USING CALCULATORS TO HELP YOUNG CHILDREN LEARN MATH

by

SCOTT PIERSON

AA, Community College of the Air Force, 1992
BS, Eastern Connecticut State University, 2010

A CALCULATOR PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR
TECHNOLOGY APPLICATIONS IN MATHEMATICS (EDU 556)
Instructor: Dr. Hari P. Koirala

DEPARTMENT OF EDUCATION
EASTERN CONNECTICUT STATE UNIVERSITY
July, 2014
USING CALCULATORS TO HELP YOUNG CHILDREN LEARN MATH

Introduction

If you ever feel like starting a heated debate, place yourself in the middle of a group of elementary school math teachers and start talking about the use of calculators in the math curriculum. As one teacher noted, “the arguments for and against calculators have the spirited vigor of a Red Sox vs. Yankees game...” (Vilson, 2013, p 1) The argument can be simplified into two basic thoughts. The first holds that calculators enable children to concentrate on understanding and studying mathematical concepts instead of spending time on tedious calculations. Further, calculators help students develop number sense and makes students more confident in their math abilities. The second group believes that using calculators in lower level math teaching inhibits student learning of basic math facts, prevents students from discovering and understanding underlying mathematical concepts and encourages them to randomly try different operations without understanding what they are doing. Additionally, it is commonly believed that students will fall into the habit of using the calculator as a crutch, rather than applying knowledge they have previously learned. (HomeSchoolMath Staff, n.d.)

Having been schooled in the 1960s and 1970s, calculators were not as prolific as they are now. The first time I went shopping for a calculator I was, I believe, in high school. The store only carried one brand (Texas Instrument) and it cost over $100. Today you can buy one at the supermarket checkout or at a “dollar store” for $1.00... but most people don’t need to buy one because they have a calculator program on their phone. Calculators have become so readily available that they have become commonly-used technology and part of our lives. It seems reasonable, therefore, that we include this technological tool in our children’s education.
USING CALCULATORS TO HELP YOUNG CHILDREN LEARN MATH

When I was a student, I used the calculator for the little I really needed it for and the rest of the time I just played with the sign, cosign, square route, and other interesting buttons. I suppose I learned a little from them but the only information I learned back then that has lasted is that it is a whole lot easier to figure out the diameter or circumference of something by using the pi button than by doing all the math by hand!

I remember one drill we were given on my first day in Algebra I class. The high school was in a “rich” town and most of the students’ parents were pretty well off. I think I was about the only student in my class that didn’t own a calculator. The teacher gave us all an assignment. He pointed to the calendar of September and asked everyone in the class to write on a piece of paper the average number of the days of September. While most of the students were laboring on their calculators adding 1 + 2 + 3 + 4 + 5, etc., a few students quickly calculated in their heads that the lowest number (1) and the highest number (30), averaged 15.5, as did 2 and 29, 3 and 28, and all the rest of the subsequent pairs of numbers. My way was similar. Knowing that 15 + 16 were the two middle numbers, I knew the answer had to be 15.5. Because we few students had an understanding of numbers, it was quickly obvious to us while it was not to the “calculator-dependent” students.

I have never taught a mathematics class. In fact, I have almost no teaching experience. But I do have enough experience with children and with technology to understand the issues. If children (or adults for that matter) are given an easier way to do something, they will gravitate toward that method with increasing frequency. In our technology-saturated society, we take the risk of allowing our students to perform the work without completely learning how to perform the tasks. In math, there is a legitimate
concern that students will not develop a curiosity about how number work because they can get the answer with the push of a button.

Not all these “old school” educators are completely against the use of calculators and technology; they are just against unlocking all the mysteries and intricacies of math so quickly (Vilson, 2013).

From the other side, educators in the “new school” wonder why we would deprive students from a tool that can so easily solve the problems. They argue that the old way of writing out the multiplication table is antiquated and tiresome. The calculator is much more efficient and reduced the time it takes to accomplish a task. Some say calculators enable children to “concentrate on understanding and studying mathematical concepts instead of spending time on tedious calculations” (HomeSchoolMath, n.d.) Further, it is noted that using calculators as learning tools can “empower young children with the capacity to investigate number ideas in ways that were previously inaccessible to them.” (Huinker, 2002)

Educator and Edutopia blogger, Jose Vilson, writes that his position lies somewhere in the middle. He uses the calculator often when creating the answer key for his exams, however, that is only after he writes the problems out himself. Therefore, he uses the tool for ease and to save time but only after he has done out the problem by hand.

