Blackboard vs. Computers: It Depends on the Application

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Can the use of computers in the classroom take learning to a new level? The emergence of computer-based teaching methods has raised high expectations. Will the next generation of digital natives learn much quicker and better when technology is involved? Most previous studies[1] have arrived at one surprising answer: No. Most scholars find little to no effect of classroom computers on student achievement.

Blackboard vs. Computers?

Does this mean the purchase of expensive computers for the classroom is merely a waste of money and we should stick to blackboard and chalk? Evidence from our own[2] study suggests the answer must again be: No. The devil is in the details here. We find that the lack of effects is the result of using computers in different ways. Some are productive while others are not. The combination of using computers for activities that are more productive than traditional teaching methods and using computers in ways that are less effective than conventional teaching practices leads to overall null effects.

Our empirical analysis uses information from the so-called TIMSS, the Trends in International Mathematics and Science Study. Our sample of the 2011 TIMSS test covers the math and science achievement of over 150,000 students in 30 countries in 8th grade and nearly 250,000 students in 53 countries in 4th grade. In detailed background questionnaires, TIMSS surveys how often teachers in each subject have their students use computers in three distinct activities: look up ideas and infor-

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mation; practice skills and procedures; and (only in 8th grade) process and analyze data.

In line with most of the literature, we do not find a significant effect of computer use on student achievement in math and science on average. However, we find that this null effect is indeed the result of positive and negative effects of specific computer uses: Students' achievement profits from using computers to look up information but suffers from using computers to practice skills (and it is unaffected by using computers to process data).

Blackboard and Computers

The central point in our reasoning is that there are opportunity costs of time, meaning that each classroom minute can only be used in one way or another. Time spent on the computer is time that is unavailable for other modes of teaching. Researching information on the internet does not have a conventional teaching equivalent that is equally effective. In the context of a geography class for instance, rummaging through an encyclopedia is less efficient than using an online search engine to gather detailed and up-to-date information. Thus, using classroom computers to explore information does, in fact, increase student learning.

Practicing skills, however, apparently can be achieved more efficiently applying traditional teaching methods. Solving mathematical equations under the teacher's guidance, for instance, will further mathematical understanding more efficiently than using inflexible drill and practice programs. In this case, the use of computers will decrease student learning.

Policy Implications

Our results also have implications for policy. Recently there has been a big push in many countries to bring computers into classrooms resulting in numerous initiatives that invest large sums of money in classroom technology. According to our findings, the success of these initiatives will depend on the specific uses that the computers are brought to. This not only entails investing in the appropriate hardware but also developing suitable applications.

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