The 'battle' over calculator use

Some people say calculator enables children to concentrate on understanding and studying mathematical concepts instead of spending time on tedious calculations. They say calculator helps develop number sense, and makes students more confident about their math abilities.

National Council of Teachers of Mathematics (1989) has recommended that long division and "practicing tedious pencil-and-paper computations" receive decreased attention in schools, and that calculators be available to all students at all times.

Others are against using calculator in lower level math teaching, saying that it makes children not to learn their basic facts, prevents students from discovering and understanding underlying mathematical concepts and instead encourages them to randomly try different operations without understanding what they're doing.

They say calculators keep students from benefiting from one of the most important reasons for learning math -- to train and discipline the mind and to promote logical reasoning.

There IS a balance

In my opinion, calculator can be used in the teaching in a good way or a bad way - it all depends on the teacher's approach. Calculator in itself is not bad or good -- it is just a tool. It is used a lot in today's society, so students should learn to use it by the time they finish school.

At the same time, children SHOULD learn their basic facts, be able to do mental calculations, and master long division and other basic paper-pencil algorithms. Mathematics is a field of study that builds on previously established facts. A child that does not know basic multiplication (and division) facts will have hard time learning factoring, primes, fraction simplification and other fraction operations, distributive property, etc etc. Basic algorithms of arithmetic are a needful basis for understanding the corresponding operations with polynomials in algebra. Mastering long division precedes understanding how fractions correspond to the repeating infinite (non-terminating) decimals, which then paves way to **understanding irrational numbers and real numbers**. It all connects together!

For this reason, it is probably very wise to restrict the calculator use in the lower grades, until a child knows her basic facts and can add, subtract, multiply, and divide even large numbers with pencil & paper. THIS, in my opinion, can build number sense — as do mental calculations.

This does not mean that you couldn't use calculator occasionally in the elementary grades for special projects or when teaching specific concepts, or for some fun. It could be used for example in science or geography projects, or for exploring certain new concepts, or for some number games or checking homework. See below for some ideas.

The discussion here does not apply to graphical calculators in high school. I am strongly in favor of using graphical calculators or a graphing software when studying graphing of functions and calculus. Even there though, one certainly needs to learn the basis of how the graphing is done on paper.

Things to keep in mind when using calculator

When calculator is used more freely, one should pay attention to following points:

- Calculator is a **tool** to do calculations. So is the human mind, and paper & pencil. Children should be taught **when** to use calculator, and when mental computing (or even paper & pencil) are more effective or appropriate. Choosing the right 'tool' is part of effective problem-solving process.
- It is very important that students **learn how to estimate** the result before doing the calculation. It is so very easy to make mistakes when punching in the numbers, and a student must not learn to 'rely' on the calculator without checking the reasonableness of the answer.
- Calculator should not be used for a random trying out of all possible operations and seeing which one produces the right answer. It is crucial that the child understands the different mathematical operations so she knows WHEN to use which one - whether the actual calculation is done mentally, on paper, or with a calculator.

Ideas for calculator use in elementary grade math

If you use these ideas, make sure the kids don't get the idea that calculator takes away the need to learn mental math. It can serve as a tool to let children explore and observe, but afterwards the teacher should explain things, justify the math rules, and put it all together.

- Let preschoolers or first graders explore numbers by adding 1 repeatedly (which can be done with first punching in 1 + 1 =, and then pressing the = button repeatedly) or subtracting 1 repeatedly. Observe

their faces when they hit negative numbers! Or, let them investigate what happens to a number when you add zero to it.

- **Calculator pattern puzzles**: An extension of the idea above, where first-third grade children add or subtract the same number repeatedly using a calculator. Children will observe patterns that emerge when you add 2 or 5 or 10 or 100 repeatedly, or will make their own "pattern puzzles" which are simply number sequences with a pattern where you omit some numbers, for example 7, 14, __, __, 35, __, 49. The activity can connect with the idea of multiplication very easily.
- **Place value activity with calculator**: Students build numbers with the calculator, for example:
  Make a three-digit number with a 6 in the tens place; OR Make a four-digit number larger than 3,500 with a four in the ones place; OR Make a four-digit number with a 3 in the tens and a 9 in the hundreds place; etc.
  Afterwards teacher lists several on the board and discusses what the numbers that students made have in common, like all might be sixty-something etc.
- Write number one million on the board. Ask students to pick a number that they will add repeatedly with the calculator to reach one million within reasonable class time. If they pick small numbers like 68 or 125 they won't reach it! This can teach children about how vast and big the number one million is.
- When introducing pi, have students measure the circumference and the diameter of several circular objects, and calculate their ratio with a calculator (which saves time and can help keep the focus on the concept).