Dr. Adam Feldhaus, an assistant professor of mathematics at the University of Northern Iowa, has always felt that manipulative technology for mathematics education is currently way too expensive for most elementary schools.

“Classroom sets of physical manipulatives are expensive while most computer-based virtual manipulatives are either non-intuitive or based on dated technology or locked behind publishing deals or some combination thereof,” he says.

These manipulatives are a powerful learning tool for students to learn mathematics, especially at the elementary level, he adds.

The challenge, thus, is to develop a technology that is not just affordable but also engaging and accessible for elementary students.

That is exactly what Dr. Feldhaus and Dr. Sarah Diesburg, an assistant professor of computer science at UNI, have been working on for the past couple of years.

“We wanted to create a modern manipulative platform that relies on inputs that most students are familiar with (i.e. touchscreens), can be widely available, and are cost-effective for schools on a limited budget,” Dr. Feldhaus says.

It all began on the sidelines of a university program, with Dr. Feldhaus sharing his thoughts on manipulative technology for elementary mathematics with Dr. Diesburg.

This initial exchange of ideas led to a series of brainstorming sessions, eventually crystallizing into a grant proposal towards developing Motion Virtual Manipulatives (MVMs). The project was approved in 2015.

Dr. Diesburg and Dr. Feldhaus say that the MVMs will not just be an effective tool for teaching core mathematical concepts in the elementary classroom but also potentially reach students who do not respond to typical mathematics instruction.

The manipulatives will function in an environment built on Ubi Interactive, a hardware plus software solution that turns any surface into a touch screen.

“Our technology can turn any blank wall into a virtual touch screen that functions similarly to the way modern touch screens work (similar to an iPad),” explains Dr. Diesburg. “We have built a suite of mathematics manipulatives into that technology, as well as a method to ‘play back’ specific actions for evaluation.”

“We would like to learn if our platform is comparable to current technology solutions as well as how students use our touch-screen user interface,” she says.

Moreover, a data-collection tool has been built in that will allow the researchers to “improve the software and answer questions about the mathematical thinking of the students,” she adds.

Dr. Feldhaus says the MVMs could be used daily in the elementary school classroom.

“This toolset is highly expandable, and we would like to work to create something that is useful for multiple concepts in the mathematics classroom,” he adds.

Although the project began with the objective of developing an affordable manipulative technology for elementary mathematics classroom, the two UNI professors plan to continually work on the manipulatives, and enhance and expand their utility.

“First, we would like to grow our suite of available manipulatives to be something more complete for use in K-8 classrooms,” says Dr. Feldhaus. “Beyond that, we have
been approached by other education researchers who see applications of our software to high school math, and also to other subjects such as literacy, science, and computer programming."

The involvement of undergraduate students has been an important aspect of the research project.

"It has been great!" Dr. Diesburg says. "Undergraduate researchers built the software for our research and helped us throughout the entire design process."

On one occasion at least, the help may not have been intended as such.

"We ran into the perfect training tool for our platform by accident," she recalls. "We were working on developing complex training exercises when one of us put on the game Angry Birds for a break. It turns out this game is a fabulous way to train students how to point, drag and perform other gestures in our environment!"

The experience has also been inspirational for many undergraduate students.

"After working with us, many have decided that they would like to pursue graduate school," Dr. Feldhaus says. "One specific undergraduate alumni, Cole Boudreau, is now successfully enrolled in graduate school at the University of Toronto."

ALL ABOUT MATH MANIPULATIVES

Physical (also known as concrete) manipulatives like the abacus or blocks have been basic tools of the math teaching trade since time immemorial.

The ancient Romans and Greeks conceived of counting boards and eventually the abacus, and the Chinese abacus that came into use centuries later is thought to be an adaptation of the Roman version.

Closer to our time, Italian educator Maria Montessori brought manipulatives to early childhood learning over a hundred years ago with great success.

Today, the National Council of Teachers of Mathematics (NCTM) recommends the use of manipulatives to teach math at all grade levels to teach from NCTM standards: problem solving, communicating, reasoning, connections, and estimation.

Source: www.dreambox.com