BUILDING A CONNECTION FROM PAINT TO GEOMETER'S SKETCHPAD

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Abstract

Elementary students start using the computer to play. *Paint*, a Windows application, encourages the students to draw pictures as an extension of their coloring books. Why not take this *Paint* experience and extend it into a smooth transition into the *Geometer's Sketchpad* environment? In this article, examples will be provided for both applications. This paper discusses insights for using geometry sketching software to teach geometric concepts for primary-age children.

Introduction

This paper discusses insights for using geometry sketching software to teach geometric concepts for kindergarten to grade 4. The authors emphasize the bridge teachers can build from Microsoft *Paint* and extend it into a smooth transition into the *Geometer's Sketchpad* (*GSP*) environment. The authors share hands-on resources that incorporate technology in a user-friendly environment. The authors emphasize the importance of the concrete teaching of geometry going from real-life examples, drawing, children's literature, *Paint*, and *Geometer's Sketchpad*. The second graders who participated in the activities commented on the fun and ease of the *GSP* software and compared it to the software *Paint*. The paper provides a literature review and appendices with geometry worksheets that can be used by elementary teachers to excite students about mathematics while incorporating the technologies reflected in the National Council of Teachers of Mathematics *Standards* (1989) and *Principles and Standards for School Mathematics* (2000).

Building spatial relationships can begin with real world shapes, teddy bears and other examples, any toy with various shapes for example. Parents lead students to exploring shapes when they begin coloring in books with crayons and by using children's literature, free-hand drawing, and by using *MicroSoft Paint* on the computer. All of this can help a child easily transition into using *Geometer's Sketchpad.* Primary teachers in school settings can have children describing real world objects like a new toy and ask the students, "What is the difference?" between two types of stuffed animals. The can share descriptions with friends, comparing sizes and shapes, or geometric characteristics.

Technology as a Principle for Teaching Mathematics

For many years, the use of technology has been advocated by the National Council of Teachers of Mathematics (NCTM, 1989 & 2000). As suggested by the NCTM guidelines, our young people need to be prepared to use the technology to solve problems and access information via the Internet. Technology surrounds us in most jobs, studies, and services. We cannot escape the information age and all it has to offer. Research states that geometry should be taught to young children because they are surrounded by geometric shapes in their environment and toys (Reys, Lindquist, Lambdin, Smith, & Suydam, 2004). As Piaget was credited, the idea of learning from concrete to abstract, learning geometry also uses this process (Reys, et. al., 2004):

- Very concrete and hands-on problem solving setting for learning geometry
- Semi-concrete experience using pictures and drawings in computer software
- Understanding geometric concepts in more abstract forms such as being able to compare and recognize both Euclidean and non-Euclidean geometries.

The technology like that of drawing/sketching software as in *Paint* and *Geometer's Sketchpad* can serve as a bridge in helping to develop the connections from the concrete geometry to ideas in modern advanced geometry which involves more abstract thinking.

Geometry Sketching Software

Geometer's Sketchpad by Key Curriculum Press is one of the most dynamic construction and exploration tool that exists to enable students to explore and understand mathematics in ways that are simply not possible with traditional tools. One may construct an object and then explore its mathematical properties by dragging the object with the mouse. *Cabri Geometry II*, mathematical software for learning geometry by Texas Instruments, also allows for geometry sketching and construction and brings its full dynamic power to study Euclidean and non-Euclidean geometries, algebra, trigonometry, pre-calculus, and calculus. Both software packages are commonly used by math departments in high schools and universities.

When activities are presented in a dynamic hands-on engaging manner, students today are motivated to learn. *GSP* software is an excellent interactive tool which allows students to create their own understanding of geometry and mathematical ideas. By

utilizing "best practices" in mathematics instruction (Zemelman, Daniels, & Hyde, 2005; NCTM, 1989, 1995, & 2000) like incorporating emerging technologies, educators can see greater gains in math achievement among their students. These activities also eradicate much math anxiety and fear of using computer software and learning mathematics. Almeqdadi (2000) has found in a controlled/experimental study that children who learned geometry using both a textbook and *GSP* software had significant gains in achievement over students who just used a textbook without software use. *GSP* makes the learning of geometry exciting and dynamic where one constructs his/her own understanding of geometry, not just reading it passively from a textbook.

Starting Early

Elementary school classrooms students should learn shape recognition through hands-on manipulatives (Reys, et. al., 2004). In Pre-K and first grade, students should experience activities that involve shape recognition with real-life examples. They should recognize that the shape of the table-top is a rectangle and that the shape of a pizza is a circle.

