INTERNATIONAL SUMMIT ON ICT IN EDUCATION

EDUSUMMIT
2011

**Building a Global Community of
Policy-makers, Researchers and Teachers
to Move Education Systems into the Digital Age**

Summary Report

Report Editors

**Paul Resta
Michael Searson
Mariana Patru
Gerald Knezek
Joke Voogt**

Building a Global Community of Policy-makers, Researchers and Teachers to Move Education Systems into the Digital Age

Summary Report of EDUsummit 2011 and Call to Action

EDUsummIT 2011 was held June 8-11 at the UNESCO Headquarters in Paris. This invitational summit brought together an international group of 120 researchers, policy-makers, teachers, journal editors, private sector leaders, and winners of the UNESCO King Hamad Bin Isa Al-Khalifa Prize for the Use of ICTs in Education. They came to discuss critical issues in the use of Information and communication technologies (ICT) to improve education. The theme of the summit was "Building a Global Community of Policy-makers, Researchers, and Teachers to Move Education Systems into the Digital Age" and its goals were to

- Report on the impact of the strategies described in the International Handbook of Information Technology in Primary and Secondary Education, as well as the impact of UNESCO's programmes and initiatives in ICT in education
- Refine the national, international, and regional models for the use of ICT in 21st century education
- Apply the lessons learned to address the future UNESCO ICT Competency Framework for Teachers version 2.0
- Develop strategies to build a global community of researchers, policy-makers, and teachers in the field of ICT in Education
- Develop recommendations for policy, practice, and research that will help educational systems move into the digital age.

The summit goals were closely aligned with UNESCO's goals to "expand the knowledge base on the use of ICT for more equitable and pluralistic development in education,"[1,2] and focused discussion on the following questions:

- How can ICT accelerate progress toward the goals of "education for all" and "education throughout life?"
- How can ICT increase both equity and excellence in education?
- How can ICT help reconcile local specificity with universality of knowledge?
- How can education prepare individuals and society to benefit from ICT, which increasingly permeate all aspects of life?[3]

EDUsummIT 2011's distinguished participants worked to address these questions, define current problems, and make recommendations that will help schools around the world move into the digital age of the 21st century. The summit included both interactive plenary sessions and breakout sessions, in which eight working groups addressed various dimensions and issues related to moving educational systems into

the digital age. The following is a summary of the discussions and recommendations for policy, practice, and research identified by the working groups during the summit.

The first EDUsummIT was held in 2009 at The Hague in The Netherlands, when 70 researchers, policy-makers, and educators from six continents met to establish a clear view of the role of ICT in 21st century learning, and to examine the implications of ICT's emerging role in both formal and informal learning. The first EDUsummIT issued a Call to Action on the Future of ICT in Education (see www.edusummit.nl). Since then, the EDUsummIT participants have committed themselves to examining the impact of dissemination strategies on future ICT policies and practices in countries around the world. This work led to the convening of EDUsummIT 2011.

Global Context

Exponential changes in technology and knowledge are transforming the economies, politics, and cultures of societies around the world. National economies have become more internationalised, with increasing flows of information, technology, products, capital, and people between countries. In industrialised nations, the economic base is shifting from industrial to knowledge production, resulting in a growing demand for advanced skills, digital literacy, and higher levels of education. Information and communication technologies are also changing the nature of work and the types of skills needed in most fields and professions. A wide array of jobs have been created that did not exist ten years ago, while the need for many types of low skilled workers has been reduced.

There has been exponential growth in the amount of digital information created and replicated in the world. In 2011, the amount of this new digital information surpassed 1.8 zettabytes (1.8 trillion gigabytes)—growing by a factor of 9 in just five years. A record was set in 2009, with information growing 62% to nearly 800,000 petabytes.[4] To envision the amount of information this represents, think of a stack of DVDs reaching from the earth to the moon and back. It is estimated that by 2020, the Digital Universe will be 44 times as large as it was in 2009.
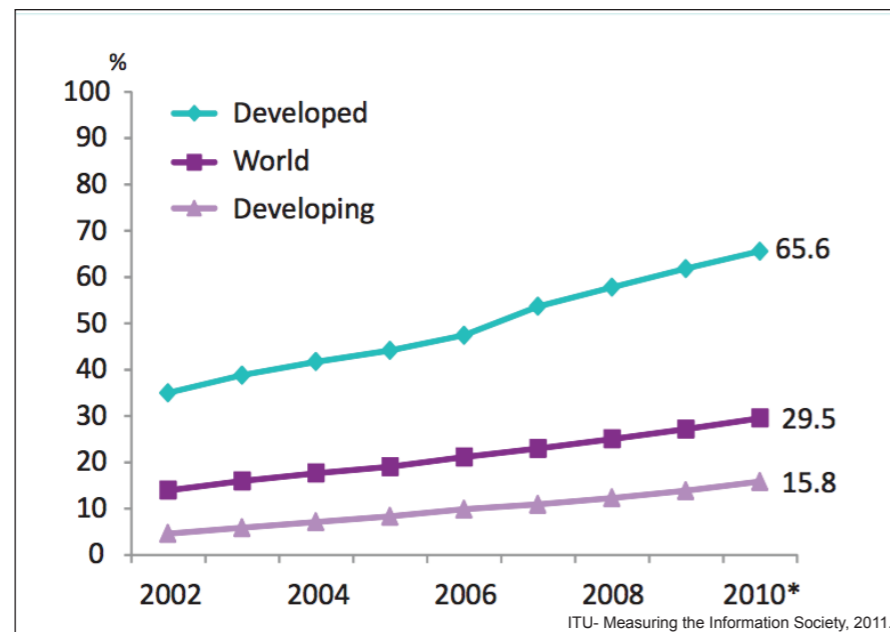

ITU- Measuring the Information Society, 2011.

