



The Impact of Technology on Student Achievement

A Summary of Research Findings on Technology's Impact in the Classroom.

A seventh-grader slips a CD into a computer and ponders a series of algebraic equations. A group of high school students study physics problems collaboratively over their school's local area network. A teacher connects to the Internet and projects a website for an entire class to see. A fourth-grade class creates a virtual field trip by combining digital video and photos they took during a visit to a museum with music and their own narration. It happens every day in classrooms around the country.

But does technology really make a difference in student achievement?



How Technology Impacts and Improves Student Achievement

For more than 25 years, Apple has been the leader in bringing innovative technology to schools. Our commitment to education encompasses a range of products and services designed to help schools maximize their investments in technology. At Apple, we believe the effective integration of technology into classroom instruction can and will result in higher levels of student achievement. This paper is a summary of research findings that shows the impact of technology on student achievement. For your convenience, we've organized the findings into four areas:

1. Mastering Fundamental Skills

This section explores whether the addition of technology in the classroom has helped students master the reading, writing, and math skills that provide a foundation for future learning.

2. Becoming Proficient Users of Technology

This section looks at how proficiency with technology affects students' ability to write better, express themselves more clearly, and understand presented material faster and with greater recall.

3. Preparing Students with 21st-Century Skills

This section explores the effectiveness of technology in K–12 classrooms in preparing students for later achievement in college and in the workforce at large.

4. Motivating Students to Higher Levels of Achievement

This section examines how technology can decrease absenteeism, lower dropout rates, and motivate more students to continue on to college.

For an annotated bibliography of the research studies cited in this paper and for information on other research studies, go to www.apple.com/education/research.

Mastering Fundamental Skills

The fundamental skills of reading, writing, and arithmetic remain the cornerstones of schooling and student learning. Studies have shown that students with routine access to technology learn these basic skills faster and better when they have a chance to practice them using technology. One of the reasons cited for this improvement is that students are engaged by the technology. As a result, they spend more time learning and practicing the basic tasks than students who approach the same tasks in a traditional paper-and-pencil manner. Students are more motivated to learn when technology is part of their daily school experience.¹

At-risk students show substantial improvement when technology is introduced into their curriculum. Experts believe the reason for this is that technology provides educators with a way to individualize and customize the curriculum to match learners' developmental needs and also provide a nonthreatening and motivating environment for repetitious learning tasks.²

The findings of a research study conducted by Rockman ET AL supports technology's positive effect on writing skills. Researchers found that students who use laptops regularly at school and at home are better writers, outperforming their peers in all four scored areas of writing assessment—content, organization, language/voice/style, and mechanics. When asked what impact using laptops had on their writing, students reported that computers allowed them to do more extensive editing, which led to better writing.³

Improvements in student achievement, however, are not limited simply to writing skills. Fourth-grade students who participated in Missouri's eMINTS project (a program that incorporated a wide range of multimedia and computer technologies) consistently scored 10 to 13 points higher on Missouri Assessment Program (MAP) tests than non-eMINTS students. Special education and Title I students enrolled in eMINTS classes scored 10.1 points higher on MAP tests than their non-eMINTS counterparts.⁴

In addition, an eight-year study of SAT I performance involving students at Brewster Academy showed that students who regularly used laptop computers increased their combined SAT performance by an average of 92 points.⁶

Research has also shown that the benefits of technology go well beyond the classroom. A study conducted by the U.S. Department of Education revealed that when schools provided students with home computers and modems so they could connect to the schools' networks, students increased the amount of time spent on educational activities outside of school. Furthermore, students with home computers spent less time watching television, enhanced their problem-solving and critical-thinking skills, improved their writing and math skills, and showed greater computer literacy.⁵

Becoming Proficient Users of Technology

Studies show that once students become familiar with technology, they quickly develop proficiency in its use. This opens up an exciting new world of learning possibilities for them, and their potential for achievement skyrockets. Students gain new skills and become familiar with new technologies that will help prepare them for future success in an increasingly technological world. Even the most basic tools can help young learners become more productive. Researchers involved in the Apple Classrooms of Tomorrow (ACOT) project revealed that third-grade students found it easier to write with a keyboard than with a pencil or a pen. Because writing was easier, they wrote more. By writing more, they learned to write better.¹

Web browsers make it easy for students to find in-depth information on just about any subject, while basic software tools such as databases, spreadsheets, and concept maps help them to organize and evaluate the data they find online. As a result, students express their ideas more clearly and creatively, using a variety of communications media including words, images, audio, and video. Technology also helps students create work that looks more professional. So when it's time to hand in or publish their work, students take pride in sharing it with their peers, parents, and teachers.¹

In the classroom, many teachers are turning to digital media to strengthen students' basic skills. Using video and audio technology brings class material to life in a way that stimulates young minds and facilitates learning. By incorporating pictures, sound, and animation, multimedia significantly enhances students' ability to recall basic facts, as well as improving their understanding of complex systems.⁵ One reason for this improvement may be that digital media tools can be used to address each student's individual learning style, thereby empowering all students to achieve their potential.

Gaining technological proficiency helps students learn more effectively, and it also improves their desire to learn. One study shows that students who have access to laptop computers explore topics on their own and work longer on school projects. In an interesting side note, the same study revealed that students with regular access to laptops are more confident in their computer skills. That confidence often translates into better performance in the classroom.³

“Students with routine access to technology learn these basic skills faster and better when they have a chance to practice them using technology.”

Preparing Students with 21st-Century Skills

As the world becomes more complex, the skills that students need to acquire and master are quickly changing. The rise of the global economy, an increasingly multicultural society, and rapid changes in technology require students to learn and apply new skills in their academic and career endeavors. Students need to learn to communicate more effectively, both through speech and the written word. They need to learn how to work with others to find new and better ways to solve problems and meet the challenges of everyday life. They need to develop skills they can use in college or the workforce.

