

Running Head: AN INVESTIGATION IN TO IF TECHNOLOGY CAN

An Investigation in to if Technology Can Help Students Learn Number Sense

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Abstract

Mathematics is based around the concepts of number sense. Without number sense students are not able to complete more complicated math problems. When students have gaps in their number sense it is more unlikely that they will be able to stay proficient in math as they go on to higher grades. It is important to address these gaps in Elementary school to make sure that they understand their basic skills before progressing. This literature review will examine if technology could help close the number sense gaps, and if so, in what way. The review will identify in what ways technology can be used best for students to master number sense. In the end the articles will show that students need a combination of instruction with a focus on student talk and practice to master number sense. This review will clearly show that students can do both of these best by using technology.

What is Number Sense?

Number sense is an understanding of numbers and their relationships. According to John A. Van de Walle, number sense involves five components: well-understood number meanings; multiple relationships on numbers; recognition of the relative magnitude of numbers; knowledge of the effect of operations on numbers; referents to measure of things in the real world. (Walle, 1994) Research has shown that students who are able to manipulate numbers in order to solve problems are able to solve increasingly complex problems. Manipulating numbers means that students can come up with different strategies that make numbers make sense. (Boaler, 2015) In the past most students were taught number sense through learning basic facts. Basic facts are addition, subtraction, multiplication, and division problems within 144. Most students were taught this through memorizing. Student's ability to know these facts were determined based on their memorizing the answers to these problems and reciting the answers quickly. However, research has recently proven that this is an ineffective way to determine if students are able to apply the knowledge of the basic facts to more challenging math problems. (Boaler, 2015) To be able to solve complex math problems students must have mastered number sense.

Why is number sense important?

When students are met with a challenging math problem they must be able to find a pathway for how to figure out how to solve the problem. For example when a student is asked $123 + 76$ students should be able to understand that to solve this problem the mathematician is actually adding $(3+6) + (20+70) + (100)$. Without the understanding of the different parts of the

number a student would not be able to simplify this problem to do mentally or quickly. A student with good number sense might also be able to estimate to find the answer. These skills are not a given and cannot be formed through memorizing facts. It is imperative that students understand numbers and how they work so that they are able to progress to more challenging mathematical concepts.

How is Number Sense built?

A general agreement has formed that number sense should be built through direct instruction, reasoning and modeling with complex task, and practice. One way that students are given the opportunity to reason and model with complex tasks is through number talks. Number talks are a daily routine that gives students a chance to have meaningful conversations around computation problems. Students express their strategies and discuss with each other about most efficient ways to solve problems. The teacher's job during number talks is to select and present problems that make mathematical and number relationships clear to them. Problems should have varying degrees of difficulty that encourages students to think deeply about their process. (Number Talks, 2007) This process can often be time consuming for teachers. One way to simplify the process of planning number talks is by using technology.

Students are often given worksheets to practice completing math facts and computational problems. These worksheets are based on how many computational facts students have memorized. In addition, these worksheets take a lot of time to grade and often are not interesting to students. To help make this practice more interesting and easier to grade there are many ways students can practice online. Several programs allow students to practice

through games, while others have more purposeful practice that give teachers dashboards with information about what students have mastered which facts. (Kuhn & Holling, 2014)

Technology and Number Sense

To address the need to deliver efficient number talks a teacher might use ActivInspire software with Promethean boards. Knowing that number talks are based around the planning of the teacher, this technology allows teachers to plan in advance for the questions that will be asked during the number talk. Once the students have discussed the questions the teacher can then insert the strategies and answers students came up with directly in to the presentation. In addition, students and teachers can write in to the presentation and then save the notes. All of these examples show how the ActivInspire software can be used as a manipulative that will help focus student's thinking. According to Sara Delano Moore, "students who use hands-on manipulatives during math lessons on a weekly basis, prove to be 72% of a grade level ahead on mathematics." (Moore, 2013) The ActiveInspire is used as a manipulative that both teachers and students can use to understand how to solve the problems at hand.

When deciding on an online program that allows students to practice math fluency there are many options. However, many of the options do not focus students thinking enough to get the results desired. Ideally, students will be able to have mastered their basic facts by using the program and are able to transfer this knowledge to other mathematical problems. For example, the program Fasst Math (scholastic) does not allow a teacher to track what the students know or don't know and so the teacher cannot inform students what to work on. This fault in the program allows students to simply play games instead of actually internalizing the

facts. (Fasst Math, 2015) Another program is ST Math. ST Math is a great program for students whose focus is on all different math skills or remediation. This program gives students an opportunity to practice math in a spatial way but it will not specifically give students the opportunity to practice fluency in basic math facts. (ST Math, 2015) Another program that can help students practice basic facts is First in Math. This program is based around the theory that students need to be motivated to internalize practice. Therefore, the program is set up so that students can drive their own learning and choose different activities that interest them. The part that keeps the students focused on the goal is the clear data reports and incentives for hard work that are incorporated with the system. According to a research study done in May 2005 in San Diego, 75% of students agreed that math is fun with First in Math and that it was fun to try a problem on their own when using the program. In the same research paper, it was clear that students made a small but significant improvement on the standardized tests after using First in Math consistently. (Flaherty, Connolly, & Lee-Bahya, 2005)

Conclusion

Based on this literature review, it is clear that fact fluency can not simply be taught through drills. It is essential that students are taught number sense and are able to solve any problem using their knowledge of how numbers can be manipulated. One of the best ways to teach this is through the daily practice during Number Talks. In this space students are communicating with their peers about strategies and understandings they might have that can then help others solve the problem at hand. To help teachers plan purposefully and efficiently, the use of ActivInspire on Promethean boards is recommended. Once students are taught number sense

it is important that they practice solving problems on their own. Students want to be motivated to solve problems independently by playing exciting games and being challenged. First in Math does this for students and allows them to grasp the concepts they are working on mastering.

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