Promising Practices in K-12 Mathematics Software

"Learning with technology doesn't happen because a specific tool "revolutionizes" education; it happens when proven teaching strategies intersect with proven technology tools."

-Liz Kolb, "Learning First, Technology Second", University of Michigan

The use of highly effective instructional practices in mathematics is the most productive way to improve a student's mathematics achievement. When used in concert with effective instruction, personalized learning (PL) software is an invaluable tool that educators can use to both improve their instruction and more fully meet each students' needs. It should not be used to replace Tier 1 instructional time (see the Utah Multi-Tiered System of Supports (MTSS) for Mathematics framework), but rather to help the educator meet their objectives and student meet learning goals.

Using mathematics software as a stand-alone solution for students' mathematical studies results in them not receiving many of the benefits that high-quality instruction in a collaborative classroom provide (including high depth of knowledge experiences, peer collaboration, the use of meaningful mathematical discourse, and others). Care must be taken to ensure each and every student has equitable access to software supports.

Effective Methods of Using Mathematics Software to Improve Student Learning Including:

- **Formative Assessment:** Student data from mathematics software can be used to inform instruction at the classroom and individual student levels, while monitoring learning progress. Students have opportunities to monitor their own progress using real-time feedback and to self-assess their strengths and weaknesses. Data can be analyzed to inform instructional decisions by the teacher, offering them immediate feedback on student progress and performance.
- **Differentiating Instruction using the MTSS:** Mathematics software can be used to assist students who need additional support in mastering math content or provide enrichment opportunities, increasing depth and rigor. The content that students receive (when the program is used appropriately) is personalized to their needs and desires, allowing them to pursue work in a low risk/feedback rich environment.
- **Learning Mathematics Content:** Mathematics software can be used in combination with teacher-lead activities to increase content knowledge.* For example, it can assist students in building procedural fluency within a content domain. Students who have access to computers/smartphones have the ability to pursue this mathematics education anytime, anywhere they have access to the internet.

Potential Pitfalls Arise When Mathematics Software is Used in the Following Ways:

- **Acceleration:** Using math software by itself to accelerate students' mathematics studies is inappropriate. It is an ineffective replacement of high-quality, interactive, teacher-led classroom experiences. For students demonstrating need for course compacting or acceleration, USBE-approved methods should be employed.
- **Tier 1 Content Instruction:** Tier 1 instruction should effectively differentiate for a wide array of learners, engaging all students in Utah math content standards and practices. High quality instruction from a capable teacher is the most effective way for students to learn mathematics, using mathematics software as a tool to assist them in this process, not as the primary means of instruction (this includes in competency- based education programs using software as the primary pedagogical modality).
- **Replacing supplemental intervention mathematics courses:** When instituted effectively, supplemental mathematics intervention courses provide far more effective support than students engaging daily on personalized learning software (including credit-recovery circumstances). Therefore, software should be used as a component of, not a replacement for, these courses.

*(Ma, Adesope, Nesbit, & Qing, 2014)

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