Siding with the “old school”, he wonders how we really know that the calculator is telling us the truth. Just because a man-made tool tells us it’s true? If we rely solely on calculators without giving much thought to the number we have put down. He also states that calculations made on-the-fly matter more than the ones we make in math or science class but it’s these classes that students feel the more need to use them. Students taught to
USING CALCULATORS TO HELP YOUNG CHILDREN LEARN MATH

rely heavily on calculators will not gain that sense of numeracy that they would if taught to use primarily pencil and paper. I can certain attest to that. How many time have I been driving and had to quickly calculate in my head miles-per-hour or miles-per-gallon or any number of distance calculations needed to accomplish the task at hand (and at 70+ miles per hour). There was no time to pull over and pray I could find a calculator for assistance. Because I was trained the “old school” way, I was able to estimate, with pretty good success, and complete my mission.

Calculators are a tool designed to solve the problem, but they are not the solver of the problem itself. Students need to develop a sense of numeracy that allows them to make their own estimates and arrive at their own possible solutions without leaning on “the crutch”. Whether estimating the amount of time it will take to type a ten-page paper if you use 12 point font and double spaced or making some other quick calculation by comparing numbers without having to resort to “the crutch.”

The answer to the issue lies somewhere between these two ends. We should not deprive students of a well-established technological tool that can help them learn math, but neither should we allow students to perform all math functions with the push of just a few buttons. It is essential that we strike a balance, as we should with the use of any form of technology. All the various forms of technology that we have created are just tools developed to help us with a task or problem. Imagine removing computers from your student’s curriculum! You and the parents would argue that students will lose a very important tool that has been proven to help them to learn! iPad and iPhone apps have proven to provide a great source of education for students. No one questions their
USING CALCULATORS TO HELP YOUNG CHILDREN LEARN MATH

presence in the classroom. But the mere suggestion of adding a calculator to a math class and many people will be up in arms!

Like any tool used in the classroom, it’s success or failure lies in the application... in the teacher’s approach (HomeSchoolMath, n.d.). Since the teacher has a wide variety of tools technical and non-technical tools at his/her disposal, the application of these tools should all be used as part of the curriculum so as to offer the student a more complete learning experience. In fact, since calculators are used throughout the business world and even at the corner convenience mart, teaching children how to use this common tool from an early age will find it easy and effective to use when they need to use them (SEDL, 1998). Further, research has shown that students who use calculators score higher in both basic computation and problem solving and those who use calculators within a mix of instructional styles do not lose their “paper and pencil” skills. In fact, calculator use in the classroom was reported to improve the paper and pencil skills of students, regardless of their ability level. And it was noted that those who use calculators in class have a better attitude toward mathematics that children who do not use them (SEDL, 1998). While this past statement was not true for my early math years, when $x$ and $y$ entered the picture, having a calculator at the ready gave me a lot more confidence in class!

The Project

With this “old school” / “new school” balance in mind, let’s consider a calculator project designed for first grade students. The purpose of this project is to explore the use of calculators in teaching number relationships to first grade students or any aged student who is just learning numbers. More specifically, the project has the following objectives:

1. Teach children how to use a calculator
USING CALCULATORS TO HELP YOUNG CHILDREN LEARN MATH

2. Turn students on to numbers and counting
3. Help students learn the difficult task of counting backwards
4. Help students learn to count by 2’s, 3’s, etc.
5. Increase children’s interest in large numbers in relation to small numbers

Project Overview

As mentioned previously, this project is designed for first graders or any aged child who is learning numbers and counting. This project is taken directly from an article written by DeAnn Huinker (2002) and has not been modified. The basic concept of Ms. Huinker’s project is supported by the National Council of Teachers of Mathematics (NCTM) and the Southwest Educational Development Laboratory (SEDL) as noted on the SEDL website (1998). If executed carefully and correctly, this project will help students gain a better understanding of number relationships and give them a new love and excitement for numbers and technology.

Project Activities

The teacher will need access to an overhead-projector calculator. If one is not available, the teacher may use a drawn or printed oversized replica of a calculator. Any calculator with an automatic or button-operated ‘constant’ function will work.