Figure 1. Households with Internet access, 2000-2010, world and by level of development.

Access to the Internet and mobile phone use have both increased greatly over the last ten years. As shown in Figure 1, the developed world has 65 Internet users per 100 inhabitants, while developing areas have 16 Internet users per 100 inhabitants.

Mobile phone use in developing countries has in particular grown exponentially. As shown in Figure 2, in the past ten years access to mobile phones in developing countries has grown from virtually none to a current level of over 70 mobile subscriptions per 100 inhabitants.
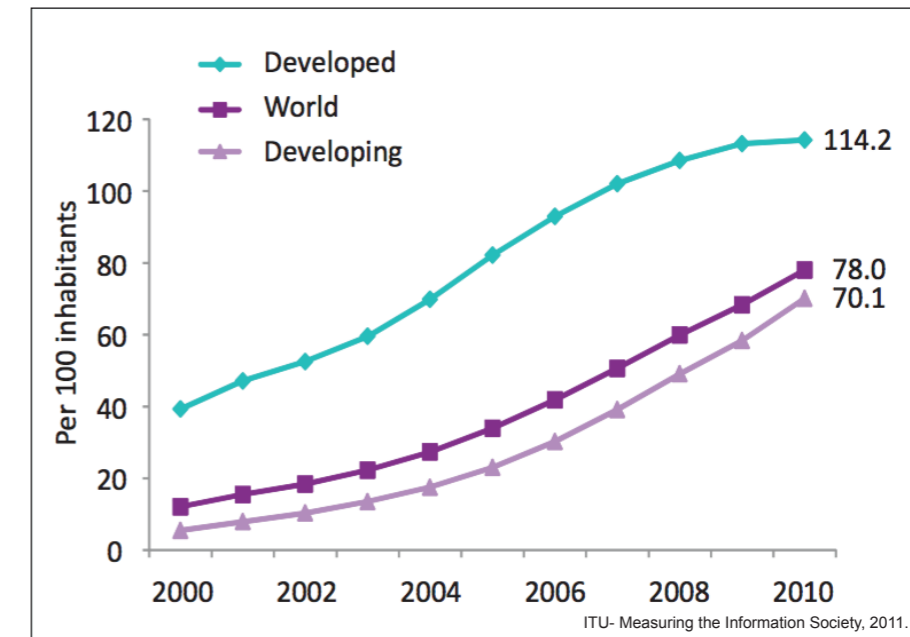

ITU- Measuring the Information Society, 2011.

Figure 2. Mobile-cellular subscriptions, 2000-2010, world and by level of development.

However, these figures spotlight the major differences in access to media and digital information between developing and developed countries. There is a dramatic divide even with access to radio and television, which are traditional and well-established means of communication, information dissemination, and provision of learning opportunities.[5] For example, in several countries in both sub-Saharan Africa and the Asia-Pacific region, less than half of households are equipped with radio and fewer than 25% have access to television. In these same countries, less than 10% of the population have access to a computer.[6]

These technological changes have also created major challenges for the world's education systems. It is increasingly clear that people must be digitally literate if they are to participate in a technology and knowledge-based global society, so there is a critical need for basic skills and digital literacy in a large portion of the world's population. According to the most recent UNESCO Institute for Statistics data, 20% of all adults, some 793 million people, were not literate as of 2009 (UIS, Adult and Youth Literacy, 2011). Of these, 64% were women. There are 75 million children who do not attend school and therefore are not on the path to becoming literate. Digital literacy includes the confident use of ICT for work, learning, communication, and leisure and is considered one of the eight essential skills for lifelong learning.[7]

This need for basic skills and digital literacy will further intensify the growing demand for teachers. A critical teacher shortage faces developing and developed nations

alike. By 2015, as many as 112 expanding countries will each need at least 2 million more teachers in classrooms than in 2009 to provide quality primary education for all. More than half of this number will be needed in sub-Saharan Africa alone.[8] The shortage of teachers has contributed to high pupil-teacher ratios. In the least developed countries, the ratio is three times higher than in developed countries, and class sizes of 100 pupils are not unusual.

Although technology and knowledge have transformed all aspects of society, the educational paradigm has changed little in the last 100 years and is slow to respond to the rapid changes in global society. Many countries have begun efforts to reform their educational systems and to address disparities in access to ICT and the learning opportunities they afford. However, a shared knowledge base of exemplary change models, policy structures, and best practices in the use of technology to create 21st century learning environments is lacking.

