

Introduction

Despite the fact that education systems have been heavily investing in technology since the early 1980s, international indicators on technology uptake and use in education are missing. For more than 25 years education systems have been able to design and implement policies in this domain without those indicators, so the question is: why start discussing them now? Is the information available not good enough?

Why now?

The existing international indicators still mirror the first policy priorities of the early 1980s: securing student access to computers and the Internet in schools. Indicators such as ratios of students per computer or percentage of schools with broadband access, although still a concern in some countries, do not yet provide the most relevant information for today's policy in the field: how is technology used in schools? Is this use truly supporting the emergence of the learning environment that a knowledge-based society requires?

Certainly, knowledge economies and societies would greatly benefit from a broader set of internationally comparable indicators. These could monitor progress in ICT uptake and unveil important information about use, ranging from issues such as frequency to purpose. If carried out in an international comparable framework they will become an important tool for benchmarking policies and practices across countries and over time.

Our increasingly technology-rich world raises new concerns for education while also expecting schools to become the vanguard of knowledge societies. Firstly, technology can provide the necessary tools for improving the teaching and learning process, opening new opportunities and avenues. In particular, it could enhance the customisation of the educational process, adapting it to the particular needs of the student. Secondly, education has the role of preparing students for adult life, and therefore it must provide students with those skills necessary to join a society where technology-related competencies are becoming increasingly indispensable. The development of these competencies, which are part of the set of the so-called '21st century competencies', is increasingly becoming an integral part of the goals of compulsory education. Finally, in a knowledge economy driven by technology, people who do not master these competencies may suffer from a new form of digital divide that may affect their capacity to fully integrate the knowledge economy and society.

Because of these reasons, most countries have undertaken significant investments to enhance the role of technology in education recently, after some years of less activity immediately after the implosion of the Internet bubble. Many would say that the incorporation of technology in education has lost its status as policy priority number one, although for a number of political reasons investments have not been stopped. In many respects, the principle of 'build it and they will come' seems to have taken root, and education systems keep investing in technology based on the belief that, sooner or later, schools and teachers will adopt it and benefit from it. The question that arises then is whether or not these new investments are paying off; is this investment in technology within education systems managing to fulfil expectations?

New policy concerns, increased need for evidence and indicators

Ironically, what countries have been investing in this field has hardly been the subject of any comparison. Therefore, countries can hardly claim that they are investing significantly in this. But even more important than the amount of effort invested, what really presses for an evidence-based policy debate about technology in education is the emergence of new policy concerns. At least some of them, and the corresponding policy discussions, could benefit from more solid and comparable evidence: the emergence of a second digital divide, the need to promote the broad set of 21st century skills, and the still unfulfilled experience of promoting radical change in the provision of school education.

First, recent evidence has unveiled that the digital divide in education goes beyond the issue of access to technology. A new second form of digital divide has been identified: the one existing between those who have the right competences and skills to benefit from computer use, and those who do not. These competences and skills are closely linked to the economic, cultural and social capital of the student. This has important implications for policy and practice. Governments should make an effort to clearly convey the message that computer use matters in the education of young people and they should do their best to engage teachers and schools in raising the frequency of computer use to a relevant level. Such an increase could not only be a clear indication of teachers' and schools' engagement with the development of 21st century skills and competencies, but it could also report gains in educational performance. In addition, schools should be reminded that they have a crucial role in the development of the cultural capital that will allow students to bridge the emerging second digital divide.

Second, the changing needs of economic and social development require a wide range of new skills and competencies, known as the 21st century competencies. These are considered key enablers of responsible citizenship in a knowledge-based and technology-pervaded economy. For instance, the recommendation of the European Parliament and the Council on key competences for lifelong learning defines a framework of eight competences considered important for the knowledge society. Digital competence is highlighted as one of the eight key

competences. In 2007 the Council identified a framework of 16 core indicators for monitoring progress in the field of education. ICT skills are a core indicator in this framework. Technology is hence expected to play an increasing role in education in the coming years.

Last but not least, there is the pending issue of whether or not today's teaching and learning experience in schools matches what could be expected from a knowledge society. The question is not which technology leads to increased productivity in education, but which new technology-supported methodologies improve student performance over traditional ones, if any at all, and which other factors intervene. Previous calls have already been made in order to investigate the explicit relationships among technology, instructional strategy, psychological processes and contextual factors. The almost infinite array of methodological possibilities makes this kind of investigation extremely difficult, but not impossible, provided that there is sufficient effort devoted to the accumulation and dissemination of the resulting knowledge base. Such a task might appear overwhelming, particularly as the technological frontier is constantly changing. However, it is worth the effort. And policymakers and researchers cannot be in a position to monitor what is truly going on in schools unless critical indicators about intensity, purpose and context of use of technology in education are available.

A truly international effort

Therefore it is relevant to assess and compare how education systems are dealing with technology integration in schools — particularly in terms of securing and improving access, enhancing a wide range of educational and managerial uses, and monitoring the effects and impacts on the development of critical technology-related skills and competencies. Such a comparison is not possible in the absence of appropriate indicators which, at the moment, are missing in the international collections already available.

Both the European Commission and OECD have recognised the need for reliable indicators in the area of technology in education. OECD has raised this issue in the context of the recently published report *Beyond Textbooks. Digital Learning Resources in the Nordic Countries*. It highlights the need for a comprehensive approach to indicators on technology in education and the difficulties associated with their development and data collection. The same need has also emerged during the analysis of the relationship between technology use and educational performance drawing on PISA 2006 data, which will be published by CERI in 2009. The European Commission has initiated several studies intended to summarise existing and available information in the field.

