

Using Technology and the Internet to Develop Rich Mathematics Units

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This paper summarizes activities of the Mathematics Through Technology (MTT) project, a program of development and research funded by the National Science Foundation. The focus of the project is to develop instructional units in mathematics for middle grade students that use technology in appropriate ways to enhance learning.

Context: The MTT project began two years ago at a time when the nation's schools were spending heavily on technology and many people in the public sector were concerned about student performance in mathematics. The situation has changed little over the intervening years. Schools continue to invest heavily in technology, albeit mostly for equipment and Internet access and not on teacher development and instructional materials. The practical effect is that in many schools there is adequate access but limited use. With regard to student performance, the critics are as vocal as ever, although it is hard to assess their number.

Project: The MTT project is in the process of creating six Internet-based instructional units for students in grades 5-8 and accompanying teacher guides for use in mathematics instruction. These stand-alone units use real-time Internet sites as a source of realistic, current data for students to use in activities and investigations. The materials guide students to learn about and use computer software as tools to organize, display, and analyze data, and then to develop solutions to pre-planned and post hoc research questions they have posed. The units foster an active, investigative approach to learning and center on important mathematical concepts. The key mathematical concepts include exploratory data analysis, rates of change, proportional reasoning, and relationships among fractions, decimals and percents. There is a focus on connecting mathematics to other disciplines such as science (e.g., weather, tides, volcanoes) and social studies (e.g., population growth, economic indicators). Specific attention is given to embodying the ideas and concepts in the National Council of Teachers of Mathematics Principles and Standards for School Mathematics (PSSM) and the International Society for Technology Education (ISTE) technology standards. The units are designed to coordinate with recently published NSF middle school curriculum projects and with widely

used commercial textbook series. The attention to ways the units will fit with existing curriculum is important because the units are designed to complement existing curricula rather than supplant them.

Instructional Units: All instructional units developed by the project go through the same process: an initial pilot test, revision, a field test, and then a final revision. Currently this process has been completed for two units that deal with traffic speeds and flow on Interstate highways. The mathematics unit of the Curriculum Research and Development Group (CRDG) at the University of Hawaii, Dr. Barbara Dougherty, Director, is publishing these units. Other units at various stages of development center on weather data, river stages, currency exchange rates, and banking and finance.

Findings: Student and teacher response to the units has been very positive. Assessments indicate that students develop an understanding of the important mathematical ideas embedded in the units and make major strides in their ability to use technological tools such as spreadsheets and graphing programs. Difficulties noted with the use of the units include an initial learning period that takes some extra instructional time for both students and teachers to become acquainted with using the technology in the units, especially spreadsheets. Once familiarity and skill in the use of the technology is accomplished, progress through the units is markedly increased and mathematical learning is substantial.

Conclusion: Use of the MTT instructional units allow teachers to give their students experience with core mathematical ideas beyond that found in their textbooks. Simultaneously, the students increase their understanding of and ability to use technology in contexts that are realistic and interesting.