Geometry Sketching Software Research: Two- and Three-dimensional Space

A problem occurs when representing the three-dimensional real life objects to a two-dimensional computer screen environment. It is important for students to move gradually into the computer environment by relating hands-on manipulatives to two-dimensional computer shapes. A study found *GSP* provides opportunities to have a distinct positive affect on students' learning of three-dimensional geometry. (McClintock, Jiang, & July, 2002). By introducing students to these activities at an early age, they will be able to proceed to more abstract mathematical concepts in the upper elementary grades and beyond. When primary age children are learning mathematics concepts, Berlin and White (1986) found that computer simulations provide a smooth transition from concrete manipulation of objects to their abstract understanding. The flow chart in Figure 1 describes the Process of Learning Geometry.

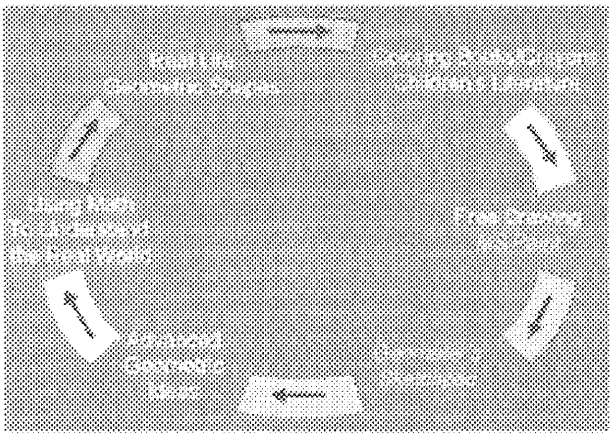

Figure 1- Flow chart of the Process of Learning Geometry

Math Standards

In our standards-based curriculum, most schools follow the NCTM (2000) and state standards like the Florida Sunshine State Standards (State of Florida DOE, 2006). In the Florida Sunshine Standards in Geometry and Spatial Sense, students are expected to work with two- and three-dimensional shapes; combine and subdivide shapes; use coordinate geometry to locate objects; and describe objects algebraically. In the Measurement Standard, students explore and solve real-world problems by estimation and measurement techniques.

Summary

Many benefits can occur as young students use the *GSP* software. Many elementary students compared *GSP* to *MS Paint* and thought it was very easy to use. By moving to graphing software, students can practice drawing, develop visualization skills, compare real-life objects, communicate with geometric terminology, and interact with drawing software. Students can work on assigned explorations independently or collaboratively. Teachers can use *GSP* to create worksheets, exams, and reports by exporting *GSP* figures and measurements to spreadsheets, word processors, other drawing programs, and the Web (Key Curriculum Press, 2001). When primary age students have mastered the basic sketching tools, they then are curious to explore the measurement tools and even animations. Young children can play for hours using this software to create their own understandings of mathematics.

The following websites may be accessed and used by teachers with many activity sheets that connect *MS Paint* and *Geometer's Sketchpad* along with a selection of children's literature for using to tie in with such lessons mentioned in the article:

Websites:

Key Curriculum Press	http://www.keypress.com/sketchpad/
Math Forum	http://mathforum.org/dynamic/sketchpad.weblinks.html
***GSP* Tutorial**	http://members.aol.com/markwestbr/GSPtutorial/home.html
Carol A. Marinas	http://mcs-cmarinas.barry.edu/net/gsp/index.htm

Children's Literature Related to Geometry and Measurement:

Friedman, A. (1994). *A cloak for the dreamer.* NY, NY: Scholastic Inc. Teaches geometric concepts in a real-life context. Teaches informal ideas of tessellations.

Keenan, S. (1996). *The biggest fish.* NY,NY: Scholastic Inc. Gives children firsthand experience in measuring in different ways.

Neuschwander, C. & Geehan, W. (1997). *Sir circumference and the first round table: A math adventure.* Scholastic Inc. NY, NY: Scholastic Inc. Teaches concepts involved with the measurement of circles.

Pallotta, J., & Bolster, R. (2005). *Twizzlers pull-n-peel math: From simple shapes to geometry*. NY,NY: Scholastic, Inc. This picture book uses twizzler candies to learn about geometry ideas.

Tompert, A, & Parker, R. A. (1997). *Grandfather tang's story: A tale told with tangrams.* NY, NY: Dragonfly Books published by Crown Publishers, Inc. This book uses tangram pieces to make pictures to tell a story. The tangram shapes help to develop spatial sense.

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