

Innovative ICT-supported pedagogical practices: results from the international study of information technology in education

Introduction

This special issue presents a number of secondary analyses of data collected in 2006 in the Second Information Technology in Education Study (SITES 2006) that was conducted under the auspices of the International Association for the Evaluation of Educational Achievement (IEA).

IEA conducted from 1998 to 2006 SITES composed of three studies on the integration of information communication technology (ICT) in education. Table 1 presents an overview of the three SITES studies as summarized by Anderson and Plomp (2009).

The SITES studies are a follow-up of IEA's Computers in Education (CompEd) study. CompEd had a focus on surveying the extent to which ICT was available in schools and what problems were experienced by schools and teachers. Data collection took place in 1989 (Pelgrum & Plomp 1993) and in 1992 (Pelgrum *et al.* 1993). In addition to the focus of CompEd, the purpose of SITES also was to study to what extent and how education is responding to demands of the information society versus those of the industrial society (see also Anderson 2008; Voogt 2010). Several terms have been used in the three SITES studies to distinguish between educational practices that are associated with the information society and the industrial society, respectively. An overview of the terminology used in the different SITES studies is presented in Table 2.

SITES-Module 1 (or SITES-M1) collected data in 1998 in 26 participating countries in one or more of three school levels: primary, lower secondary and upper secondary. As reported in Pelgrum and Anderson (1999), this module produced findings about the extent to which ICT is used in education and whether education systems have implemented objectives and pedagogical approaches that are considered important for education in an information society. The findings of

SITES-M1 showed that educational systems differed a lot in this respect but that in a few educational systems, more than half of the schools had begun to use ICT to change towards a more student-centred pedagogical approach with the aim of making students more active in and responsible for their own learning. In SITES-M1, principals were asked to give an example of '*the most satisfying experience of a learning activity in their school in which students use computer-related technology which gives them the most useful, effective and advanced learning experiences with technology*'. Voogt (1999) analysed these experiences and concluded that students' activities with ICT focused on information processing, production or communication in combination with word processing, technology for searching for information and technology for facilitating communication (p. 220). She concluded that many of these 'most satisfying experiences' with technology were aimed at offering active/productive learning activities to students, in which ICT played a substantial role.

In the SITES-M2 study, conducted from 2000 to 2003, the so-called 'innovative pedagogical practices supported by ICT' were examined by conducting comparative case studies in 28 countries (Kozma 2003). In total, 174 cases provided researchers and practitioners with good examples of how technology can change classroom teaching and provided policy-makers with guidelines on how to increase the positive impact of technology in their education systems. An important finding was that the students involved in these innovative pedagogical practices often were engaged in constructing knowledge products, including tasks of searching, organizing and evaluating knowledge. These tasks refer to skills that are often referred to as 'lifelong learning skills' or '21st century skills'. The learning activities reflected pedagogical approaches that are considered important in the information or knowledge society (Voogt & Pelgrum 2005). The findings of SITES-M2 also provided a better insight regarding the

Table 1. The three modules of Second Information Technology in Education Study (SITES) (adapted from Anderson & Plomp 2009).

Module	Time frame	Number of countries	Issue	Data
SITES-M1	1997–1999	26	What are the main trends in the use of ICT in education?	Surveys of principals and of technology coordinators
SITES-M2	1999–2003	28	What innovative teaching uses are made of technology and what does it take?	In-depth case studies of innovative teaching in schools
SITES 2006	2004–2008	22 education systems from 20 countries	What pedagogical practices do teachers apply and how is ICT used in these? Are schools ready to support this?	Surveys of schools (principals and technology coordinators) and (mathematics and science) teachers.

Table 2. Overview of terminology used in the different Second Information Technology in Education Study (SITES) studies to associate educational practices with the industrial society and the information society.

Study	Terminology used for education associated with the industrial society	Terminology used for education associated with the information society
SITES Module 1	Traditionally important paradigm	Emergent paradigm
SITES Module 2	–	Innovative pedagogical practices using technology
SITES 2006	Traditionally important practice orientation	Innovative practice orientation comprising: lifelong learning orientation + connectedness orientation

contextual factors that are critical for successful implementation and sustainability of these exemplary teaching practices using ICT.

The last study in this series is the SITES 2006 study that built on the findings of the previous two SITES modules. As a number of secondary analyses of SITES 2006 data are being reported in this special issue, the aims of this study as well as key aspects of the research design are summarized here.

