

Chapter 37

The Incorporation of *Geometer's Sketchpad* in a High School Geometry Curriculum

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ABSTRACT

The Common Core State Mathematics Standards (CCSSM) recommend that technology should be integrated into teaching and learning Mathematics. This chapter addresses how the Geometer's Sketchpad computer program can support students' thinking skills and learning outcomes in a high school geometry class, in particular for more effectively addressing the High School Geometry Standards (CCSSM: G.CO.10, G.CO. 11, and G.CO. 12). The findings from the study presented in this chapter indicate that this tool can help high school students increase their learning of geometry in terms of inductive reasoning and conceptual knowledge, but may not help improve students' motivation to learn geometry.

INTRODUCTION

Geometry is a “network of concepts, ways of reasoning and representation systems, used to explore and analyze shape and space” (Battista, 2007, p. 843). This critical area of mathematics appears in both the physical and virtual world that students encounter every day. Yet, according to

the Learning Principle from National Council of Teachers of Mathematics (NCTM) (2000), middle and high school standardized test results in mathematics from the past 10 years indicate that many U.S. students lack conceptual understanding and reasoning skills in geometry. At the current time, mathematics education in U.S. schools places an emphasis on learning procedural and basic skills, before applying them to concepts. As a result, there has been a lack of understanding of the

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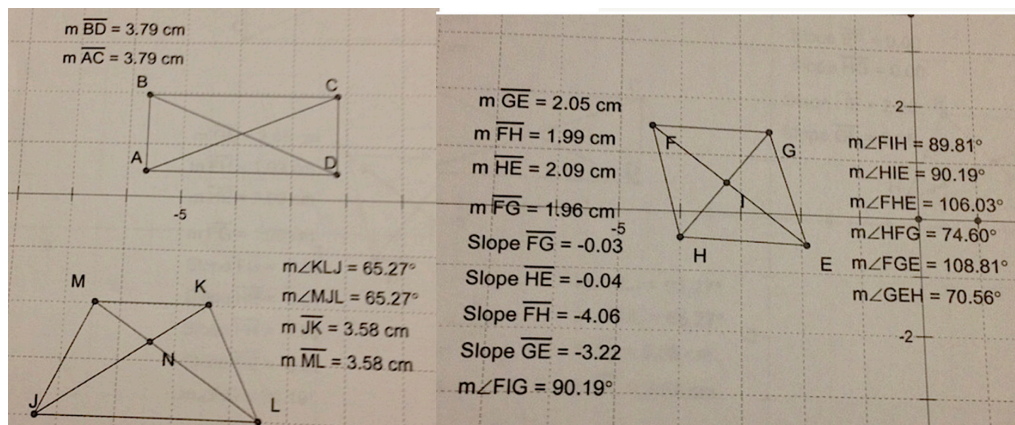
“big ideas” in mathematics and how they relate to other disciplines. When students lack conceptual understanding in mathematics, they also tend to lose interest and motivation to continue their learning because it comes across as the study of isolated facts and procedures rather than a process of reasoning and critical thinking (Acker, 1999; Anderman & Maehr, 1994; Teoh, Koo, & Singh, 2010). The Learning Principle from NCTM (2000) therefore indicates that there is a need to focus on conceptual learning in order for students to be able to apply their knowledge to a variety of mathematical situations. NCTM (2008) has also stressed in its position statement on technology that it is an essential tool for mathematical success in the 21st century.

As a proposed solution, many reformers have suggested that technology can play a role in improving learning outcomes in mathematics (Bos, 2007; Isikasal & Askar, 2005; Myers, 2009; Ploger & Hecht, 2009; Santos-Trigo & Cristobal-Escalante, 2008). Within the area of geometry, technology has been cited as being particularly useful in enhancing visualization (Kimmins, 1995; Mayes, 1995; Myers, 2009). Furthermore, while the Common Core State Mathematics Standards (CCSSM) focus on mathematics content, they also emphasize integrating technology as a way

to learn mathematical knowledge and skills. The Standards for Mathematical Practice (<http://www.corestandards.org/the-standards/mathematics/introduction/standards-for-mathematical-practice/>) expect that mathematically proficient students should know which tools would help them perform various tasks more effectively and use the appropriate tools strategically. One of these tools includes a highly visual discovery-based, interactive dynamic geometry computer program called *Geometer's Sketchpad* that can target key understandings identified in the CCSSM. When developing mathematical models, this rich, hands-on learning tool can help students visualize the results of various assumptions, to explore consequences and compare predictions. This tool is uniquely positioned to transform learning geometry through critical thinking and active exploration, thus empowering students to discover new relationships (See Figure 1).

Moreover, in recent years, mathematics teachers have been faced with a strong push towards using technological tools in their classrooms to supplement their print resources and to gain the interest of our ever-growing millennial student population, who are surrounded by and use technology on a constant basis. Current educational research is also stressing the need to tap

Figure 1. Using the measurement and construction tools in Geometer's sketchpad to determine properties of quadrilaterals



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