These issues are particularly acute for indigenous peoples. EDUsummIT and UNESCO should work with indigenous peoples to identify ways in which ICT can be restructured to serve indigenous peoples and build their capacity for self-determination. Models for educational technology advocacy and best practices should be designed specifically for educational settings in developing nations.

Need for 21st Century Skills

The globalisation and internationalisation of economies, along with the rapid development of ICT, are continuously transforming the ways people live, work, and learn. While the need for routine production workers has decreased, the need for service and knowledge workers has grown, as has the need for creative and innovative workers. Advances in ICT have created many new kinds of jobs, and young people must be educated for careers that do not yet exist. These developments require drastic changes in what must be learned and how.

The technology and knowledge-based global economy requires new skills of those entering the work force. These skills are often called '21st century skills,' although the term has varying connotations in different countries and its chronological nature makes it somewhat static. '21st century skills' can be thought of as the knowledge, skills, attitudes, and values learners need to participate fully in contemporary society. An analysis of various frameworks for 21st century skills shows broad consensus on what skills are most often included: collaboration, communication, digital literacy, citizenship, problem solving, critical thinking, creativity, and productivity. Some skills, such as problem solving and critical thinking, have evolved from the 20th century and have been studied for some time, while others, such as creativity and digital literacy, are new and unfamiliar.

An important change has occurred in the way new digital tools and collaborative environments have enhanced learning, moving from an emphasis on reproducing information to content creation and sharing in virtual environments. Some describe this as a 'remixing culture.' In Nordic European countries, the concept of 'digital building', or what it means to be digitally literate in contemporary culture, is emphasized.

Digital literacy is a broad concept that has several aspects:

- Technological literacy: to be aware of the interplay between technology and so-

ciety and to understand the technological principles needed to develop relevant solutions and achieve goals;
- ICT literacy: the skills needed to make effective and efficient use of ICT;
- Information literacy: the capacity to access information efficiently and effectively, to evaluate information critically, and to use information accurately and creatively.

The New Learner

Many youth around the world are confronted with a dichotomous set of realities when it comes to their learning. In formal school settings, they are often expected to comply with performance objectives set by standardized tests, designed to measure objectives contextualized by local, state, or national agencies. Out of school, their learning is often governed by interest-based informal learning, which is highly flexible and often social. Increasingly, informal learning is connected to the ubiquitous availability of smart phones or other mobile devices that serve as personalized learning spaces[9]. Commonly, communication through these devices is highly collaborative and social. Participants at the EDUsummIT 2011 took the position that informal learning should have a greater role in classroom practice.

A wider school ecology that breaks down barriers between learning in school and learning outside of school would incorporate students' organic and viral informal learning practices into the formal schooling environment. Such a transformation for most schools would challenge the premise of the locus of knowledge and learning, moving it from the teacher at the front of the room to the student armed with a smart device with access to abundant information resources and collaborating with peers around the world.

Such a redesign of schooling could begin to address the large dropout rates that face many school systems by more effectively engaging students in their own learning. Educators should endeavour to create learning environments that embrace today's digital learners' life-styles, improve their access to educational content, and make the learning process more creative, collaborative, and challenging. They should leverage key features of informal learning, such as peer collaboration, ready access to information, and rich out-of-school experiences.

This redesign of schooling presents a huge challenge for education. Teachers will be required to shift their pedagogical beliefs and practices, from requiring students to reproduce knowledge, to encouraging students to create knowledge, often with the use of technology. To prepare classroom teachers for such an environment will require teacher education programs to model effective informal learning supported by rich technology-based practices. In other words, schools of education must also be prepared for a dramatic shift in their practices.

Therefore, new policies should be implemented to bridge the gap between formal and informal approaches, building a solid foundation that can support community based learning environments, with students as active agents of their own learning. New pedagogies should employ emergent technologies to support this hybrid blend of formal and informal learning. Teachers should be provided the appropriate professional development to integrate these new pedagogies and technologies and their efforts should be valued and recognized.

21st Century Learning: Curriculum and Assessment

The implementation of 21st century skills requires a restructuring of the curriculum. It is not only a matter of trading 20th century content and goals for those of the 21st century, but also of defining what should be considered core content in the 21st century curriculum and considering the implications of a 21st century curriculum for the current school system. Based on their analysis of frameworks describing 21st century competencies, Mishra and Kereluik identified three key areas that should be addressed in a 21st century curriculum[10]:

- Foundational knowledge (or what do we need to know). This includes core content knowledge of the disciplines, information literacy (also sometimes called digital literacy) and cross-disciplinary knowledge or synthetic knowledge.
- Meta knowledge (or how do we act on this knowledge). Included in this were processes such as Problem solving, Critical Thinking, Communication, Collaboration, Creativity and Innovation
- Humanistic Knowledge (what do we value): This form of knowledge offers a vision of the learner's self and its location in a broader social and global context. These include knowledge of life/job skills, cultural and global competence, and ethical and emotional awareness.

The implementation of 21st century skills also requires drastic changes to the traditional classroom, in which the teacher lectures in front of the classroom and students take notes or do worksheets. A 21st century learning environment must be created, in which students are actively engaged in "constructivist activities," such as collaborating, working on projects, searching for information, designing products, and publishing or presenting their work.

