Is Information Technology Improving Education?


Over the past 20 years, K–12 schools have invested billions of dollars on information technology (IT) for instructional use. Annual expenditures are now approximately $6 billion a year, or 2% of the entire school budget. People are asking, “Why hasn’t this large investment produced a significant improvement in education?”

This is a difficult question to answer. One way we can do this is by comparing business with education. Table 1 summarizes this comparison.

<table>
<thead>
<tr>
<th>Business</th>
<th>Education</th>
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<tbody>
<tr>
<td>The IT industry is now more than 8% of all U.S. business. It is successful and growing.</td>
<td>Many students are successfully learning about IT. State and national standards and goals are being developed.</td>
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<td>Computer-assisted learning and distance learning are successfully used in staff and customer training.</td>
<td>Progress is occurring on integrating IT tools with curriculum, instruction, and assessment, but educational investment levels lag significantly behind business.</td>
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<tr>
<td>IT tools that support the individual worker are relatively well integrated in the workplace. Business has invested heavily in this area.</td>
<td>Progress is occurring on integrating IT tools with curriculum, instruction, and assessment, but educational investment levels lag significantly behind business.</td>
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Table 1. IT in Business and Education Business

**IT in Business**

For many years, there have been arguments about the immense amount of money that businesses have spent on IT and their lack of results. In the 1960s, businesses in the United States were spending an average of 3% of their equipment funds in information technology. This amount has steadily grown to the current average of 45%. Communications, insurance, and brokerage companies are now spending more than 75% of their equipment funds on IT.

According to the U.S. Department of Commerce (1998):

In recent testimony to Congress, Federal Reserve Board Chairman Alan Greenspan noted that “...our nation has been experiencing a higher growth rate of productivity—output per hour worked—in recent years. The dramatic improvements in computing power and communication and information technology appear to have been a major force behind this beneficial trend.”
Other economists remain skeptical about the contribution of the IT industry to overall productivity. As yet, there is limited direct evidence in government data that investments in IT have substantially raised productivity in many non-IT industries.

Notice that Greenspan’s claim is specifically about the IT industry. The commerce department report also provides solid evidence to back up Greenspan’s claim. In brief summary:

- IT industries have been growing at more than double the rate of the overall economy.
- The IT share of the gross domestic product (GDP) grew from 4.9% of the economy in 1985 to 6.1% by 1990, 6.4% by 1993, and an estimated 8.2% for the current year.
- In 1996 and 1997, declining prices in IT industries lowered overall inflation by one full percentage point. For example, without the contribution of the IT sector, overall U.S. inflation, at 2.0% in 1997, would have been 3.1%.
- In recent years, IT industries have been responsible for more than one-quarter of real economic growth.

None of this data provides evidence that IT has improved productivity in non-IT businesses. Even though great effort has been made to support claims that IT has made a substantial contribution to increased productivity in non-IT businesses, the evidence is not clear-cut. Thus, it is not surprising that in education, where we have spent far less money for IT, we do not have much research evidence to support IT’s effectiveness.

**Education**

Look at the first comparison row in Table 1. It suggests that the IT industry should be compared with the educational component that has students learning about IT. Teaching about information technology is a large, growing, and successful component of education. Education has not only developed computer science courses and computer science degree programs, but also facilitated huge numbers of students in learning to use tools such as word processors, spreadsheets, graphics, hypermedia, and the Internet. Our educational system has set this as one of its goals (International Society for Technology in Education, 1998), and it has made significant progress in achieving this goal.

The second comparison row in Table 1 focuses on computer-assisted learning (CAL) and distance learning. Business uses both methods in customer and staff training. Education also uses these aids to learning.

The evidence on the educational success of distance learning is strong. Students and educators can and do learn effectively through distance learning. The evidence of success is even stronger, of course, if one views distance learning as a new opportunity to learn—making coursework available that a student or educator would not otherwise have. For more information about distance learning, visit the Distance Learning Resources Network home page at [www.wested.org/tie/dlrn/](http://www.wested.org/tie/dlrn/).

Next, consider CAL. Substantial research has been done on CAL in the past three decades. Kulik (1994) provides a meta-meta study that analyzes many meta studies on CAL. In brief summary, CAL works. On average, students learn faster and better as compared with traditional education. Test scores are raised through the use of CAL aligned with the tests.

The third comparison in Table 1 is that business has integrated IT as a tool throughout its operations, and that education is striving to do likewise. Remember, the evidence is still weak that IT as a tool is significantly increasing business productivity.
Clearly, the nature of many jobs has been changed by IT. For example, the business “secretary” now routinely uses a wide range of IT tools. The typewriter may get dusted off occasionally to fill out a preprinted form, but in many offices it has disappeared. We no longer measure secretarial productivity in terms of how many letters per day are transcribed from dictation or how many sets of notes are edited and typed. It is a challenge to measure a secretary’s changes in productivity when the nature of the job has changed so much.

Similarly, how does one measure the increased productivity of a student who has learned to search the Web for up-to-date information as compared with the student who has learned to retrieve information from a traditional school library? Although information is retrieved in both cases, how do we measure the difference in productivity? How do we measure the productivity of a student who uses a graphing calculator to solve math and science problems versus a student who has learned to solve such problems using paper-and-pencil techniques? The point is, we lack appropriate measures of student productivity. Until we develop such measures, we will have difficulty “proving” that IT is increasing student productivity.

Final Remarks
Integration of IT into education would mean that IT was thoroughly integrated into curriculum, instruction, and assessment. It would mean that students and teachers had routine access to these facilities, and that a technical support staff was in place to provide high quality and timely support. Business has spent far more per capita than education to support employee use of IT, and business is still questioning the effectiveness of this investment. It is not surprising that education lacks solid evidence that this aspect of IT improves the productivity of students and educators.

In essence, each teacher who is facilitating routine student use of IT in the classroom is a researcher experimenting with the effectiveness of such IT use. These teachers can make a significant contribution to education by carefully observing the results of IT use in their classrooms and then sharing their experiences. Learning & Leading With Technology is actively seeking this type of action research.

References