Other international organisations, such as Unesco, the World Bank and the Inter-American Development Bank, share similar needs and are willing to cooperate in this process. An inter-agency seminar carried out in Korea in July 2009 ⁽¹⁾, provided an excellent opportunity to compare priorities and agree on the need to explore further synergies.

⁽¹⁾ see <http://go.worldbank.org/DJTDITWI40>

What this volume adds to the discussion

It is within this context that the present volume has to be understood. The contributions included stem from an international expert meeting which took place in April 2009 when the Centre for Research on Lifelong Learning (CRELL), in cooperation with CERl, organised and hosted an international expert meeting on the issue of benchmarking technology use and effects in education. The workshop specifically aimed at constructing a framework to look at the relevant domains and interdependence between components related to ICT in educational processes from a holistic perspective ^(?).

This book is organised into four different sections. The first one looks into the context of ICT impact assessment in education. This chapter addresses the political context and includes reflections about the assessment needs at an international level. Øystein Johannessen follows a policy perspective. He discusses the challenge of developing benchmarks and the need to incorporate a multi-faceted approach which takes into account the complexity of issues to consider when setting up a knowledge-base on ICT in education. In his article, Ola Erstad maintains the need for a broadened understanding by policymakers of impact and outcomes. Based on experience gained in Norway, he suggests a multilevel approach and tries to identify key indicators of impact for all the different levels addressed.

The second chapter is about the state of the art of ICT impact assessment. A conceptual overview on educational monitors is provided by Willem Pelgrum, who introduces the various dimensions and challenges of ICT assessment and methodologies issues in international comparative monitoring. Michael Trucano then presents conclusions from the World Bank series of 'knowledge maps' about ICT in education. Despite a variety of useful resources, he identifies important gaps and a lack of reliable impact evidence in order to better support the effective integration of ICT in developing countries.

Conceptual frameworks are discussed in Chapter 3 in order to agree on a general common understanding about aspects to take into account when assessing the effects and impact of ICT in education especially for comparative purposes at country level. A conceptual framework should provide an orientation for any kind of measurement required in the decision-making process and act as a reference which is flexible and adaptable to specific purposes of studies to be carried out. It should also provide a holistic view and support the setting of standard orientations when defining the evaluation methodology and selecting appropriate instruments for measurement. The framework developed by Katherina Kikis, Friedrich Scheuermann and Ernesto Villalba for the Joint Research Centre of the European Commission aims to contribute to a systematic approach on how to identify the use of ICT and its effects on all different levels and stages. A similar approach is then presented from Marcelo Cabrol and Eugenio Severin, which is currently being implemented in projects of the Inter-American Development Bank in Latin America and the Caribbean. Finally, Beñat Bilbao and Francesc

^(?) Contributions are published at the CRELL website (<http://crell.jrc.it/workshopimpact.htm>).

Pedró discuss the conceptual approach proposed by the OECD for looking into the impact of digital learning resources and benchmarking the use in school education.

A series of reflective case studies are presented in Chapter 4. One important aspect of ICT impact assessment is to be clear on what is to be assessed at the individual level and to think about appropriate ways of measurements. Technology use and critical thinking and problem-solving approaches ('new literacies') are discussed by Edys S. Quellmalz in the context of assessment design and implementation. She looks at current approaches in assessment and underlines the need to reach consensus about what is to be measured. ICT implementation policies in education in Hong Kong are then analysed by Nancy Law, Yeung Lee and H. K. Yuen in terms of their impact on teaching and learning processes. They also present an interesting research design and concepts of information literacy assessment. Willem Pelgrum then reports about monitoring scenarios and sets of indicators on the use and impact of ICT in primary and secondary education. His work is based on the results of a study carried out in the European Union which can be seen as a further step to implement mechanisms for regular ICT implementation monitoring at a European level. A theoretical framework of various factors affecting ICT use in education is presented by Heeok Heo and Myunghee Kang. This framework had been embedded in a nationwide investigation in Korea. Findings clearly indicate that a better understanding of the real impact can only be achieved if more consideration is given to the use of ICT in informal learning. In addition, results from a comparative analysis in the European countries on ICT in primary education are then described by Roger Blamire. The approach was based on an analytical framework allowing an examination of the impact on three different levels: on learning and learners, on teachers and teaching and on primary school development plans and strategies. Altogether these cases help to better understand the need for comprehensive studies of the complex interactions between various types of ICT implementation and its effects, including other factors to take into account which have not yet been addressed by existing studies.

The aim of this book is to provide a basis for the design of frameworks, the identification of indicators and existing data sources as well as gaps in areas where further research is to be initiated. The contributions clearly demonstrate that there is a need for the development of consensus around widely accepted approaches, indicators and methodologies. In this context more harmonisation of existing survey approaches would be desirable. Therefore, this collection of articles follow the intention of both organisations, the OECD and the European Commission, to foster international cooperation with other relevant international organisations and to serve as a starting point for common reflection on ways to assess how ICT is used in education.

Without such an assessment, it is virtually impossible to make any progress in the direction of understanding better how the actual pedagogies are transformed and which policies, both at national and local levels, are making a difference. Only a truly international comparative effort can provide the necessary evidence. And even if the contributions in this book show a vast diversity of

perspectives, at least they point in the right direction. Even more important than getting the hard evidence is to make significant progress in understanding the worth of technology in education and in how to measure progress. This book has to be seen as a serious attempt to touch base and, as such, has to be taken as the beginning of a journey. The sooner we start walking the better.

Friedrich Scheuermann

Francesc Pedró