ICT should be used comprehensively to enhance student learning and the mastery of 21st century skills. ICT applications such as Web 2.0 tools, multi user virtual environments, and augmented reality can contribute to the development of 21st century skills.

> The Second Information Technology in Education Study (SITES) revealed that, when findings from 1998 are compared with findings from 2006 and across countries, the perceived presence of 21st century learning in schools, according to their principals, had increased.[11] However, a closer inspection showed that school principals in a number of Asian countries, such as Hong Kong, Japan, Taiwan, Thailand, and Singapore, reported an increase in 21st century learning in their schools, while principals in some European countries, such as Denmark and Norway, reported a decrease. The importance addressed to 21st century skills is confirmed by the development of new courses in several Asian countries including the Integrated Practice Activity in China and life-wide learning in Hong Kong. However, although school principals and teachers support the importance of 21st century skills, this support is not always reflected in teacher and student practices.[12]

To align 21st century curricula and learning environments, assessment models must be revised. Education stakeholders should articulate and support a shift in assessment from the dominant high stakes, test-based evaluation model used in many school systems, to one that more effectively measures the preparedness of today's digital age learners. To effectively revise assessment models, three major questions should be considered: "What is the nature of assessment?" "How can technological advances impact assessment?" and, "Exactly what should be assessed?"

When addressing the "nature of assessment," Summit participants noted that, while educators seem to recognize the distinction between summative and formative assessment, a disproportionate emphasis is placed on the summative evaluation of learning in most school systems. This often undermines the role of formative assessment in the learning continuum. A key feature of formative assessment is that learners and teachers use information obtained from assessment to understand learning needs and to adapt teaching and learning to meet those needs. The term "assessment *for* learning" (formative assessment) is often used to distinguish these practices from "assessment *of* learning" (summative assessment).

New technologies can support both formative and summative assessment and are increasing the range of possibilities for assessments. Today, students can be assessed through simulations, e-portfolios, or interactive games. Formative assessment can be enabled by online peer assessment systems, adaptive feedback from computers, self-assessment, and "semi-automatic systems" that combine teacher, peer, and automatic feedback.

Technology also makes it possible for many types of assessments to be marked automatically, which can provide large cost savings. However, some assessments present significant technological challenges for automatic marking, including hand-drawn diagrams, collaborative problem solving activities, and advanced essay answers. Therefore, it may be a challenge to ensure that the focus of assessment remains on designing valid instruments that assess important knowledge and skills, rather than on potential time and cost-savings.

Finally, there is the issue of "what to assess?" Developments in assessment systems should focus on finding ways to assess higher order and more complex 21st century skills. A further challenge stems from current high-stakes assessments at the school level focused predominantly on assessing individuals. The importance of assessment of collaborative work is sometimes recognized, but rarely addressed. In addition, assessments of teaching skills, such as observation, judgment, test making, and scoring, which could contribute significant information for the assessment of 21st century skills, have decreased because concerns about reliability and costs have outweighed those of validity, trustworthiness, and value to the learner.

Restructuring Educational Systems to Move into the Digital Age

Creating new curriculum and assessment practices poses new challenges to educational systems. In restructuring educational systems it is important to recognize that "the right drivers—capacity building, group work, instruction, and systemic solutions—are effective because they work directly on changing the culture of school systems (values, norms, skills, practices, relationships); by contrast the wrong drivers alter structure, procedures, and other formal attributes of the system without reaching the internal substance of reform—and that is why they fail."[13]

The required organisational development depends on distributed leadership within and across schooling systems and on the communities that support them.[14,15]. The principal or chief executive must be involved in the implementation process along with others who lead in formal or informal ways and embody the adoption of ICT. Other

factors that support sustainable ICT implementation[16] include:

- Leaders who in promote the use of ICT must have a sound understanding of the potentials of ICT to enhance learning.
- Support of teacher collaboration in the implementation of new ICT developments. Cooperation must be supported on all levels, such as the context, input, and process levels, to become operational.[17]
- Close linkage of ICT use to existing and prospective pedagogical aims, such as language support for student migrants to enhance curricula.
- Strategies to cope with new digital trends, such as staff development programs, private-public partnerships, increased technical support staff, and students as ICT mentors.

The radical restructuring of schools and schooling gives rise to strong debates that revisit past issues in new ways. For example, while Derndorfer (2010)[18] describes activities that appear to show early visions of greater equity coming to fruition with the OLPC project, others critically compare OLPC's "technocentric vision to similar attempts to solve complex social problems with overly simplistic solutions." OLPC and other such initiatives underscore the need for changes in teacher education, professional development, and education leadership to prepare for change as dramatic as one laptop per child. There is also concern that the risks of such radical restructuring to nations, regions, and individuals include loss of face when challenges become public, and this may reduce reliability of reports from such investments.

The evolution of virtual schools in the USA and other regions has also resulted in polarized views, with some considering them a "supermarket" of low quality courses while others hail them as a means to increase access to a first class education for students in rural locations. The opening up of public education to profit making enterprises and changes in participation also are bringing new challenges to governance and strategic leadership of the school sector, for which many educational leaders are not well prepared[19]. Many school leaders have little knowledge of ICT-enabled 21st century learning[20]. Research and development of the preparation of leaders for ICT-enabled learning is scarce[21]. Even recent guidance for building capacity for ICT in teacher education[22] often omits the importance of leadership of networked organisations.