SITES 2006

SITES 2006 has been an international comparative survey aimed at examining the extent of ICT integration in classroom practices and identifying factors that contribute most to effective integration of ICT into learning and teaching. Various sources [e.g. policy papers; findings from SITES-module 2 (Kozma 2003); recent national surveys and other research outcomes] were used to elaborate these questions into a conceptual framework (see Fig 1). Indicators for each of the concepts in the framework were developed and questionnaires for school principals, ICT coordinators and math

and science teachers were designed. Schools and grade 8 math and science teachers from 22 educational systems participated in SITES 2006. Per educational system, 400 schools and four teachers per school participated. The main international findings have been reported in Law *et al.* (2008).

Pedagogical practices in math and science classrooms, and the way these practices were supported by ICT, were important foci in the SITES 2006 study. In addition, SITES 2006 tried to understand which conditions at student, teacher, school and system level influenced (ICT-supported) pedagogical practices.

In the study, a distinction has been made between pedagogical practices that are *traditionally important* and, on the other hand, emerging practices. Traditionally important practices are those pedagogical practices that complied with requirements of the industrial society. Emerging practices were divided into *lifelong learning orientation* and *connectedness orientation* (see also Table 2). In this special issue, we label the latter two as *innovative pedagogical practices*. These innovative pedagogical practices try to respond to challenges of the information society and aim at student

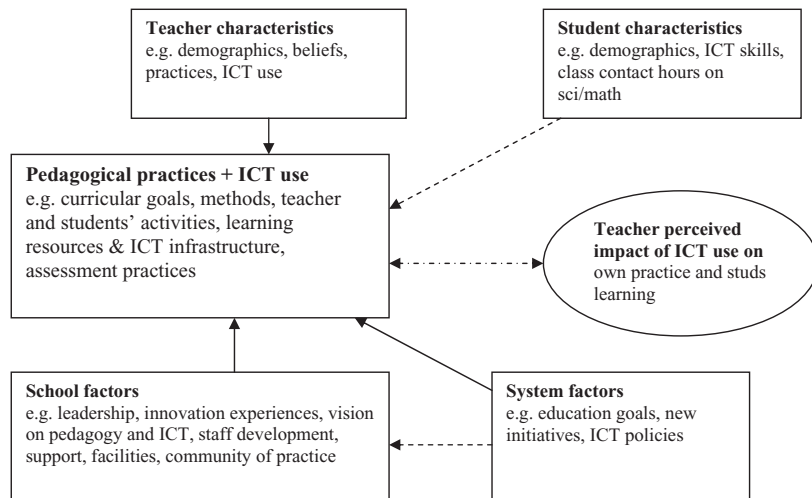


Fig 1 Conceptual framework used in the SITES 2006 study.

outcomes that are considered relevant in the 21st century, such as communication and information handling skills (Kozma 2003; Anderson 2008).

Although the traditional pedagogical orientation is being found in all classrooms, the variation between educational systems in the appearance of the innovative pedagogical orientation as well as in the support for integrating ICT in classroom practice is much wider. For example, where the interest in and use of innovative pedagogical practices dropped in Scandinavian countries from 1998 to 2006, the reverse took place in Asian countries such as Hong Kong Special Administrative Region and Singapore. This type of observation leads to analysis questions such as ‘how can the variation in applying innovative pedagogical practices be characterized’, ‘how can the variation in ICT support for these pedagogical practices be characterized (do we find similar things as in the special cases of SITES-M2)’, etc.

This special issue

The leading research question for the special issue is: ‘How innovative are ICT-supported pedagogical practices and what factors are influencing them?’ Voogt takes in her paper a cross-national perspective to address the leading research question. Two contributions to this special issue address an aspect of the question by analysing the data of a selected number of educational systems participating in SITES 2006, viz. Law, Lee and Chan (Hong Kong), and Ottestad (Norway). Two contributions analysed factors that are conditional for ICT-supported pedagogical practices

but not necessarily innovative ICT-based pedagogical practices. Mioduser, Nachmias and Forkosh-Baruch (Israel) analysed ICT uptake and practice by comparing two sub-populations within the Israeli school system from the perspective of digital inequality. The paper of Howie (South Africa) analysed the different uptake of ICT in education in policies and practices of two developing countries.

