

Position of the Association of Mathematics Teacher Educators on Technology

The Association of Mathematics Teacher Educators (AMTE) supports the National Council of Teachers of Mathematics' Tool and Technology Principle in *Principles to Actions*: "An excellent mathematics program integrates the use of mathematical tools and technology as essential resources to help students learn and make sense of mathematical ideas, reason mathematically, and communicate their mathematical thinking" (NCTM, 2014). Thus, mathematics teacher preparation programs must ensure that all mathematics teachers and teacher candidates have opportunities to acquire the knowledge and experiences needed to incorporate technology in the context of teaching and learning effectively.

Digital devices and applications have the potential to help students and teachers strategically use and transform data and visual representations for learning. NCTM (*Technology in Teaching and Learning Mathematics: A Position of the National Council of Teachers of Mathematics*, 2011) claims: "technological tools include those that are both content specific and content neutral...content-specific technologies support students in exploring and identifying mathematical concepts and relationships. Content-neutral technologies... increase students' access to information, ideas, and interactions that can support and enhance sense making."

The Use of Technology to Improve the Learning of Mathematics

Technology can be used to facilitate mathematical discovery, reasoning, and connections that may be difficult or impossible without its use. It has the power to change the nature of mathematics learned in the classroom. Activities that engage students in connecting multiple representations (e.g., graphical, numerical, algebraic and verbal), and those that invite students to analyze or create images, visualizations, and simulations provide wide-ranging opportunities for mathematical exploration and sense-making. Instruction that takes full advantage of what technology has to offer can encourage, foster, and support students' construction of mathematical knowledge in a variety of ways to encourage a growth mindset. Technology can also improve mathematical communication and collaboration to enhance learning opportunities. Instruction and assessment can be individualized and differentiated through the use of technology.

AMTE recognizes that technology has become an essential tool for doing mathematics in today's world, and thus it is essential for the teaching and learning of mathematics. Mathematics teacher educators need to design programs and courses that encourage teacher candidates to use high-level instructional knowledge and skills with technology to improve their pedagogy and make content relevant and meaningful.

A mathematics teacher educator's program should include the development of:

- Technological Pedagogical Content Knowledge (TPACK) to understand and describe the kinds of knowledge needed by a teacher for effective pedagogical practice in a technology enhanced learning environment;
- deep, flexible, and connected conceptual understanding of K-12 mathematics that recognizes the potential impact of technology on what content should be taught;

- research-based understanding of how students learn mathematics and the impact technology can have on learning (for example, the effects of mathematical action technologies);
- development of skills to determine appropriate technological tools to use for curricular purposes;
- strong pedagogical knowledge base related to the effective use of technology to improve mathematics teaching and learning;
- opportunities for teacher candidates to design and practice teaching lessons that take advantage of the ability of technology to enrich and enhance the learning of mathematics.
- an understanding of the needs and interests of students as they relate to use of technology.

By the completion of their preparation, new mathematics teacher candidates should be able to:

- demonstrate a working understanding of the Technological Pedagogical Content Knowledge (TPACK);
- incorporate mathematical tools and technology as an everyday part of the mathematics classroom, recognizing that students should experience “virtual manipulatives” to explore important mathematics, and to amplify mathematical concepts.
- demonstrate flexibility with high-quality and creative instructional techniques to help students explore and learn mathematics with technology, promote students’ deep mathematical thinking, and solve complex real-world problems;
- understand how technology affords and constrains student actions and thoughts;
- efficiently troubleshoot technology difficulties in both student and teacher use;
- incorporate a variety of assessment techniques, including the use of technology to evaluate students’ understanding of important mathematical concepts;
- communicate and collaborate within online environments and enable K-12 students do the same;
- build K-12 students’ confidence and disposition in using technology for learning; and
- differentiate instruction to assist students with special needs using technology.

If technology is used to improve the learning of mathematics at all levels, K-12 students will be better prepared to use technology appropriately, fluently, and efficiently to do mathematics in the techno-rich environments in which they will study and work in the future. One must remember media and technology do not evoke the dynamics of learning environments, but the dynamics are the result of the interplay between the content, teachers, and learners.

References

- National Council of Teachers of Mathematics. (2014). *Principles to actions: Ensuring mathematical success for all*. Reston, VA: Author.
- National Council of Teachers of Mathematics. (2011). *Technology in teaching and learning mathematics: A position of the National Council of Teachers of Mathematics*. Retrieved from <http://www.nctm.org/Standards-and-Positions/Position-Statements/Technology-in-Teaching-and-Learning-Mathematics/>