Games/Drill and Practice in Grades 3-5

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What are some important features to consider when purchasing a mathematics computer program? As elementary educators continue to shift away from using only a drill-and-practice approach to mathematics instruction, there are important issues to keep in mind when considering which mathematics computer programs are worth the district's money and the students' time. Furthermore, these issues become even more pertinent as general educators continue to find ways to ensure that the general curriculum is accessible to students with diverse learning needs.

As mentioned in K-2 Games/Drill and Practice, researchers have found more value in using mathematics computer programs that focus on learning discipline-specific concepts such as fractions, geometry, or place value. (For more information on these programs, refer to the research on digital manipulatives.) In the 1980s, researchers' central finding was that computers do not appear to be more effective than traditional paper-and-pencil instruction as a means for helping students engage in lower-ordering thinking. In this respect, however, the research highlighted below seems outdated regarding the technology used and instructional practices emphasized—namely drill and practice. Yet their findings regarding instructional feedback, individualized instruction, and engagement are important to keep in mind when purchasing mathematics software for students with or without special needs.

Curriculum studies

First, consider computer programs that provide specific instructional feedback. Okolo (1992) compared the learning outcomes of 29 fourth- through sixth-graders identified as "learning disabled" (LD). These students practice multiplication computation skills in two computer-based environments: one with "attribution retraining" feedback (experimental group), and the other with "neutral" feedback (control group). Neutral feedback included comments on the computer screen such as, "You now have 15 correct of 15 tries." The experimental group received positive feedback that stated, "You really know these," or, "You are really trying hard." When these students were not as successful, the computer program gave them feedback that stated, "You can get it
if you try harder," or, "You can do better if you try harder." It should be no surprise that the students in the experimental group did not outperform their control-group peers. Yet this finding points out the importance of specific instructional feedback. That is, when considering a computer program’s value, it is important to find out whether it provides feedback that simply tells the students to "try harder" or if it gives them specific feedback that facilitates conceptual or computational learning.

Second, do not forget the importance of individualized instruction. More recent developments in technology have allowed educators to demand that computer programs track student learning and use that data to individualize the instruction for a student. Wilson & colleagues (1996) observed the learning outcomes of four upper-elementary students identified as having a learning disability. Their research sample was small; however, they found that students benefited more from individualized teacher-led instruction than a computer program that offered a generic practice for similar mathematics skills.

Finally, student engagement is another important factor to consider. No doubt, teachers have repeatedly noticed that students are typically more excited to work on computers than fill out worksheets. Yet Christensen & Gerber (1990) present a word of caution when considering the benefits to LD students of using computer programs that use “flashy” sounds and graphics. They observed 30 general education students and 30 LD students working in one of two conditions: 1) a drill and practice computer program that was designed with arcade game-like graphics and sounds, and 2) a drill and practice computer program that did not have these arcade game-like features. They noticed that the LD students’ latency and accuracy in the arcade game environment was lower than their peers in the other group. When taken into account with the above research, this finding suggests that educators will want to consider computer programs that provide relevant feedback and individualized instruction over programs that merely offer “flashy” graphics and sounds that only facilitate lower-order thinking.

References
