

Background

The *American Recovery and Reinvestment Act of 2009* (ARRA) included a \$650 million allocation in ESEA Title II, Part D, commonly referred to as the *Enhancing Education Through Technology program* (EETT). This case study was prepared by the State Educational Technology Directors Association (SETDA) – the principal association representing the technology leadership of state and territorial departments of education – to provide an example of ARRA funds working at the district and classroom level that creates effective, viable, and robust reform in education, and improves the way teachers teach and students learn.

Maine's EETT Competitive Grants

Maine's ARRA EETT competitive grant focused on the integration of Open Educational Resources (OER) into the daily curriculum. The grant provided professional development to increase awareness of OER, research, and evaluation of the resources. In addition, Maine built an online community to provide an avenue for sharing and evaluating OER beyond the end of the grant cycle.

Open Educational Resources in Mathematics Professional Development Project Maine Regional School Districts #54 and #11, Statewide Grant April 2010-September 2011

The primary goal of the Open Educational Resources in Mathematics Professional Development Project was to build the capacity of mathematics teachers and technology integration specialists to effectively utilize open educational resources for selected mathematics topics to improve mathematics achievement and technological literacy for students in grades 7 to 12. Development teams of teachers and education partners designed resources and activities to connect content topics and curriculum needs to assessment practices and instructional strategies.

Demographics

The grant recipients included two partner districts: Regional School Unit (RSU) #54, which includes schools from Canaan, Cornville, Mercer, Norridgewock, Skowhegan, and Smithfield and RSU #11 with schools from Gardiner, Pittston, Randolph, and West Gardiner. Both districts are regional school units drawing from nearby rural communities. Three of the partner schools are Title I schools.

Project Description

The Maine Learning Technology Initiative (MLTI) currently provides professional development to Maine teachers and 21st century tools to middle and high school students to support the state curriculum and standards. As of January 2010, 226 middle schools and 66 high schools were participating in the 1-to-1 MLTI program. With tools and strong professional development initiatives in place, Maine sought to utilize and extend resources and assessment data to better meet the needs of students, particularly in the area of mathematics. This project took advantage of the potential of

OER, combined with training and appropriate technological hardware, to support classroom technology integration with the goal to improve mathematics achievement and technological literacy for grades 7 to 12 students.

State and district assessment data showed students struggling in foundational algebraic concepts. Therefore, Maine RSU #54 and RSU #11, in partnership with Education Development Center, Inc. (EDC), collaborated to develop, pilot, and implement a comprehensive package of professional development resources for teachers to help impact mathematics instruction and student achievement. The professional development focused on use of research-based instructional methods for mathematics indicators in the Maine Learning Results (MLR): Parameters for Essential Instruction (PEI) aligned with identified needs in the partner districts and the state. The targeted indicators were critical foundational skills for algebra in grades 7 to 12, including rational number concepts. Professional development was designed to use OER and technology tools to support the connections between and among Assessment practices, Curriculum, and Instruction (ACI). In addition, the project utilized the technological pedagogical content knowledge (TPACK) framework for project planning and professional development activities with educators. Teachers were trained to use formative assessment data to determine specific areas of student difficulty and how to explicitly target those areas of weakness through the online resources.

ARRA EETT Grant Details	
Grant Focus	Ongoing Professional Development, Digital, and/or Open Content
Beginning/End Date of Grant	April 1, 2010-September 30, 2011
Locale	Rural
Funding	\$183,868
Grade Level (s)	7-12
Number of Teachers Impacted	97
Number of Administrators Impacted	5
Number of Students Impacted	1,684

Project Implementation

The project was designed as a multi-tiered professional development initiative with three cohorts involved; the development team of teachers from the partner districts, the partner teachers from the partner districts, and the statewide online group. The professional development activities provided instruction, guidance, and support for all participants. The three groups were engaged in using OER and other technologies to connect Assessment practices, Curriculum topics and Instruction (ACI) through the learning cycle.

The first cohort, the development team, which included 14 teachers from 2 partnering districts, received face-to-face professional development in the spring and summer of 2010 along with online professional development that included both synchronous and asynchronous components from the fall of 2010 through the spring 2011. This team, along with the EDC staff, created a series of lesson sets, which were organized by targeted mathematics topics, such as the distributive property. The lesson sets, now available on the project website (<http://maine.edc.org/file.php/1/oermath.html>), included lesson materials, diagnostic assessment tools, information on analyzing data, classroom implementation and instructional resources, and a post-assessment tool. Designed for teachers and students, a typical lesson set included screencasts—digital recordings of the computer screen—as a demonstration of student thinking or as a guide to implementation of the resources. As well, the instructional resources included applets designed specifically for the lessons and many other appropriate OER resources. Fifteen topic sessions were made available on the project website (see http://maine.edc.org/file.php/1/oer/math_PDResources.html).