Synchronising systemic changes prompted by adoption of ICT requires coherent leadership at many levels. ICT is often missing within quality assurance and its integration into standards and procedures by relevant agencies has lagged,[23] which may also be linked to the lack of 21st century knowledge by senior staff. This applies to both schools and teacher education.[24] Group assessment and electronic portfolios are examples of innovations that will pose challenges for nationwide assessment systems.

Although change is always complex in highly interdependent educational systems with multiple stakeholders and interdependent systems, new educational organizations and networked structures are emerging in some countries, including virtual schools, the blending of formal and informal learning, and inquiry based learning. Similar efforts to restructure educational systems should consider:

- Governance and leadership development to enhance quality assurance, with partnerships between public and profit-making enterprises involved in education
- Improving equity and cultural diversity while restructuring schooling with ICT

- Finding new models for organizational development of networked schools that acknowledge the necessary distributed leadership and support

While some networked structures involving multiple schools and other partners are emerging to improve cultural diversity and educational opportunities, there is a lack of research into what types of leadership and governance are needed. It is clear that some emerging approaches are not informed by the research into how people learn, such as the "supermarket" of online courses/resources marketed by for-profit organizations.

Strategic planning is needed to address these considerations at the local, regional, and global level. For these efforts to succeed, quality assurance must be incorporated into the redesign of educational organizations, with governance to ensure an equitable multilingual and multicultural communication infrastructure within and across networked educational organizations, including schools, teacher education, professional development, and agencies responsible for quality assurance.

ICT can be an indicator for quality assurance for teaching, school leadership, and in-service professional development. ICT and its use to support learning must become part of quality tableaux, which necessitates professional development for those involved in policy-making and inspection of schools.

Although school systems change slowly, it is important to steer this change by gathering empirical data and using multidisciplinary research from diverse cultures to overcome inequality and digital gaps. Furthermore, visions of how schools could evolve to address future needs and challenges will be important in guiding the restructuring efforts.

Teacher Professional Development

Although there are an increasing number of initiatives by educational systems to provide students with access to digital devices and connectivity to the Internet, research has shown that, without adequate teacher professional development and support, these efforts will not achieve the intended results. To successfully move education into the 21st century, a new approach to teacher professional development should be adopted. Teachers should be given the opportunity to develop 21st century skills
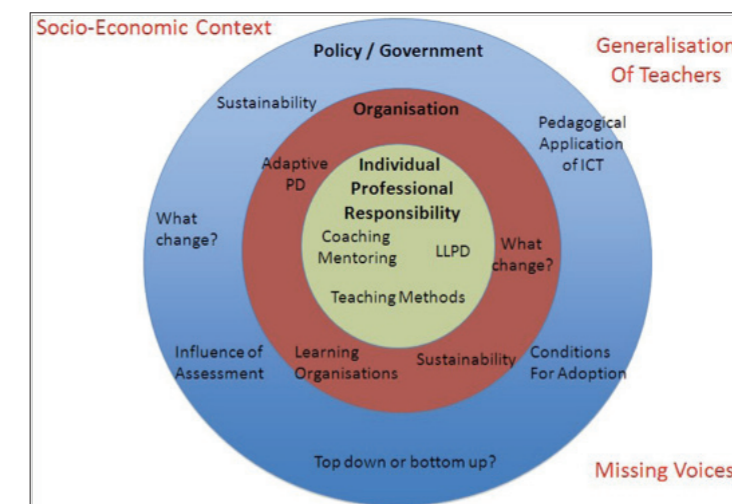

Figure 3. Teacher professional development in context.

themselves and to experience how these skills can be brought into the classrooms. New approaches are also needed for school leadership programs, focusing on the way schools can develop into learning organizations that support the learning of 21st century skills.

One of UNESCO's main goals is to help member states understand the ICT competencies needed by teachers, but UNESCO also provides guidance for pre-service professional development. This is critical because education students must learn not only how to use ICT effectively within the current system to support and extend practice, but also learn to use ICT in ways that can transform practice.[25]

There is consensus in the literature on many of the features of effective continuing professional development (CPD). Twining[26] concluded that effective CPD should address "socio-economic context, effective models of pedagogy, and missing voices that may not have access to educational leaders." As shown in the figure, next page, teacher development takes places within a larger context that involves many players, factors, and forces. This context must be considered when planning and implementing the continuum of professional development, from pre-service preparation through the continual updating of teachers knowledge and skills.

While educational stakeholders often call for improved teacher professional development and usually provide fiscal support, barriers to effective training can thwart sustained change in teacher practice. These barriers often centre on the lack of a unified vision that can drive these initiatives forward in the same direction.

Accelerating changes in technology and knowledge require not only changes to the ways teachers are prepared, but also to the ways that teachers update their knowledge and skills. Teacher professional development should be seen as a continuum, from pre-service to in-service, and lifelong development. The emergence of mobile devices with ubiquitous network access has spurred interest in mobile and informal learning as alternatives to traditional formal training. Recent research points to the importance of informal elements, such as collegiality, for encouraging reciprocal learning between beginning and experienced teachers.

