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# Editorial: A Call for Articles on AMTE's Standards for Preparing Teachers of Mathematics Use of Technology in K-12

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The Association of Mathematics Teacher Educators released the *Standards for Preparing Teachers of Mathematics* (*SPTM;* amte.net/standards) in 2017. To generate guidance as to how to apply teaching of mathematics with technology, a call for manuscripts is being extended by *Contemporary Issues in Technology and Mathematics Teacher Education* (*CITE-Math*). The following quote from the *SPTM* illustrates how important preservice teacher (PST) preparation can be:

> Well-prepared beginners are able to guide students in exploring how technology can be used to explore patterns, shape, transformations, and sequences. Technology can assist one in making connections between multiple representations, and it can help students communicate their mathematical ideas to their classmates. Well-prepared beginning teachers are particularly prepared to use "mathematical action technologies" (p. 125).

Technology use is not to be taken lightly in building a healthy mathematics identity for all students. Mathematical reasoning and sense making is essential in students' knowing and doing of mathematics. Teachers need to know when to support students' learning needs with the use of technology. To understand appropriate design and implementation of technology, one must understand how mathematics learning takes place when using these tools. "These are powerful tools for doing mathematics that will be a part of the lives of the students they teach" (p. 125). This claim applies to elementary and middle levels of mathematics education as well as high school.

Being mindful of teaching techniques in intentionally designed technology can help change the teaching of mathematics into a joyful and purposeful activity while reinforcing effective teaching practices, promoted by the National Council of Teachers of Mathematics (NCTM) and AMTE through their *SPTM*. First, one must start with a well-defined goal, then look for visual, interactive patterns to help in making predictable relationships that support mathematical sense making.

*SPTM* Standard P. 3. refers to teaching mathematics requiring a central focus on mathematics. Moreover, in Standard C.2.2 Plan for Effective Instruction, it states, "Well-prepared beginning teachers of mathematics attend to a multitude of factors to design mathematical learning opportunities for students, including content, students' learning needs, students' strengths, task selection, and the results of formative and summative assessments" (p. 14).

PSTs need to understand more than the mathematics (*SPTM* C.1) they teach; they need to know their students and the appropriate pedagogy to teach a particular content (*SPTM* C.2 and C.3). Understanding and then recognizing the student's engagement in mathematical practices is extremely important (*SPTM* C.3.2). This goal is where the use of technology becomes important. When used appropriately, technology can foster effective interactive and exploratory environments and stimulate creativity and teamwork, while challenging students' problem solving abilities. Technology can help make meaningful mathematical connections and encourage mathematical discourse. Technology provides interactive objects used to show relationships that foster meaningful classroom discussions where students can predict and make suppositions about observable relationships.

These important components enable students to interact with data supported in life experiences mentioned in the *SPTM*. An example where data represents real life would be Tinkerplots, a software package, which can shows relationships between age, sex, and test performance of a group of people.

## Implications

Using technology in a meaningful and appropriate way is challenging and requires thoughtful training about what constitutes the use of technology for mathematics teaching and learning. Technology use should never be taken lightly or misused for lack of understanding of its ultimate purpose (*SPTM* P.3.4). For example, many excellent intelligent software packages are being used to individualize elementary mathematics courses and streamline common content, class discourse, and teacher-led discussions. Intelligent software is designed with the idea of differentiating instruction, (tutorials are included) and serve a purpose, but it is not intended to substitute for teachers. Teachers need to know what thought processes are being used.

To omit mathematical discourse, or supersede teacher input and questioning, leaves one alone to problem solving (*SPTM* P.3.3). A major concern is students' work in a closed environment with little student exchange (*SPTM* P.4.1). Some students are more resourceful than others. This situation may work for bright students who prefer to work by themselves. Some children are very adaptable and open to help from other students. Some need more support than what is offered in online help section (*SPTM* P.4.3). Technology use in mathematics was never intended to homogenize thinking but to provide sense-making opportunities that need to be discussed and scrutinized (*SPTM* 3.4). The creative power of the use of technology in mathematics enables students to think deeply about the mathematics itself and not the creation of an answer for the sake of going to the next section. As stated so well in the *SPTM*, technology is not an excuse for solitary interchange (*SPTM* P.3.1).

## Conclusion

While technology does not have its own standard in the *SPTM* nor is it highlighted in all grade bands as well as it is highlighted in the high school section, it is an important indicator within the Mathematics Concepts, Practices and Curriculum

standard. Technology has an important role in the preparation of well-prepared beginning teachers, and we should share the experiences and tasks we are currently using ourselves. PSTs need to know about the potential issues and strengths of technology in the mathematics classroom. Mathematics related technology is constantly looked at to expand procedures to that of arriving at a deeper understanding that comes through discussion, conjectures, reasoning and promoting deep and lasting growth (*SPTM* 3.1). Individual mathematical insight may be different for each participant and can be enhanced by a PST's open attitude toward its use and then plan accordingly. The importance of teacher education programs is to help PSTs and to foster technology's use to assess and deepen mathematics understanding in their future classrooms.

Accept this challenge to use *SPTM* to strengthen your courses and program and share how the use of technology facilitated those important changes. Share your experience by submitting a manuscript any time to *CITE-Math* that demonstrates the standards coming alive from the technology used in mathematics teacher education.

- How can the standards be used in the study of elementary geometry with technology?
- How can computational thinking and coding blend with mathematics using technology support the *SPTM*?
- The field is open in terms of the many uses of technology in mathematics and mathematics methods classes in teacher education programs. How can the *SPTM*, along with the thoughtful use of technology, add the structure and support needed in mathematics education courses?