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Mathematics TPACK (Technological Pedagogical Content Knowledge) Framework

AMTE believes that students at all levels, PreK-20, benefit from technology-enriched learning environments. Mathematics educators serve their students by considering the potential impact of a variety of forms of 21st Century digital technologies and planning accordingly.

The following framework is based on the work of Mishra and Koehler (2006). It further elaborates important considerations related to TPACK and the National Educational Technology Standards for Teachers (ISTE 2009) for those whose primary content responsibility is mathematics. It is intended to serve as a guide for mathematics educators (K-12 teachers, university faculty, teacher educators, and professional development facilitators) and researchers to plan, examine, improve, and evaluate mathematics instruction at all levels. The framework describes essential components for enhancing mathematical learning experiences via technology and is organized around four major areas: designing and developing technology-enhanced learning experiences; facilitating technology-integrated instruction; evaluating technology-intensive environments; and continuing to develop professional capacity in mathematics TPACK. Specific guidelines for each area are described below.

- I. Design and develop technology-enhanced mathematics learning environments and experiences.** Educators use their knowledge of technology, pedagogy, and content to design and develop learning environments and experiences to maximize mathematics learning. They:
 - a. Establish and utilize mathematical environments, tasks, experiences and resources to integrate technology tools that support learners' individual and collaborative mathematical learning and creativity;
 - b. Design challenging and engaging mathematical learning experiences that utilize appropriate technologies to support the diverse needs of learners; and
 - c. Identify and utilize strategies and activities that promote equitable access to and facility with technology resources.

- II. Facilitate mathematics instruction with technology as an integrated tool.** Educators implement curricular plans that integrate appropriate technology to maximize mathematical learning and creativity. They:

- a. Incorporate knowledge of learner characteristics, orientation, and thinking to foster learning of mathematics with technology;
- b. Facilitate technology-enriched, mathematical experiences that foster creativity, develop conceptual understanding, and cultivate higher order thinking skills;
- c. Promote mathematical discourse between and among instructors and learners in a technology-enriched learning community;
- d. Use technology to support learner-centered strategies that address the diverse needs of all learners of mathematics; and
- e. Encourage learners to become responsible for and reflect upon their own technology-enriched mathematics learning.

III. Assess and evaluate technology-enriched mathematics teaching and learning. Educators assess and evaluate mathematics teaching and learning using appropriate assessment tools and strategies. They:

- a. Assess learning of mathematics applying technologies when appropriate, reflect upon the assessment results, and communicate those results using a variety of tools and techniques;
- b. Assess learners' appropriate and ethical use of technology resources in learning and communicating mathematics;
- c. Use formative assessment of technology-enriched lessons and activities to evaluate mathematics learning and adjust instructional strategies accordingly;
- d. Align the technology expectations for assessment tasks and practices with that of mathematics instructional activities; and
- e. Evaluate and reflect on the effective use of existing and emerging technologies to enhance the mathematical learning of all.

IV. Engage in ongoing professional development to enhance technological pedagogical content knowledge. Educators seek, identify, and use technology to enhance their knowledge, productivity, and professional practice. They:

- a. Collaborate with others in ongoing professional activities to promote excellence in learning mathematics in technology-enriched environments;
- b. Promote social justice for access to and facility with technology in learning mathematics;
- c. Advocate, model, and promote safe, legal, and ethical use of technology for learning and exploring mathematics with learners, families and caregivers, and colleagues;
- d. Communicate and collaborate with families and caregivers, colleagues, and the larger community using appropriate technologies in order to nurture mathematical learners; and
- e. Exhibit leadership by demonstrating a research-based vision for integrating technology in teaching mathematics.

References:

Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: A new framework for teacher knowledge. *Teachers College Record*. 108(6), 1017-1054.

International Society for Technology in Education (2008). *National Educational Technology Standards for Teachers*. (<http://www.iste.org/AM/Template.cfm?Section=NETS>)

Acknowledgements:

Initiated during the AMTE 2008 annual meeting, the development of the Mathematics TPACK Framework is the result of work initiated by the AMTE Technology Committee. The ideas presented in this document were reviewed, vetted, and refined through multiple conference presentations and meetings of AMTE and SITE (Society for Information Technology in Education) as well as an open call for feedback from the AMTE membership.

The following individuals took primary responsibility for initiating the development of this document. The AMTE Board acknowledges and thanks these members for their work.

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Date of Adoption by the AMTE Board of Directors: 6-19-09