There was also agreement that ICT can change the very nature of pedagogy and subject disciplines. Specialist subject teachers must understand how their disciplines have changed. The Technological Pedagogical Content Knowledge framework (TPACK) is one way of analyzing the knowledge required for teaching that explicitly recognizes the importance of the intersection of knowledge of discipline content and knowledge of technology application. A number of countries have adopted this framework to enhance graduating teachers' capacity for working with ICT.

Essential Conditions and Barriers to Them

One of the most important aspects of 21st century learning environments is the use of ICT as educational tools. Other essential conditions should be in place to ensure that ICT investments have the expected educational benefit. The development and dissemination of a list of these essential conditions is a critical first step in moving toward ideal learning environments. It is also important to understand the barriers that might preclude the essential conditions for ICT use in education.

Although the identification of "essential conditions" can be somewhat contextualized, varying from region to region and country to country, a number of encompassing conditions have emerged. For example, in 2009, the International Society for Technology in Education (ISTE)[27] listed fourteen essential conditions that often serve as standards.

Others have developed variations on the ISTE model that better fit their needs. For instance, the Global eSchools and Communities Initiative[28] (Hooker and Wachira, 2009) drew from the ISTE model but then asked the question, "What are the essential conditions that must be in place to begin moving forward?" The Initiative focused on six of ISTE's essential conditions, as prioritised by participants of a roundtable discussion. They decided that their first three conditions—a shared vision, empowered leaders, and implementation planning—would be the same as ISTE's. The roundtable participants then identified three barriers or "challenges":
- Lack of understanding of the benefits of ICT as a concept in Education
- Lack of a policy framework
- Resistance to change

Others have distilled the ISTE set of essential conditions even further. In a study of Malaysian Smart Schools, Ali, Not, and Alwi[29] (2009) made a distinction among "emerging," "essential," and "supporting" conditions. They conclude that essential conditions can be reduced to "availability of ICT resources" and "acquisition of ICT knowledge."

In all cases, when determining conditions that are essential to support responsible integration of learning technology into education settings, barriers that thwart such integration must be identified. Of all the essential conditions that have been articulated, leaders who examined this issue at EDUsummIT agreed that a *shared vision* is the most critical.

Scalability

Beyond making 21st century skills a part of education, it is important to shift our educational structures from industrial era schools to new types of 21st century educational models through the use of ICT. Societies can no longer afford a labour-intensive model of education that uses expensive human resources inefficiently. This is not a temporary financial dislocation due to an economic downturn, but a permanent sea change that has already happened in every other service sector of our economy.

In compulsory education, innovative practices are too often based on personal heroism, educators who make sacrifices in every other part of their lives to help their students.[30] These are wonderful stories, but such a model for educational improvement is unscalable to typical teachers. A way to be effective and affordable at scale has not been found. The U.S. Department of Education's 2010 National Educational Technology Plan[31] presents a transformational vision for 21st century education that builds on insights about modern interactive media gained from other parts of the economy, but also depicts new processes and structures that recognize the unique challenges of helping students learn, lifelong and life-wide.

Research

Recent evidence from major research studies in Technology Enhanced Learning (TEL), show that current research is remarkably similar to that of 40 years ago, in which researchers investigated the relationship between an IT application/resource through its stages of development, and teachers and learners engaged in its use[32] (TLRP-TEL, 2011). Where students are still studying within formal education, recent research trends reflect the increased mobility of the technology; from use of small but very portable devices[33] (Looi et al., 2011) to connected online learning enabling students to study anytime, anywhere.

Previous research in TEL (E-learning) shows that some methods ignore the learning conditions that might promote changes in cognitive structuring and therefore the impact the IT environment will have on the learner. The way in which new technologies have changed the representation and codifying of knowledge, and how this relates to learners' mental models, has shown that learners develop new ways of reasoning and hypothesizing knowledge. Therefore, measuring the effect of IT on students' learning should address student literacy in the IT medium and learning outcomes related to the aims of the curriculum. All of these considerations should also address changes taking place between the 'Present Stage,' in which, in many cases, the main concept is still based on traditional face-to-face teaching with E-Learning as an enhancement or optional extra, to the 'Future Stage,' in which the primary instructional mode is E-learning which may include a face-to-face learning component.

