



# Integrating ICT in Teaching and Learning in Schools

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## ABSTRACT

Computers and the Internet are increasingly part of the environment in which young adults grow and learn. Schools and education systems therefore need to reap the educational benefits of information and communications technology (ICT). Co-ordinated ICT policies are common at the school, district or national level. They help schools and teachers to keep abreast of the constant flow of technological novelty, and to manage the change and disruption that new tools may introduce. E-learning has grown steadily in recent years as an option for higher education and is expected to expand progressively around the world. Although data and statistics on e-learning are difficult to find, which makes it complex to accurately evaluate the extent to which HEIs have adopted it, almost all the existing evidence indicates a steady growth.

**Keywords:** Information and communication technology, Educational Gaming, Online Laboratories

There are several grounds for developing education policies that aim to embed ICT more deeply into schools and teachers' practices. First, as a tool, ICT devices and the Internet hold the promise of enhancing the (traditional) learning experiences of children and adolescents, and perhaps of acting as a catalyst for wider change, where such change is desired. Second, the widespread presence of ICT in society, used for everyday work and leisure activities, and the increasing number of goods and services whose production relies on ICT, create a demand for digital competencies, which are, arguably, best learned in context. Third, while learning with and about ICT may well take place outside of school, initial education can play a key role in ensuring that everyone can use these technologies and benefit from them, bridging the divide between rich and poor. Finally, school ICT policies may be based on the desire to

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reduce administrative and other costs. Where teacher shortages exist or can be expected, ICT policies may complement other actions taken to attract and retain teachers in the profession. Information and communication technology can support and enhance learning. With access to computers and the Internet, students can search for information and acquire knowledge beyond what is available through teachers and textbooks. ICT also provide students with new ways to practise their skills – such as maintaining a personal webpage or online publication, programming computers, talking and listening to native speakers when learning a second language, and/or preparing a multimedia presentation, whether alone or as part of a remotely connected team. ICT devices bring together traditionally separated education media (books, writing, audio recordings, video recordings, databases, games, etc.), thus extending or integrating the range of time and places where learning can take place.

The widespread presence of ICT in everyday lives also creates a need for specific skills. At the very least, education can raise awareness in children and their families about the risks that they face on line and how to avoid them. As a dynamic and changing technology that requires its users to update their knowledge and skills frequently, ICT also invites the education sector to rethink the content and methods of teaching and learning. users of ICT – as we all are today – often have to adjust to a new device or software or to new functions of their existing devices and applications. As a result, ICT users must learn, and unlearn, at a rapid pace. Only those who can direct this process of learning themselves, solving unfamiliar problems as they arise, will fully reap the benefits of a technology-rich world.

More specifically, education can prepare young people for work in the sectors where new jobs are expected to be created in the coming years. Today, ICT is used across all sectors of the economy, and many of the sectors with high levels of ICT use, such as financial services and health, are also those that have increased their share of employment over the past several decades (OECD, 2013).

Other sectors of the economy that were shielded from international competition, such as retail trade or news dissemination, have been transformed by the rise of the corresponding online services. Whatever their desired jobs are, when today's students leave school or university, they will most likely search and apply for jobs on line. As a consequence, a high level of familiarity with ICT among the workforce can be a competitive advantage for countries in the new service economy. This section investigates how education systems and schools are integrating ICT into students' learning experiences, and examines changes since 2009. It provides an overview of country differences in schools' ICT resources and how these are related to computer use. It shows that the use of ICT clearly depends on the availability of adequate infrastructure – equipping schools with more and better ICT resources – but is also related to the wider context shaped by teacher and curricular policies.

## Teachers and ICT

Teaching practices The teaching practices deployed by teachers can play a significant role in how much students learn. Technology alone will not enhance learning, but using it as part of good teaching practice can open new doors to learners and teachers. It is striking that although technology is prevalent in our daily lives, the majority of teachers in many countries do not frequently use ICT in their practice. In some schools this may be due to the lack of provision, but teachers' professional development and their beliefs about work are key to unlocking technology's potential for teaching and learning. There are several factors associated with increased use of ICT in teaching. For example, teachers should also be encouraged and given the time to collaborate with their colleagues. Teachers who report a positive disciplinary classroom climate are more likely to use ICT in their teaching. This could be because a positive classroom climate is more conducive to the use of ICT. This may be due to the fact that ICT can enable students to pursue knowledge in more independent ways than traditional teaching, in line with the constructivist approach.

### The effects of ICT on students' learning outcomes

Do improvements in learning environments, the availability of ICT in schools and the ICT skills of teachers result in better learning outcomes of students? Have the investments made paid off? A better understanding of how computers affect education outcomes is critical for effective investment in education technology. Across countries and economies, the amount of ICT resources available to students is positively related to students' performance.

