study of Technology in Mathematics (MISTM)

### Research Brief



#### SUMMARY

An independent study by Maine's Department of Education, in collaboration with the Maine Education Policy Research Institute (MEPRI) and the Education Development Center, Inc. (EDC), involving 56 rural middle schools found strong scientific evidence that:

- **teachers receiving a professional development program centering on the use of online virtual manipulatives, including ExploreLearning Gizmos™, significantly outperformed control group teachers in mathematics content knowledge.**
- **their students significantly outperformed those in a control group on mathematics test scores.**

#### PROGRAM OVERVIEW

Maine's Impact Study of Technology in Mathematics (MISTM) evaluated the impact of a technology-infused two-year professional development program for teachers on the mathematics achievement of rural middle school students.

The program was initiated to address pressing needs in Maine's rural middle schools regarding mathematics instruction:

- 79% of Maine's eighth grade students fail to meet state mathematics learning standards; 85% of low performing schools in mathematics are in rural communities.
- More than half of Maine's middle school teachers have limited mathematics content knowledge because they were trained as elementary school teachers.

Through a combination of face-to-face and online workshops, peer coaching and mentoring, and site visits, the professional development program focused on improving teachers' math content knowledge, pedagogical skills, and ability to integrate technology effectively into their instruction. In addition to measuring teachers' progress in these areas, researchers also investigated whether these gains translated into higher student achievement as evidenced by their math test scores. Online virtual manipulatives, including ExploreLearning Gizmos, were integral to the program and were chosen because of their strength in building conceptual understanding while catalyzing inquiry-based teaching methods.

#### RESEARCH METHODOLOGY

The MISTM evaluation was funded by the U.S. Department of Education through the Office of Elementary and Secondary Education's School Support and Technology Program, and followed criteria for a 'gold standard' study:

- a RCT (randomized, controlled trial) design, where participating schools were randomly assigned to treatment or control groups, and pre-existing differences between groups (if any) were measured and statistically controlled for;
- an adequate sample size – 109 teachers and 5413 students participated in the study across 56 school sites;
- academic achievement was measured using standardized test instruments whose validity and reliability were statistically confirmed;

- reported results include both the effect sizes measured and statistical tests showing the effect is unlikely to occur by chance.

## RESULTS – Student Performance and Teaching Practice:

**Student Performance - Statistically significant differences** between treatment and control groups were found in middle school students' overall mathematical achievement, as evidenced by their test scores. The strongest area of improvement was in the area comprising the understanding of patterns, relations and functions, algebra concepts, and mathematical communication.

Measure	$p$	Effect size	Percentile*
Total Test Score	$p < 0.01$	$d = .39$	66 <sup>th</sup>
Subtest: Patterns, Relations, Functions; Algebra Concepts; Mathematical Communication	$p < 0.01$	$d = .50$	69 <sup>th</sup>

**\* Example: the average student in the treatment group scored better than 66% of the students in the control group on the Total Test Score measure.**

**Teaching Practice - Statistically significant differences** were found between teachers in the treatment and control groups in mathematics content knowledge, frequency of use of laptops in lessons and activities, and the use of interactive applets to support inquiry-based learning methods.

Measure	$p$	Effect size	Percentile*
Mathematics content knowledge of teachers: Number & Operations	$p < 0.01$	$d = .79$	79 <sup>th</sup>
Mathematics content knowledge of teachers: Patterns, Relations & Functions	$p < 0.01$	$d = 1.14$	86 <sup>th</sup>
Frequency of use of laptops in lessons and activities (scale of 1-10)	$p < 0.01$	$d = 1.23$	89 <sup>th</sup>
Use of interactive applets to support inquiry-based learning methods (scale of 1-5)	$p < 0.01$	$d = 1.24$	89 <sup>th</sup>

**\* Example: the average teacher in the treatment group scored better than 86% of the teachers in the control group on the knowledge of Patterns, Relations, and Algebra measure.**