Furthermore, in the research field of IT in education, more effort has been made in recent years to identify theories which will underpin research methods and scope, such as attitudinal and pedagogical theories about teachers' pedagogical beliefs; sociological theories about educational change and institutional innovations; system theories relating to IT in schools, such as activity theory; and psychological theories relating to human computer interactions and knowledge representations[34] (McDougall et al., 2010). The challenge for the research community is to know enough about the technology to be able to: (a) identify a range of effective research methods; (b) underpin the research with appropriate theories; and (c) report, share and distribute the research outcomes in a manner which will enable policy makers and practitioners to benefit from the findings[35] (OECD/CERI, 2001; McDougall et al., 2010, Wilson et al., 2010 and Zenios (2011).
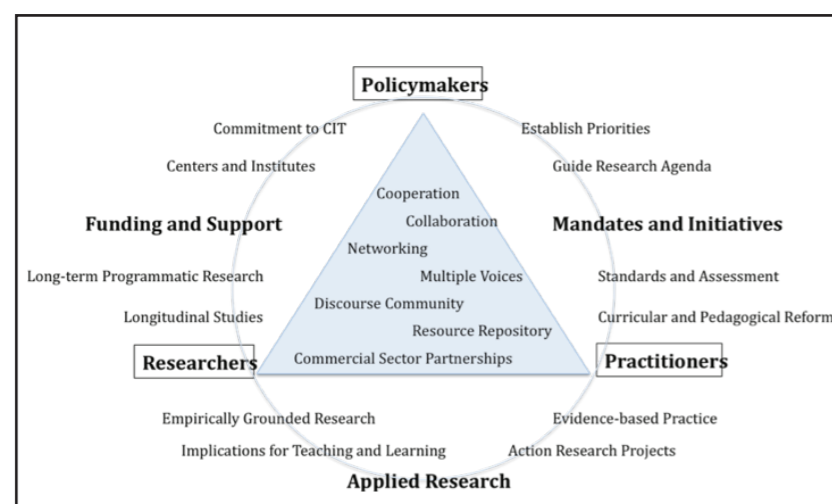
Figure 4. Responsibilities and interactions in research on ICT in education.

There are many issues concerning how to communicate research priorities, findings, and implications to those who may be affected by research outcomes, whether policy-makers or individual users. A communicative approach is needed to convey research needs and outcomes effectively. The figure, next page, shows responsibilities around the outer circle and interaction considerations among researchers, policy-makers, and practitioners in the inner triangle.

Research methods should also evolve to take advantage of new technologies. New open research models should be disseminated that make research findings immediately available. High resolution, multimedia, digital information from many sources, which can often be collected unobtrusively during learning and assessment processes, should be utilized. Academic research, development, and assessment of emerging ICT literacies, novel tools, and environments, such as social networking, mobile devices, and online gaming environments, should be thorough and ongoing. In addition to more fundamental research, there is also a need for research in which practitioners and researchers together determine the focus of research, as was mentioned by the working group on teacher professional development. Such research, that aims to improve and innovate educational practice may be best served by alternative forms of research and development, such as design research and research directed by knowledge communities.

Call to Action

A Call to Action emerged from EDUsummIT 2011. It addresses the organisations and individuals that have committed themselves to the mission of the EDUsummIT.

Globalisation

Globalisation of the world's economies means that 21st century skills will be essential worldwide. It is important to understand how the development of 21st century skills could create new knowledge divides within countries and cultures. A cultural understanding of the need for 21st century skills is needed.

Specific Actions
- Initiatives are needed to work with indigenous peoples to identify ways in which ICT can be restructured to serve indigenous peoples and build their capacity for self-determination.
- To foster digital equity on a worldwide scale, teacher professional associations should encourage the exchange of learning experiences between teachers and learners from different socio-economic and cultural backgrounds.
- Models for educational technology advocacy and best practices should be designed specifically for educational settings in developing nations.

21st Century Skills and 21st Century Learning

There is broad global consensus on what is meant by "21st century skills" and their importance for learners in today's schools. All stakeholders in education, but teachers and learners in particular, should be owners of the concept of 21st century learning.

The need for different types of literacy in the knowledge society has been ac-

knowledged. Digital literacy should not be regarded as a separate set of skills. It should be embedded within the other 21st century skills and core subjects.

Specific Actions
- A developmental continuum of pedagogical approaches supported by technology is needed to address the development of students' 21st century skills as they progress through school.
- Professional associations and related professionals should establish a clear stance on the role of ICT in 21st century learning and its implications for formal and informal learning
- School systems should develop procedures that enable teachers and students to better integrate formal and informal learning practices to support 21st century approaches that are sustained through new media and learning technologies. Revision of such policies and procedures could take place at multiple levels: national, state/provincial, and local.
- Models and examples should be developed to show how 21st century skills can be related to core subject domains, so that policy-makers, school leaders, and teachers can more easily implement 21st century skills in the school curriculum.

The New Learner

The informal ICT learning experiences of students are essential to realize the goals of schooling in the 21st century; there is great potential for learning 21st century skills in informal learning settings. Therefore, the role of informal education contexts in the acquisition of 21st century skills should be better understood.

Specific Actions
- Empower learners by enabling them to articulate their understanding and capabilities through their choice of media.
- To address the needs of the digital learner, more research is needed on the potential of emerging technologies for supporting both formal and informal learning.
- Model strategies are needed to provide examples on how to link what is learnt in school with what is learnt outside school.

Assessment

ICT-supported assessments that serve 21st century learning goals can become a lever for the implementation of 21st century learning. Innovative forms of assessment should be based on a solid research model that continually examines the efficacy of 21st century teaching to support 21st century learning. The emphasis should shift from summative assessment to continual, diagnostic, and formative assessment throughout the learning process. Extend assessment to include personal growth of the student, impact on social issues, and cultural importance.

Specific Actions
- Schools and accountability agencies should support a balance of assessments that incorporate peer assessment, student self-assessment, and learning potential assessment.
- The development of formative, performance based assessment cultures, should be encouraged.
  Novel assessment tools and resources should be researched and designed.

