**Mathematics Education in Elementary School**

**A Literature Review**

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EDTC-670

Fall 2012

**Abstract**

In an evaluation of literature, it is found that the use of virtual tools and lessons can have a positive impact on the teaching and learning of mathematics in the elementary school classroom. There are many factors that influence student learning, but, by supplementing virtual resources into lessons, student achievement and learning will increase.

**Introduction**

In today’s world, technology is everywhere. There is not a single day where people don’t encounter some kind of technology, whether they’re on their way to work, sitting in a meeting, or relaxing with their families. Advances are constantly being made to improve our lives through technology. In fact, Carlson (2005) refers to the current generation of children as the Millenial or Net generation because of the amount of technology that they are exposed to on a daily basis. Television and movies are a common social gathering and computer programs such as Skype, Twitter, and email are the most convenient forms of communication. Texting via cell phones is an even more immediate form of keeping in touch and airmail is beginning to be used less and less. The college application process has changed from paper-based to almost completely online. Credit card companies are “going paperless” and sending out their bills via email and people don’t even need to leave their homes to go grocery shopping (e.g. Peapod Home Delivery). Televisions, computers, videogame systems, and cell phones are commonly seen and used around the ordinary household.

Along with all of the technology that children see in their homes, there has been an increase in the technology within schools. From class sets of laptop computers to interactive Promethean Boards, students are now using technology as a part of their daily learning. Exposure to all of this technology is changing the way that children view the world. Children are learning in vastly different ways and teachers need to adapt their teaching and assessment methods to meet these needs. The advances of modern technology have forced significant changes in the way professionals teach and assess student learning through the increased access and understanding of newer and more interactive classroom technology (Musso, 2009).

In addition to an increased use of technology in schools, there has been greater emphasis placed on teachers and administrators to implement more science and math based programs. National studies have shown that American schools are falling behind in the fields of science, technology, engineering, and math, otherwise referred to as STEM (National Association of Education Statistics, 2011; OECD PSA, 2003). However, the reaction to this research is most commonly seen in middle and high school programs. In reality, the best time to introduce programs like this is during the elementary school years. It is at this time that students are more likely to form an interest in science and math disciplines (Dejarnette, 2012).

**Using Technology to Teach Math**

Elementary education sets the standard for all future learning that children will do. Along with reading, science, and social studies, children spend a significant amount of their elementary school experience studying math. The basic ideas that these students form about math will support their learning through middle school, high school, and beyond. This is why it’s not only important to provide students with strong mathematical knowledge, but also a positive outlook and acceptance of math. Every year, my students come into class and tell me that they don’t like math because it is hard. This stereotype is commonly accepted and passed along from generation to generation of students. Unfortunately, this belief can lead to a very negative attitude towards math and makes it challenging for students to learn. This negative attitude and low performance can lead to math anxiety and phobia in young students (Mundia, 2012).

By integrating technology into education, teachers can engage their students more in the learning process and help build their interest in lessons. This positive environment serves as a battering ram to break down the previously formed negative ideas towards math. However, merely adding technology to a lesson doesn’t mean that it’s going to increase student learning and achievement (Roblyer & Doering, 2010). While technology does serve to motivate students and gain their attention, it is the way that the technology is used that makes the biggest impact on student learning. Teachers need to use technology as a support tool to their lessons, not as a means to teach the lessons.

In her study of best practices for teaching mathematics, Marilyn Burns emphasizes that “children need to learn mathematical concepts and to see relationships among those concepts. Mathematical concepts and relationships are abstract ideas that people learn through the process of sense making and constructing understanding” (Burns, 2007, pg 27). By using specific technological tools with students, they can construct meaning of mathematic concepts while making personal connections. This combination of strategies makes the mathematical concepts learned in elementary school more accessible and easy to remember for students as they progress through their education.

**Concrete and Virtual Manipulatives in Teaching Math**

One very important aspect of teaching math in elementary school is the use of manipulatives. Manipulatives are defined as, “physical objects that are used as teaching tools to engage students in the hands-on learning of mathematics,” (Boggan, Harper, & Whitmire, 2007, pg 1). These objects can be used to support almost any mathematical concept as part of whole-group instruction or independent practice (Burns, 2007; Linder, 2012). The use of manipulatives allows students to play with mathematical concepts and make their own sense out of these abstract ideas (Burns, 2007). They add a visual meaning that can be easier for young students to remember.

Traditionally, manipulatives are small objects that can be used to model specific math concepts. However, in this age of technology, there are an increasing number of virtual manipulative programs available on the internet or in software packages. These virtual manipulatives allow for all of the same exploration as physical manipulatives, with some additional features. Many virtual manipulatives allow students to backtrack and trace their previous actions, as well as connecting multiple sets of manipulatives (Manches, O’Malley, & Benford, 2010). This allows students to not only practice different concepts, but connect ideas and expand on their mathematical knowledge. A large part of mathematical reasoning encourages students to be able to take their knowledge of basic concepts and apply them to newer and more challenging concepts. Being able to see this modeled virtually will encourage students to make these connections on their own in the future.

Rather than just memorizing formulas and other mathematic concepts, students use this manipulatives to experiment with additional ways to solve problems. In many math concepts, there is not just one way to solve a problem. By being able to manipulate the data or shapes in question (either physically or virtually), students are able to form opinions about the concepts and create new ways to solve problems. The use of manipulatives increases student learning and understanding while allowing students to make personal and mathematical connections (Boggan, Harper, & Whitmire, 2010).

**Conclusion**

In conclusion, the use of virtual tools during mathematics lessons has value for students of all ages and should be promoted by school boards and administration because of their numerous benefits. It is important to consider that, in supporting the use of virtual tools and web-based learning, we are not talking about converting every aspect of the classroom to an online or technologically-based environment, but rather using these resources to enhance learning and engage students (Appana, 2008). In addition, the use of virtual tools can be used to connect the home and school environment to make learning more collaborative and accessible.

Particularly when it comes to mathematics, virtual manipulatives and online lessons can be a very positive influence on student learning. The use of technology can make learning and mathematical practice feel more like a game for students and may increase their motivation to learn and practice their skills. In addition, many of the available tools are user friendly and easy to learn whether in a school environment or at home. In his article discussing the pros and cons of the online classroom environment, Robert Taylor (2002) states that online lessons and tools promote “cognitive learning – where the student uses memorization … analytical skills, evaluates data and uses this knowledge to arrive at solutions” (p. 25). These independent work skills are worth promoting for students to succeed in today’s ever changing technological world.

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