

# KNOWLEDGE MAP: IMPACT OF ICTs ON LEARNING AND ACHIEVEMENT

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## GUIDING QUESTIONS:

- How are ICTs actually being used in education?
- What do we know about the impact of ICTs on student learning?
- What do we know about the impact of ICTs on student motivation and engagement for learning?

## CURRENT KNOWLEDGEBASE

*What we know, what we believe  
— and what we don't*

### General

- **It is generally believed that ICTs can empower teachers and learners, promote change and foster the development of '21st century skills, but data to support these beliefs are still limited**

There is widespread belief that ICTs can and will empower teachers and learners, transforming teaching and learning processes from being highly teacher-dominated to student-centered, and that this transformation will result in increased learning gains for students, creating and allowing for opportunities for learners to develop their creativity, problem-solving abilities, informational reasoning skills, communication skills, and other higher-order thinking skills. However, there are currently very limited, unequivocally compelling data to support this belief.

- **ICTs are very rarely seen as central to the overall learning process**

Even in the most advanced schools in OECD countries, ICTs are generally not considered central to the teaching and learning process. Many ICT in education initiatives in LDCs seek (at least in their rhetoric) to place ICTs as central to teaching and learning.

- **An enduring problem: putting technology before education**

One of the enduring difficulties of technology use in education is that educational planners and technology advocates think of the technology first and then investigate the educational applications of this technology only later.



This Knowledge Map is an excerpt from the publication, *Knowledge Maps: ICTs in Education: What Do We Know About the Effective Uses of Information and Communication Technologies in Education in Developing Countries?* produced by the Information for Development Program (*infoDev*).

## Impact on student achievement

- **The positive impact of ICT use in education has not been proven**

In general, and despite thousands of impact studies, the impact of ICT use on student achievement remains difficult to measure and open to much reasonable debate.

- **Positive impact more likely when linked to pedagogy**

It is believed that specific uses of ICT can have positive effects on student achievement when ICTs are used appropriately to complement a teacher's existing pedagogical philosophies.

- **'Computer Aided Instruction' has been seen to slightly improve student performance on multiple choice, standardized testing in some areas**

Computer Aided (or Assisted) Instruction (CAI), which refers generally to student self-study or tutorials on PCs, has been shown to slightly improve student test scores on some reading and math skills, although whether such improvement correlates to real improvement in student learning is debatable.

- **Need for clear goals**

ICTs are seen to be less effective (or ineffective) when the goals for their use are not clear. While such a statement would appear to be self-evident, the specific goals for ICT use in education are, in practice, are often only very broadly or rather loosely defined.

- **There is an important tension between traditional versus 'new' pedagogies and standardized testing**

Traditional, transmission-type pedagogies are seen as more effective in preparation for standardized testing, which tends to measure the results of such teaching practices, than are more 'constructivist' pedagogical styles.

- **Mismatch between methods used to measure effects and type of learning promoted**

In many studies there may be a mismatch between the methods used to measure effects and the nature of the learning promoted by the specific uses of ICT. For example, some studies have looked only for improvements in traditional teaching and learning processes and knowledge mastery instead of looking for new processes and knowledge related to the use of ICTs. It may be that more useful analyses of the impact of ICT can only emerge when the methods used to measure achievement and outcomes are more closely related to the learning activities and processes promoted by the use of ICTs.

- **ICTs are used differently in different school subjects**

Uses of ICTs for simulations and modeling in science and math have been shown to be effective, as have word processing and communication software (e-mail) in the development of student language and communication skills.

- **Access outside of school affects impact**

The relationships between in class student computer use, out of class student computer use and student achievement are unclear. However, students in OECD countries reporting the greatest amount of computer use outside school are seen in some studies to have lower than average achievement (the presumption is that high computer use outside of school is disproportionately devoted to computer gaming).

- **Users believe that ICTs make a positive difference**

In studies that rely largely on self-reporting, most users feel that using ICTs make them more effective learners.

## Impact on student motivation

- **ICTs motivate teachers and students**

There appears to be general consensus that both teachers and students feel ICT use greatly contributes to student motivation for learning.

- **Access outside of school affects user confidence**

(Not surprisingly) Students who use a computer at home also use them in school more frequently and with more confidence than pupils who have no home access.

## ICT use in education

### ■ **Placement of computers has an impact**

Placing computers in classrooms — rather than separate computer laboratories — enables much greater use of ICTs for ‘higher order’ skills. Indeed, a smaller number of computers in classrooms may enable more actual use than a greater number of computers located in separate computer labs). Related to this is an increasing amount of attention, given by both teachers and students, to the use of laptops (and in some places, ‘computers-on-wheels’), as well as, to a much lesser extent, the use of personal digital assistants and other mobile devices.