Guided by the teacher’s example, the students will follow the worksheet using their calculators. Using their calculators, students will count from zero to any given number, counting out loud as the calculators display the numbers. Students should be encouraged not to go ahead of the rest of the class. Teachers should remain cognizant of the slowest student and continue at his or her pace (without making it outwardly obvious). Initial activities should not be graded as this is a familiarization lesson and designed to pique the
USING CALCULATORS TO HELP YOUNG CHILDREN LEARN MATH

interest of the students. Later assessments can be given, grading the overall percentage of
correct answers, being sure to review with each student to determine where they went
wrong.

Final group project is to see who can get to 1000 first. Students will all begin at 0+1=
with “1” on their calculator. Students will then see who can press their “=” button 999
times the quickest. Allow five minutes at the end for class discussion on how hard it was
and how long it took. If class time runs short, the teacher can stop the class at 500 or
another suitable number. Future projects can include a race to 1000 counting by 10s, 20s,
or 100s to see how these numbers relate differently to 1000 by noting how much quicker it
takes to get to the final goal.

Project Assessment

   After activity, teacher should review each student sheet to see where any strengths
and weaknesses lie. Extra instruction should be given to students who had a hard time
keeping up with the class or who had incorrect answers. More challenging projects should
be considered for students with more advanced numeracy skills.

   Exit Card should be distributed to each student to determine:

   1. Which of the problems did you find the hardest? Why was it so hard?

   2. Which of the problems did you find the easiest? Why was it easy?

   3. What did you learn about 100? Did it take longer to get to 100 than you
      thought it would?

   4. Did it take a long time to count to 1000? What do you think could have
      been done to get to 1000 faster?
USING CALCULATORS TO HELP YOUNG CHILDREN LEARN MATH

Summary

In my research I came across many practical, fun, and interesting projects designed for students in all grades. Using such projects will interest the children in both the practical uses of a calculator as well as increase their interest and knowledge in numbers. Hopefully, it will also give the teacher a good basis on which to develop their own projects suitable for their students’ grade level.

It seems obvious to me that we find or develop ways to use this form of technology as a tool to help teach our children the power and nuances of numbers. Once we have shown the “old school” educators that guided calculator exercises and provide a great assistance to helping students to learn and understand math, then I think at least a few will be open to their use in the classroom.
USING CALCULATORS TO HELP YOUNG CHILDREN LEARN MATH

REFERENCES


ADDITIONAL RESOURCES

http://5thgraderocks5thgraderules.blogspot.com/2012/04/calculator-fun.html
This page contains an excellent calculator refresher drill to help students in preparation for a test where they will need to use their calculators. It’s fun and interesting for adults too!

This article ends with five good calculator projects for students of varying ages, ranging from exploration of numbers to introduction to pi.

This article offers "wipe out" games that will help students develop place-value concepts.
USING CALCULATORS TO HELP YOUNG CHILDREN LEARN MATH

WORKSHEET

1. Count from 0 to 8 as you push the numbers on the calculator:

   0  +  1  =  =  =  =  =  =  =

Write your answers here:   ______  ______  ______  ______  ______  ______  ______  ______

2. How old will you be in 8 years? Count out loud as we go.

   Age  +  1  =  =  =  =  =  =  =

Write your answers here:   ______  ______  ______  ______  ______  ______  ______  ______

3. Oh No! A genie just cast a spell on you to make you grow younger! Count out loud as we go.

   Age  -  1  =  =  =  =  =  =

Write your answers here:   ______  ______  ______  ______  ______

4. Count by 2’s out loud as you go.

   0  +  2  =  =  =  =  =  =  =

Write your answers here:   ______  ______  ______  ______  ______  ______  ______  ______

5. Count by 3’s:

   0  +  3  =  =  =  =  =  =  =

Write your answers here:   ______  ______  ______  ______  ______  ______  ______  ______
USING CALCULATORS TO HELP YOUNG CHILDREN LEARN MATH

6. Count by 10’s (notice there is no “10” button, what should we do?):

0 + 10 = = = = =

Write your answers here: _____ _____ _____ _____ _____ _____

7. Is 100 a big number? How long will it take us to get to 100?:

0 + 1 = = = = = =

Keep going until your calculator says 100

8. How old will you be in 2030?

If it’s 2014 now, how many years older will you be in 2030?

2014 2015 2016 2017 ______ ______ ______ ______ ______ ______

GROUP PROJECT

9. Who can get to 1000 first?

With everyone starting at the same place: 0 + 1 =
can you be the first to get to 1000?