Oregon Teachers of Teachers of Mathemtics (TOTOM)
Recommendation on the use of graphing calculators
on the Smarter Balanced assessments
October 1, 2015

The Oregon Teachers of Teachers of Mathematics (TOTOM) organization is an affiliate of both the Association of Mathematics Teacher Educators and the National Council of Supervisors of Mathematics. The members of TOTOM represent higher education faculty from both public and private two-year, four-year, and university institutions throughout Oregon. These faculty are all professionally involved in the mathematical content or pedagogical preparation of teachers of K-12 teachers.

TOTOM expresses its strong support of the vision of mathematics instruction provided in the Common Core State Standards for mathematics. The content and practice standards represent lofty but achievable goals for the mathematics learning of all students. Assessment plays a critically important role in helping K-12 schools monitor progress in their students meeting those standards, and in providing higher education institutions reliable evidence of students' skills, knowledge, and problem solving abilities that can form the foundation for their continued study of mathematics and related fields in college and beyond.

The CCSS mathematics practice standards include CCSS.MATH.PRACTICE.MP5:

"Use appropriate tools strategically."

(http://www.corestandards.org/Math/Practice/)

The elaboration of this standard makes explicit mention of technological tools such as spreadsheets, computer algebra systems, dynamic geometry software, and graphing calculators.

In particular, the use of handheld graphing calculators has been prevalent in secondary school mathematics classrooms for well over 20 years, and they are now viewed widely as essential tools in mathematics instruction. Graphing calculators provide not only an aid for computations too complex or tedious to be performed by paper and pencil, but also a powerful representational tool for visualizing graphs of equations and functions. They can afford students opportunities to explore, to simulate, and to investigate numerical and visual patterns.

Thomas Romberg, in his chapter "Assessment and Technology" in *Impact of Calculators on Mathematics Instruction* (edited by Bright, Waxman, Williams) made this statement regarding such cognitive tools: "if used properly, computers, calculators, manipulatives, and other technologies can be indispensable instruments for facilitating a better understanding of mathematics."

Romberg immediately follows with

"The key implication of the previous discussion of cognitive tools is that if they are used in instruction they should be used in assessment."

(p. 18, Bright, Waxman, Williams, 1992).

We are concerned with the Smarter Balanced requirement that students use an online calculator emulator with a different user interface than the graphing calculators students are most likely to have used in instruction. While we understand the attractiveness of providing an online version of a calculator to students taking a computer-based assessment, the requirement that students make use of an unfamiliar tool on a high stakes assessment when they have been making frequent use of a different tool during their instruction is seen as unnecessarily problematic. From a student perspective, such a requirement may contribute to anxiety that negatively impacts performance. From a psychometric perspective, such a requirement introduces a confounding of what is being assessed. From a practical perspective, allowing handheld graphing calculators allows administration of the assessment in paper format rather than computer-based, and this could have profound implications for schools that struggle with adequate access to computers.

In light of these concerns, TOTOM strongly recommends allowing the option of using handheld graphing calculators on its technology-active assessment items, whether those items are administered by computer or on paper. We are confident that such a move in the implementation of the Smarter Balanced assessments would be widely and positively regarded as sensible and responsive to the genuine concerns of many mathematics educators.

Reference

Romberg, Thomas. (1994) "Assessment and Technology" in *Impact of Calculators on Mathematics Instruction,* edited by George W. Bright, Hersholt C. Waxman, Susan E. Williams; published by University Press of America, Lanham, Maryland. Pages 7-25.