Evidence Summary:
What do we know about computer-assisted learning?

Computer Assisted Instruction

Studying the effects of using computers in the classroom is a popular topic for research into educational outcomes, and the earliest studies are now nearly 40 years old. As the technology used in the classroom has changed over that time period, our understanding of how we should use technology to ensure produce good student outcomes has also changed.

This Evidence Summary examines a number of studies and meta-analyses about computer assisted instruction. It is based on work by Dr. John Hattie in his book "Visible Learning". This is a high-level summary of what he found, and omits much of the statistical data. For statistical details and a list of the studies and meta-analyses, please see the original article

How effective is computer-assisted instruction?
Visible Learning ranks more than 138 strategies or practices to improve student outcomes, with effect sizes ranging from 1.44 to -0.34. Computer assisted instruction has an effect size of 0.37, and is ranked as the 71st intervention, with 70 other interventions having a greater impact on student achievement. To put it another way, 25 times out of one hundred, when computer assisted learning is used, it will make a positive difference in student outcomes.

Across the studies and meta-analyses, there was no evidence that computer assisted instruction was more effective in a particular grade, or in a particular subject. There was evidence that computer assisted instruction can assist in student engagement and positive attitudes to learning and school.

How are computers used in classrooms?
Most studies have compared how teachers use computers to teach, and there are fewer studies on how students use computers to learn. Often the studies compare teaching in classrooms with computers with teaching in classrooms without computers.

Computers in classrooms may be used for a variety of purposes, and classrooms may use computers for more than one purpose. Some

Key Points

⇒ *The use of computer-aided instruction has moderate effects on student outcomes.*

⇒ *The use of computers is more effective when there is teacher pre-training in the use of computers as a teaching and learning tool.*

⇒ *The use of computers is more effective when there are multiple opportunities for learning*

⇒ *The use of computers is more effective when the student, not the teacher, is in "control" of learning*

⇒ *The use of computers is more effective when peer learning is optimized.*

⇒ *The use of computers is more effective when feedback is optimized.*

What do we know about computer-assisted learning?

common instructional uses for computers are for tutorial, programming, word processing, drill & practice, simulations, and problem solving.

What do we know about the effective use of computers in the classroom?

The use of computers is more effective when there is teacher pre-training in the use of computers as a teaching and learning tool.

Teachers are frequent users of computers, but much of that use is for personal and administrative tasks. Teachers find it more difficult to see how computers can be related to their particular conceptions of teaching. Education is still "on the threshold of understanding how to design courses to maximize the potentials of technology".

One study that examined the amount of pre-training that teachers received found the greatest effects required more than 10 hours of training. This study also found that "less than 10 hours of training is not only unproductive, but it is counterproductive". Teachers who received short-term training seemed to have classes that achieve substantially less than average computer-using classes.

The use of computers is more effective when there are multiple opportunities for learning (e.g. deliberative practice, increasing time on task).

There are many ways that computers can assist with learning, and not all ways are as effective as others. Tutorials involved structured learning experiences and these have the greatest effect compared to other computer-administered methods. Drill and practice is an important ingredient in mastery training, and computers may make deliberative practice engaging and informative.

The evidence has also shown positive effects from using computers to engage in deliberative practice, especially for those students struggling to first learn a concept. Meta-analyses have shown that drill and practice routines delivered via computer are more effective than traditional teaching.

The use of computers is more effective when the student, not the teacher, is in "control" of learning.
When the student is in "control" over his or her learning (pacing, time allocations for mastery, reviewing) then the

effects were greater than when the teacher was in "control" over these dimensions of learning.

A good example of the student being in control of his or her learning relates to the use of word processors. When using these packages, students tend to write more than when asked to write on paper, and the quality of the writing is enhanced, especially for weaker writers.

The use of computers is more effective when peer learning is optimized.

Using computers in pairs is much more effective that when computers are used alone or in larger groups. Peers can be involved in problem solving, suggesting and trying new strategies, and working through possible next steps. There were a number of specific recommendations for students working in groups to increase the chances of positive effects. These included providing students with specific cooperative learning strategies and encourage them to work together to use appropriate and varied learning strategies.

The use of computers is more effective when feedback is optimized.

Computers can provide effective, personalized feedback to every student in a classroom, all at the same time. Providing feedback is a high-yield strategy for improving student outcomes. As well, computer feedback is potentially less threatening to students and can occur in a more programmed manner.

Characteristics of high-outcome studies.

One meta-analysis identified three key characteristics of studies that produced the best outcomes. These principles included: the teacher needs to use computer-assisted instruction to manage the attention and motivation of the learner, the teacher needs to use computer-assisted instruction to present new subject matter and learning strategies to the learner, and the teacher needs to use computer-assisted instruction to guide the practice and active involvement of learners.

*This summary is taken from **"Visible Learning"** by John Hattie (Routledge, 2009), pages 220 to 227. Please see the original document for full details. In the case of any disagreement between this summary and the original document, the original document should be seen as authoritative.*