Perhaps most important, students need to discover the joy of learning. If students are to function effectively in this ever-changing world, they must continue to learn every day of their lives. Technology can help instill in students an eagerness to learn that will follow them throughout life and better enable them to reach their goals.

The ACOT studies have revealed that in classrooms where technology is used, students interact more with their peers and teachers than in traditional classrooms. Students change the manner in which they organize and accomplish their work, choosing to work collaboratively to solve complex problems.¹ They routinely employ inquiry, collaboration, technology, and problem-solving skills uncommon to graduates of traditional high school programs. Collaboration becomes a learning tool, a means to an end, not just a chance for students to socialize.² A research study on learning with laptops showed that the use of laptops encouraged even greater collaboration among students. During the study, on average, students with laptops worked in groups several times a week, compared with a few times a month before the laptops were introduced in their classrooms.³

Technology provides powerful tools for organizing and analyzing information and modeling concepts and underlying structures. Students who have the opportunity to use these tools gain a deeper understanding of complex topics and concepts and are more likely to be able to recall information later in life and use it to solve problems in nonschool situations.²

“When technology is a routine part of their school experience, student attendance improves and dropout rates decline.”

Motivating Students to Higher Levels of Achievement

One of the most important contributions technology makes in the classroom is how it affects students' attitudes toward learning. Studies have shown that when technology is a routine part of their school experience, student attendance improves and dropout rates decline. When ACOT students were compared with their non-ACOT peers in the same high school, absenteeism was about half in the ACOT classes compared with the rest of the school.¹ Over the five years of the study, there were no dropouts in the ACOT program, while 30 percent of the student body dropped out from the regular program. This result is of crucial importance.

Research shows that more students finish high school and many more consider attending college when they routinely learn and study with technology. Fewer than half of the students in the ACOT study came into the program with any interest in pursuing college. Overall, in the school where the study took place, only 15 percent of the graduating students went on to college. Not only did 100 percent of the students in the ACOT classroom graduate, but more than 90 percent went on to college.¹

Studies show that students who participate in student-centered learning programs score consistently higher in every subject area on standardized tests.^{4,6} Teachers with routine access to computers tend to employ teaching practices that put students at the center of learning. They focus their lessons on discussion rather than lecture, encouraging student-led inquiry and emphasizing thinking skills.³ In this way, technology offers greater opportunities for learner control and greater connections between class work and the real world.²

Technology encourages students to take charge of their education. In classrooms where technology is part of the curriculum, students are more likely to initiate learning-based activities, sometimes even directing them.² In addition to exploring topics more often on their own, students who regularly use laptops assume a greater variety of roles in the learning process, helping to teach other students and even their teachers.³

In general, students respond positively when given the chance to actively participate in the learning process via technology. They come to class eager to learn and take more pride in their work.³ By giving students greater control of their education and increasing their motivation to explore and discover, technology plays a major role in instilling in students a love of learning that will help them to reach new heights of achievement not only in school, but throughout their lives.

Summary of Findings

The keys to raising student achievement are to provide students with a solid foundation of basic skills and to motivate them to learn. Technology can help accomplish this goal. It engages students and fires their imaginations. It helps teachers stimulate young minds in ways that make a profound and lasting difference. Numerous research studies on the impact of technology on student achievement have demonstrated this finding with remarkably similar results. A review of the literature resulting from these studies supports the following conclusions:

- Students, especially those with few advantages in life, learn basic skills—reading, writing, and arithmetic—better and faster if they have a chance to practice those skills using technology.
- Technology engages students, and as a result they spend more time on basic learning tasks than students who use a more traditional approach.
- Technology offers educators a way to individualize curriculum and customize it to the needs of individual students so all children can achieve their potential.
- Students who have the opportunity to use technology to acquire and organize information show a higher level of comprehension and a greater likelihood of using what they learn later in their lives.
- By giving students access to a broader range of resources and technologies, students can use a variety of communication media to express their ideas more clearly and powerfully.
- Technology can decrease absenteeism, lower dropout rates, and motivate more students to continue on to college.
- Students who regularly use technology take more pride in their work, have greater confidence in their abilities, and develop higher levels of self-esteem.

For More Information

For an annotated bibliography of the research studies cited in this paper and for information on other research sources, go to www.apple.com/education/research.

“Students who regularly used laptop computers increased their combined SAT performance by an average of 92 points.”

Research Study Sources

1. ACOT Research—Source: Teaching with Technology: Creating Student-Centered Classrooms, Sandholtz, Judy, Ringstaff, Cathy, and Dwyer, David C., 1997
2. NCREL—Published Research—Source: Computer-Based Technology and Learning: Evolving Uses and Expectations, Valdez, Gilbert, McNabb, Mary, Foertsch, Mary, Anderson, Mary, Hawkes, Mark, and Raack, Lenaya, 2000, www.ncrel.org/tplan/cbtl/toc.htm
3. Rockman ET AL—Source: The Laptop Program Research, Rockman ET AL, June 1997, September 1998, June 2000, <http://rockman.com/projects/laptop/>
4. Enhancing Missouri's Instructional Networked Teaching Strategies (eMINTS) Program—Source: eMINTS Evaluation Team Policy Brief, January 29, 2002, <http://emints.more.net>
5. U.S. Department of Education —Source: Getting America's Students Ready for the 21st Century: Meeting the Technology Literacy Challenge, U.S. Department of Education, June 1996, www.ed.gov/Technology/Plan/NatTechPlan/benefits.html
6. The Endeavor Group—Source: 1991–1999 Evaluation of the School Design Model (SDM) at Brewster Academy, The Endeavor Research Group, www.theendeavourgroup.net/research.html