### ■ **Models for successfully integrating ICT use in school and after school hours are still emerging**

There are few successful models for the integration of student computer use at home or in other ‘informal settings’ outside of school facilities with use in school.

### ■ **The appropriate ages for introducing computers to students are hotly debated**

Generally speaking, appropriate ages for student ICT use in general are unclear. However, it is clear that certain uses are more or less appropriate, given student ages and abilities. Emerging research cautions against widespread use at younger ages.

### ■ **ICTs can promote learner autonomy**

Evidence exists that use of ICTs can increase learner autonomy for certain learners.

### ■ **Gender affects impact**

Uses of ICTs in education in many cases to be affected by the gender of the learner.

### ■ **The ‘pilot effect’ can be an important driver for positive impact**

Dedicated ICT-related interventions in education that introduce a new tool for teaching and learning may show improvements merely because the efforts surrounding such interventions lead teachers and students to do ‘more’ (potentially diverting energies and resources from other activities).

## COMMENTS

### *General comments*

- A review of the research on impacts of ICTs on student achievement yields few conclusive statements, pro or contra, about the use of ICTs in education. For every study that cites significant positive impact, another study finds little or no such positive impact.
- Many studies that find positive impacts of ICTs on student learning rely (to an often uncomfortable degree) on self-reporting (which may be open to a variety of positive biases).

### *Applicability to LDC/EFA context*

- Where ICTs are to be utilized to improve educational quality as measured by most standardized tests, few such gains are to be expected.
- With sufficient teacher training, and given the existence of a variety of enabling factors, ICTs can be used to impact the nature and types of learning in which students engage.

Some areas for further investigation and research

- How does exposure to and use of ICTs in school affect future employment?
- What is the impact of ‘computer-literacy’ instruction in schools?
- What is the gender impact of ICTs in education on access, use of, attitudes toward, and learning outcomes?
- How can ICTs be used to present, comment on and discuss student work, and what are the implications of such impact?
- Are some school subjects better suited for ICT integration than others?

## Some Recommended Resources

to learn more ....

- *Assessing the Impact of Technology in Teaching and Learning* [Johnston 2002]
- *Changing the Conversation about Teaching, Learning and Technology: A Report on 10 Years of ACOT Research* [Apple Computer 1995]
- *Comparative International Research on Best Practice and Innovation in Learning* [Holmes 2000]
- *Consultative Workshop for Developing Performance Indicators for ICT in Education* [UNESCO-Bangkok 2002]
- *Developing and Using Indicators of ICT Use in Education* [UNESCO 2003]
- *The Digital Disconnect : The Widening Gap Between Internet-Savvy Students and Their Schools* [Levin 2002]
- *Findings from the Teaching, Learning, and Computing Survey: Is Larry Cuban Right?* [Becker 2000]
- *ICT and attainment: A review of the research literature* [Cox 2003]
- *ImpaCT2: Emerging Findings from the Evaluation of the Impact of Information and Communications Technologies on Pupil Attainment* [Becta 2001]
- *Impact of Educational Technology on Student Achievement—What The Most Current Research Has To Say* [Schachter 1999]
- *The Learning Return on our Educational Technology Investment—A Review of Findings from Research* [WestEd 2002]
- *Literacy Scores, human capital and growth across 14 OECD countries* [Statistics Canada 2004]
- *Monitoring and Evaluation of Research in Learning Innovations—MERLIN* [Barajas 2003]
- *Report on the OECD PISA Student ICT Survey* [Australian Council for Educational Research 2002]
- *The Second Information Technology in Education Study: Module 2 (SITES: M2) Case Reports* [ISTE 2003]
- *Technology and Classroom Practices: An International Study* [Kozma 2003]
- *Technology, Innovation, and Educational Change—A Global Perspective* [Kozma 2003]
- *Using ICT to Develop Literacy and Numeracy: Research Summary* [Institute of Education, University of London 2001]
- *West Virginia Story—Achievement Gains from a Statewide Comprehensive Instructional Technology Program* [Mann 1999]

### About these Briefing Sheets:

*infoDev's* Knowledge Maps on ICTs in education are intended to serve as quick snapshots of what the research literature reveals in a number of key areas. They are not meant to be an exhaustive catalog of everything that is known (or has been debated) about the use of ICTs in education in a particular topic; rather, taken together they are an attempt to summarize and give shape to a very large body of knowledge and to highlight certain issues in a format quickly accessible to busy policymakers. The *infoDev* knowledge mapping exercise is meant to identify key general assertions and gaps in the knowledge base of what is known about the use of ICTs in education, especially as such knowledge may relate to the education-related Millennium Development Goals (MDGs).