The second cohort, the participating partner teachers, received face-to-face professional development in the fall of 2010 and participated in online professional development that included both synchronous and asynchronous components from the fall of 2010 through the spring of 2011. Training began with review of background lesson materials in order to determine the learning targets followed by training in the administration of pre-assessments to determine students' knowledge and areas of weakness. The participating teachers then analyzed their students' data and selected instructional activities and areas of focus using the online applets and student explorations. After each lesson, teachers re-assessed to determine what students learned and the focus of the next instructional activities. Over the course of the year, participating teachers and project staff customized and shared resources, created new resources, and established a community of practice both online and in smaller school-based groups.

The third cohort, the statewide online group, participated in online professional development opportunities described above that included both synchronous and asynchronous components from the fall on 2010 to spring 2011. Teachers, not a part of the initial development, gathered to define OER, explore resources, and use OER to improve the learning process. Webinars were conducted to guide participants in utilizing the lesson sets. Upon implementing the lessons, teachers were encouraged to participate in an online discussion on the project website, including a reflection about any changes pre- to post-assessment and possible next steps in instruction. Through participation in this project, teachers gained a better understanding of OER and how to implement OER in the

classroom. Teachers also had the opportunity to create and share OER through online discussions on the project website.

A total of 58 schools supported teachers in this program and in the spring of 2011, face-to-face professional development was offered to additional middle and high school teachers during the statewide dissemination efforts.

Classroom Examples

- Before the grant, even with laptops available, many teachers taught integer operations in the seventh grade using paper and pencil activities, and some used hands-on manipulatives. As part of this program, upon starting the study of integers, students completed a formative assessment task and entered the data through the use of handheld clickers. The students and teacher then examined and discussed the results. During this process, the students and teacher identified some critical questions to explore. The teacher selected teams of students to participate in an activity in which they "walked the number line" to investigate integer operations. Students then launched an interactive applet titled "Walking the Number Line" on their laptops. This applet models the addition and subtraction of integers by walking a character along a number line (<http://maine.edc.org/file.php/1/tools/IntegerWalkNumLine2.html>).
- Students in eighth grade mathematics engaged in a lesson about equivalent expressions using a distributive property interactive applet. They began by predicting whether expressions are equivalent or not on an online formative assessment probe. Students and teacher discussed the whole class predictions then paired to explore the distributive property with an interactive applet. The students discussed and compared their findings with their original predictions. Students recorded their interactions with the applet and their discussions in a screencast to share with peers and their teacher (for an example of a screencast see: http://maine.edc.org/file.php/1/oe/math_StScreencast_EquivExprDistribProp3.html).

I am more comfortable allowing students to work at their own pace and to be more independent in their learning. I like that different students can do the same activity, beginning with different skill levels, but still advance their understanding of a topic through the applet and the assessments.

–Grade 8 Math Teacher

Evaluating Effectiveness

The formal evaluation of the project included teacher and student data. Evaluation results suggest educators in the survey sample self-reported upward shifts in areas such as: knowledge of areas of student difficulty; frequency of implementing formative assessments; frequency of use of OER; frequency of use of technology to support a cycle of inquiry; and competency with targeted technology integration strategies and tools.

A descriptive analysis of project student formative assessment results shows that student achievement did increase overall in the Maine Learning Results (MLR): PEI indicators targeted by the project. Averaging the percent correct scores across the targeted domains shows that increases varied for matched pre-/post classes from 6% to 17%, and for matched pre-/delayed post classes from 0.2% to 20%. The greatest gains for both the pre-/post matched classes and the pre-/delayed post matched classes were in the domains of Symbols and Expressions (17% and 20%, respectively) and Functions and Relations (16% and 12%, respectively).

Assessment Data

- The average percent correct scores across the targeted domains shows increases from pre-to post-assessments up to 17%.
- The greatest gains were in the domains of Symbols and Expressions (20%) and Functions and Relations (16%).

Moving Forward

The lessons and OER resources will be disseminated more broadly to ensure teachers statewide can implement the resources in their classrooms. The website developed for this project offers lessons and applets for global use.

Resources

OER in Mathematics Professional Development Project
<http://maine.edc.org/file.php/1/oermath.html>

Maine Learning Technology Initiative
<http://maine.gov/mlti/index.shtml>

Maine Department of Education
<http://maine.gov/education/>

SETDA ARRA Information and Resources
<http://setda.org/web/guest/ARRAresources>