Students may rely on calculators to bypass a more holistic understanding of mathematics, researcher says

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(Phys.org)—Math instructors promoting calculator usage in college classrooms may want to rethink their teaching strategies, says Samuel King, postdoctoral student in the University of Pittsburgh's Learning Research & Development Center. King has proposed the need for further research regarding calculators' role in the classroom after conducting a limited study with undergraduate engineering students published in the *British Journal of Educational Technology*.

"We really can't assume that calculators are helping students," said King. "The goal is to understand the core concepts during the lecture. What we

found is that use of calculators isn't necessarily helping in that regard."

Together with Carol Robinson, coauthor and director of the Mathematics Education Centre at Loughborough University in England, King examined whether the inherent characteristics of the mathematics questions presented to students facilitated a deep or surface approach to learning. Using a limited sample size, they interviewed 10 second-year undergraduate students enrolled in a competitive engineering program. The students were given a number of mathematical questions related to sine waves—a mathematical function that describes a smooth repetitive oscillation—and were allowed to use calculators to answer them. More than half of the students adopted the option of using the calculators to solve the problem.

"Instead of being able to accurately represent or visualize a sine wave, these students adopted a trial-and-error method by entering values into a calculator to determine which of the four answers provided was correct," said King. "It was apparent that the students who adopted this approach had limited understanding of the concept, as none of them attempted to sketch the sine wave after they worked out one or two values."

After completing the problems, the students were interviewed about their process. A student who had used a calculator noted that she struggled with the answer because she couldn't remember the "rules" regarding sine and it was "easier" to use a calculator. In contrast, a student who did not use a calculator was asked why someone might have a problem answering this question. The student said he didn't see a reason for a problem. However, he noted that one may have trouble visualizing a sine wave if he/she is told not to use a calculator.

"The limited evidence we collected about the largely procedural use of calculators as a substitute for the mathematical thinking presented indicates that there might be a need to rethink how and when calculators

may be used in classes—especially at the undergraduate level," said King. "Are these tools really helping to prepare students or are the students using the tools as a way to bypass information that is difficult to understand? Our evidence suggests the latter, and we encourage more research be done in this area."

King also suggests that relevant research should be done investigating the correlation between how and why students use calculators to evaluate the types of learning approaches that students adopt toward problem solving in mathematics.

Provided by University of Pittsburgh

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