Chapter 29 *Core Math Tools*: Supporting Equitable Implementation of the Common Core State Standards for Mathematics

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ABSTRACT

Core Math Tools is an open-source suite of Java-based software tools that include general purpose tools—a spreadsheet, a computer algebra system, interactive (dynamic) geometry, data analysis, and simulation tools—together with topic-focused Custom Apps and Advanced Apps for triangle congruence and similarity, data modeling, linear programming, three-dimensional visualization, and more. Core Math Tools provides a unique linked tool set that supports the full range of contemporary high school mathematics. This design promotes the important mathematical practice of selecting and strategically using software tools. Accompanying the software is a Website at the National Council of Teachers of Mathematics (NCTM) providing content designed to help school districts meet the new Common Core State Standards for Mathematics (CCSSM). This chapter describes and illustrates use of the software in implementing rich tasks aligned with the CCSSM.

INTRODUCTION

It is essential that teachers and students have regular access to technologies that support and advance mathematical sense making, reasoning, problem solving, and communications. (National Council of Teachers of Mathematics, 2011)

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The power and potential of computer technologies for enhancing student learning and understanding of mathematics has long been recognized (cf. Conference Board of the Mathematical Sciences, 1983; Fey et al., 1984; and more recently Fey, Cuoco, Kieran, McMullin, & Zbiek, 2003; Masalski, 2005; Zbiek Heid, Blume, & Dick, 2007). However, in spite of the considerable promise that computer technologies provide for the improvement of school mathematics, the fulfillment of that promise has been stymied by issues of finance, access, and equity, among others (Heid, 1997, 2005). These intermingled issues have been exacerbated by the economic recession that began in 2008 and that brought about often repeated and deep cuts in state-level funding of public schools. *Core Math Tools*, as described in this chapter, provides a viable solution to the problems of finance, access, and equity as related to the integration of mathematical software in high school mathematics.

BACKGROUND

Genesis of Core Math Tools

Core Math Tools has its roots in the research and development work of the Core-Plus Mathematics Project (CPMP). In particular, in pre-planning for the second edition of the CPMP four-year high school curriculum, surveys and interviews showed that although students using the first edition materials had access to graphing calculators in class, most did not have access to such technology outside of school. This in turn directly influenced teachers' assigned homework and overall course pacing, since most technology-intensive tasks had to be completed in class. On the other hand, pre-planning surveys revealed that students were increasingly using the Internet. As research and development began on the second edition, a decision was made to augment graphing calculator use with the use of computer technologies, specifically with a suite of Java-based software tools designed and developed by the project. Included were a spreadsheet, a computer algebra system (CAS), interactive geometry, data analysis, and simulation tools, together with topic-specific custom apps (Fey & Hirsch, 2007).

The team of mathematics educators working on the curriculum revision and software tools viewed the development process as an extended design experiment (Brown, 1992; Collins, 1992; Design-Based Research Collective, 2003; Gravemeijer, 1994) that included cycles of materials design, development, field testing, and revision. This process and the decision to fully incorporate use of the software in the instructional materials led to a richer, more engaging, and realistic problem-based curriculum. But equally important, we were able to maintain our commitment to access and equity in terms of technology use as evidenced in our field trials. These findings were substantiated by a Pew Internet and American Life Project (2009) survey that found that 95% of youth ages 14-17 were online, that 92% of families have a computer, and that 76% of those have high-speed Internet access. Reports from the field indicate that these percentages have continued to grow.

Common Core State Standards for Mathematics: Technology Expectations

The Common Core State Standards for Mathematics (CCSSM) released in June 2010 include Standards for Mathematical Practice in addition to content standards organized in conceptual categories. Among the eight identified mathematical practices is the disposition and skill to "Use appropriate tools strategically" (Common Core State Standards Initiative, 2010, p. 6). At the high school level these tools include:

A spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful.... They are able to use these tools to explore and deepen their understanding of concepts. (Common Core State Standards Initiative, 2010, p. 7) 19 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:

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