Joke Voogt explored differences between extensive and non-extensive ICT-using science teachers with respect to pedagogical orientation, ICT competencies and professional engagement. Her findings show that the pedagogical of both groups of teachers has traditionally important as well as lifelong learning components. However, those science teachers who use ICT extensively pursue curriculum goals and practices that are oriented towards lifelong learning much more than their colleagues who do not use ICT so extensively. In addition, extensive ICT-using science teachers are more confident about their ICT competencies and are more professionally engaged, two factors that were also found in other studies to positively relate to a lifelong learning orientation towards teaching and learning.

The SITES 2006 results reveal that principals’ perceived presence of lifelong learning related pedagogical activities in their schools had changed markedly since the same data were collected in 1998 in SITES-M1. Nancy Law, Man Wai Lee and Albert Chan tried to understand the fact that the directions of the changes were quite different depending on the education systems concerned – many of the Asian countries reported very high increases in lifelong learning related

practices while some of the European countries reported large drops over the same eight-year period.

Geir Ottestad (Norway) analysed innovative pedagogical practices with ICT in Denmark, Finland and Norway. Ottestad tried to understand whether and how differences in policy and investment programmes to promote digital literacy and readiness for the information age are reflected in the pedagogical goals and practices of teachers in the three countries.

David Mioduser, Rafi Nachmias and Alona Forkosh-Baruch compared ICT-based pedagogical practices in Hebrew- and Arabic-speaking schools. They found that vision and goals, higher positive attitudes on ICT importance in general and as a lever for paradigmatic change in particular were found more frequent in Arabic-speaking schools than in Hebrew-speaking schools despite the less favourable ICT infrastructure. With regard to pedagogical practice, Arabic-speaking mathematics teachers indicated greater ICT usage, while among science teachers, Hebrew-speaking teachers reported greater usage and vast influence on their pedagogy, portraying innovative usage.

Sarah Howie compared ICT-supported pedagogical policies and practices in two developing countries: South Africa and Chile. She found that the two countries differ a lot with regard to the policy development, organization, strategies adopted, resources used and most importantly, their approach to teacher development for implementing ICT.

J. Voogt & T. Plomp

Department of Curriculum Design and Educational Innovation, University of Twente, Enschede, The Netherlands

References

- Anderson R. (2008) Implications of the information and knowledge society for education. In *International Handbook of Information Technology in Primary and Secondary Education* (eds J. Voogt & G. Knezek), pp. 5–22. Springer, New York.
- Anderson R. & Plomp T. (2009) Introduction. In *Cross-National Information and Communication Technology. Policies and Practices in Education* (eds T. Plomp, R.E. Anderson, N. Law & A. Quale), pp. 3–17. Information Age Publishing, Charlotte, NC.
- Kozma R.B., ed. (2003) *Technology, Innovation and Educational Change: A Global Perspective*. ISTE, Eugene, OR.
- Law N., Pelgrum W.J. & Plomp T. (2008) *Pedagogy and ICT Use in Schools around the World. Findings from the IEA SITES 2006 Study*. CERC studies in comparative education. Comparative Education Research Centre, The University of Hong Kong, Hong Kong and Springer, Dordrecht.
- Pelgrum W.J. & Anderson R.A., eds (1999) *ICT and the Emerging Paradigm for Lifelong Learning: A Worldwide Educational Assessment of Infrastructure, Goals and Practices*. International Association for the Evaluation of Educational Achievement, Amsterdam.
- Pelgrum W.J., Janssen Reinen I.A.M. & Plomp T. (1993) *Schools, Teachers, Students and Computers: A Cross-National Perspective*. IEA, The Hague.
- Pelgrum W.J. & Plomp T. (1993) *The IEA Study of Computers in Education: Implementation of an Innovation in 21 Education Systems*. Pergamon Press, Oxford.
- Voogt J. (1999) Most satisfying experiences with ICT. In *ICT and the Emerging Paradigm for Life Long Learning: A Worldwide Educational Assessment of Infrastructure, Goals and Practices* (eds W.J. Pelgrum & R.E. Anderson), pp. 199–216. IEA, Amsterdam.
- Voogt J. (2010) To prepare students for the knowledge society: characteristics of technology-supported pedagogical practices in lower secondary education. In *Bildung und Schule auf dem Weg in die Wissensgesellschaft* (ed. B. Eickelmann), pp. 231–246. Waxmann Publ. Co. Münster, New York, Münster, New York.
- Voogt J. & Pelgrum H. (2005) ICT and curriculum change. *Human Technology* 1, 157–175.
- Anderson R. (2008) Implications of the information and knowledge society for education. In *International*