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Research Brief:
Does Educational Technology Improve Student Learning Outcomes?

In April 2013, the Office of the Commissioner of the Kentucky Department of Education requested that the Appalachia Regional Comprehensive Center (ARCC) provide a brief summary of research on the role of technology in student learning. The request was prompted by a Kentucky Board of Education member's query about evidence of the effect of educational technologies on student outcomes.

Educational Technologies Can Improve Achievement

Because the range of educational technologies is so diverse—from specific software packages to computing devices to online content delivery systems—no single research study can address the general question of whether technology yields improved student outcomes.[1] Nonetheless, ample evidence from the last 10 years suggests that particular technologies can enhance student knowledge and skills. Findings from selected studies are summarized below.

- **Reading:** A recent meta-analysis of 84 rigorous studies compares the impact of various technologies (computer-managed learning, innovative technology applications, supplemental technology, and comprehensive models) on K-12 reading achievement. Comprehensive models that integrate computer-assisted instruction with other activities as a core reading program appear to produce the largest improvements in reading scores.[2]
- **Mathematics:** A meta-analysis of 74 rigorous studies on K-12 mathematics computer applications indicates that such programs produce small but positive effects on mathematics achievement. Specifically, programs that supplement traditional math instruction with additional computer-assisted instruction at students' individualized assessed levels of need have the greatest effects on math achievement.[3]
- **Writing:** A systematic review of studies in peer-reviewed journals between 2005 and 2010 finds that participation in one-to-one computer projects (wherein each student is provided a digital device) to improved student motivation and engagement in learning, slightly improved students' writing skills, proficiency with the use of digital tools, and scores on high-stakes tests.[4] Another study indicates that students using laptops regularly outperform their peers in four areas of writing: content, organization, language/voice/style, and mechanics.[5]

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The Significance of Effective Technology Integration

Research on the impact of educational technology on student learning is promising. But the availability of technological tools alone is not sufficient to improve achievement.[6] Rather, effective integration of technology into teaching and learning is critical, according to research conducted over the last 20 years.[7] Selected findings from studies of technology integration efforts are presented here.

- **English Language Arts.** Evaluation of New York's Student Centered Active Learning Environments finds that students of teachers who adapt their instruction to accommodate technologies (such as student portals, personalized digital instruction, and electronic formative assessments) have generally better achievement, particularly in English language arts at the middle school level.[8]
- **Mathematics.** The mathematics achievement of students participating in the Texas Technology Immersion Pilot for middle schools is better than that of their non-participating peers in a control group, especially among impoverished students.[9] In addition, the positive effects of technology immersion on both mathematics and reading performance increase over time and as teachers' technology proficiency grows.
- **Closing the Achievement Gap.** Twelve states participate in the Enhancing Missouri's Instructional Networked Teaching Strategies (eMINTS), which facilitates technology integration through inquiry-based teaching, collaborative teacher professional development and lesson planning, and deliberate alignment of curriculum and instruction with relevant technology. A summary of 10 years of evaluation finds that intermediate elementary students in eMINTS classes consistently outperform their peers in non-eMINTS classes on state achievement assessments of reading and mathematics.[10] Moreover, these effects are especially strong for the most disadvantaged pupils—impoverished, minority, Limited English Proficient, and special education students, and those attending Title I schools.

Keys to the Successful Implementation of Technology for Student Learning

1. Provide effective professional development for teachers on the instructional integration of technology
2. Embed the use of technology within the daily school schedule
3. Directly support the curriculum objectives being assessed through technology
4. Adjust for students' abilities and prior experiences, and provide feedback to the student and teacher about student performance or progress with the application
5. Provide opportunities for student collaboration
6. Provide opportunities for students to design and implement projects that extend the curricular content being assessed by a particular standardized test
7. Foster school environments where teachers, the school community, and school and district administrators support the use of technology

Source: International Society for Technology in Education, 2008

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In Sum

Evidence suggests that educational technologies can improve student achievement, so long as such tools are integrated thoughtfully into teaching and learning. When digital capabilities (such as engaging online environments, access to a wide array of resources, and interactivity) are incorporated meaningfully into instruction, students have new opportunities to learn—and achieve.[11]

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