Despite the many challenges involved in integrating technology in teaching and learning, digital technology offers great opportunities for education. In many classrooms around the world technology is used to support quality teaching and student engagement, through collaborative workspaces, remote and virtual labs, or through the many ICT tools that help connect learning to authentic, real-life challenges. Teachers who use inquiry-based, project based, problem-based or co-operative pedagogies often find new technology to be a valuable tool and industry is developing a number of technologies, such as learning analytics and serious games, that promise to exploit the rapid feedback loops afforded by computers to support real-time, formative assessments, thus contributing to more personalised learning. What this shows is that the successful integration of technology in education is not so much a matter of choosing the right device, the right amount of time to spend with it, the best software or the right digital textbook. The key elements for success are the teachers, school leaders and other decision makers who have the vision, and the ability, to make the connection between students, computers and learning.

Examples of technology-supported pedagogical models Five noteworthy technology-supported pedagogic models emerged from the research carried out by grantees within the HP Catalyst

Initiative. The five broad models are associated with gaming, virtual laboratories, international collaborative projects, real-time formative assessment and skills-based assessment.

**1. Educational Gaming:** Educational gaming offers a promising model to enhance student learning, not just improving content knowledge, but also motivation and thinking and creativity skills. In educational gaming, students interact with video games, simulations or virtual worlds based on imaginary or real worlds. As a promising model for various disciplines and education levels, educational gaming may promote:

- ❖ *Learning by doing:* The interactive, reactive and often collaborative nature of educational gaming enable students to learn about complex topics by allowing them to (repeatedly) make mistakes and learn from them.
- ❖ *Student learning:* Educational gaming which covers specific topics or subject areas and takes place within a set of rules can increase students' achievements and subject specific knowledge.
- ❖ *Student engagement and motivation:* Being based on play and increasing challenges, educational gaming can foster student engagement and motivation in various subjects and education levels.
- ❖ *Students' thinking skills:* Games have the potential to help students find new ways around challenges, use knowledge in new ways and "think like a professional" (Shaffer, forthcoming). Educational gaming may also improve students' skills such as problem solving

**2. Online laboratories:** Online laboratories, whether remote or virtual, are another promising innovation intended to enhance technology-supported teaching and learning. Virtual online laboratories allow students to simulate scientific experiments while remote ones allow students to use real laboratory equipment from a distance through the Internet.

As promising innovations particularly for science instruction, online laboratories can be expected to offer the following potential benefits:

- ❖ *Lower-cost access:* Online laboratories may help bridge the digital divide by providing students with faster access to experimental learning at a relatively low cost.
- ❖ *Flexible access:* Online laboratories can enable flexible access to practical experiments, allowing increased study time that is not tied to a specific timetable or location.

**3. Collaboration through technology:** Collaboration through technology can enhance students' interaction, engagement, learning and thinking skills, in addition to increasing the flexibility and diversity of their educational experience. Technology-supported collaboration can enhance students' awareness of global challenges and develop their understanding of other cultures.

- ❖ *Better learning*: Online laboratories can help support student understanding and achievement at least as well as physical hands-on learning does. Virtual manipulatives may be used in a blended format together with physical manipulatives of experimentation to further increase student understanding. In technology-enabled collaboration, students work together (in groups) and/or interact with each other to enhance their learning with the help of various technologies. As a promising model for STEM education and other disciplines at various education levels, collaboration through technology may improve:-
- ❖ *Flexibility*: Technology enables students to collaborate and practise at “their own pace”, beyond the formal classroom hours and without limitations of physical location.
- ❖ *Cultural diversity*: Technology can significantly increase the chances for intercultural interactions by broadening the scope of collaborations to distant locations, even across borders.
- ❖ *Student interaction and engagement*: Technology-enabled collaboration can encourage students’ group work skills, interaction and engagement. However, students do not automatically adopt “active learning strategies” and activity may differ across cultures. In general, co-operative learning has shown clearly beneficial results on affective student outcomes.
- ❖ *Students’ thinking skills*: Online collaboration may enhance higher order thinking even more than face-to-face collaboration through “more complex, and more cognitively challenging discussions”.

**4. Real-time formative assessment:** Technology significantly facilitates the use of formative assessment – that is, frequent, interactive assessment of student progress and understanding. Clickers, tablet computers and other kinds of technology enable instantaneous interaction and feedback between teachers and students. In real-time formative assessment, software enables a variety of inputs to be used for student assessment including open format replies, student questions, pictures or mathematical formulas. As a promising educational innovation, real-time formative assessment could enhance:

- ❖ *Targeted instruction*: Real-time formative assessment allows teachers to monitor student learning as it happens and better adjust their teaching to the needs of individual students.
- ❖ *Student learning*: Real-time formative assessment can increase student achievement by promoting students’ reflection about the needs of and engagement in their own learning.
- ❖ *Problem solving and creativity*: Real-time formative assessment provides avenues for assessing different types of activities and variety of student skills such as problem solving or creativity – potentially enhancing the acquisition of these skills.

## CONCLUSION

A thorough look into some of the most promising pedagogic models integrating ICT reveals the huge potential of digital technologies to improve teaching and learning. Educators should consider adopting these innovative technology-supported pedagogic models to improve outcomes, including the development of higher-order thinking skills, and to expand the range of learning opportunities available to students.

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