Restructuring Educational Systems

The restructuring of schools to move them from the industrial age to the digital age is a major undertaking that requires effective leadership and the engagement of all stakeholders. Research is needed to guide and understand the restructuring process.

Specific Actions
- To set the agenda for policy and research, a repository, identifying the emergence of new structures within schools and networked across schools and related services, could help start the conversation between relevant stakeholders about new approaches to schooling, and the challenges that they bring for distributed leadership, quality assurance, and governance. It should be made accessible at the global, regional, and local level.
- Strategies to ensure stable and sustained funding to support appropriate educational technology initiatives should be developed, articulated, and disseminated. Leadership from the EDUsummIT and UNESCO could work with other key educational stakeholders to develop and implement such an agenda.
- Scenarios describing the future of education are needed to help guide the rapid co-evolution of ICT and education. These scenarios should include organisational dimensions to inform the vision of leaders and policy-makers, as well as the restructuring of space and time for schooling.

Teacher Professional Development

To successfully move education into the 21st century, a new approach to teacher professional development should be adopted. Teachers should be given the opportunity to develop 21st century skills themselves and to experience how these skills can be brought into the classroom. There should be a shared vision of education, the role of ICT, and professional development that encourages ownership among all stakeholders.

Specific Actions
- Develop minimum requirements for professional development, along a career-long continuum, that regularly updates the skills of practitioners as education moves from traditional models, roles, and practices to new and emerging ones.
- Ensure that at least 30% of funding for new educational initiatives is set aside for professional development.
- Restructure pre-service teacher education and professional development alongside school restructuring, taking advantage of ICT for career-long professional development.

Research

Research on ICT in education should address the needs of the digital learners within an emerging global society. New research, driven by theoretical frameworks that contribute to theory and practice, should be supported. To keep up with the changes in technology new methodological approaches are needed, such as rapid prototyping, which could be adapted for use in education systems

Specific Actions
- Research observatories or collaboratives could provide the ideal setting to con-

duct research that would best address the needs of the digital age learner within an emerging global society. Such collaboratives could allow teams of international researchers to work in environments in which the implementation of contemporary ICT tools to increase student learning is examined.

- Develop mechanisms for sharing and distributing research studies that suggest promising policies and practices for ICT in education.
- Articulate methods that can be used to inform policy-makers, and to influence change in education.

Endnotes

1   UNESCO, ICT in Education. Accessed, Sept 16 from: http://portal.unesco.org/ci/en/ev.php_ID=2929&URL_DO=DO_TOPIC&URL _SECTION=201.html
2   UNESCO, ICT in Education. Accessed, Sept 16 from: http://portal.unesco.org/ci/en/ev.php_ID=2929&URL_DO=DO_TOPIC&URL _SECTION=201.html
3   IBID
4   IDC (2010). The 2011 Digital Universe Study: Extracting Value from Chaos (Accessed October 9, 2011 at: http://idcdocserv.com/1142)
5   UNESCO. (2005). Toward knowledge societies: UNESCO World Report. Paris, France: UNESCO.
6   IBID
7   European Communities. (2007). Key Competencies for Lifelong Learning: European Reference Framework. European Parliament.
8   UNESCO Institute of Statistics. (2011). The global demand for primary teachers - 2011 update. Montreal, Canada: UIS.
9   Ito, M., Horst, H., Bittanti, M., Boyd, D., Herr-Stephensen, B., & Lange, P.G. (2008). Living and learning with new media: Summary of findings from the digital youth project. Retrieved March 22, 2012, from http://digitalyouth.ischool.berkeley.edu/files/report/digitalyouth-WhitePaper.pdf; Sefton-Green, J. (Ed.) (2008). Creative Learning. London: Arts Council England.
10   Mishra P. & Kereluik, K. (2011). What 21st Century Learning? A review and synthesis. In C. D. Maddux, M. J. Koehler, P. Mishra & C. Owens (Eds.), Proceedings of Society for Information Technology & Teacher Education International Conference 2011 (pp. 3301-3312). Chesapeake, VA: AACE
11   IEA (2010) Second Information Technology in Education Study. Module 2: Case Studies of Innovative Pedagogical Practices Using Technology (accessed October 9 at: http://sitesm2.org/)
12   Law, N. (2009) Mathematics and science teachers' pedagogical orientations and their use of ICT in teaching, Education and Information Technologies, 14, 309-323.
13   Fullan, M. (2011). Choosing the wrong drivers for whole system reform. Centre for Strategic Education Seminar Series Paper No. 204. Melbourne: Centre for Strategic Education. Retrieved July 10, 2011 from http://www.cse.edu.au/Publication.aspx?p=398.
14   Bennet, Davis, Dexter, Riel & Becker in Voogt, J. & Knezek, G. (eds.) (2008). International Handbook of Information Technology in Primary and Secondary Education. Amsterdam: Springer.
15   Fullan, M. (2011). Choosing the wrong drivers for whole system reform. Centre for Strategic Education Seminar Series Paper No. 204. Melbourne: Centre for Strategic Education. Retrieved July 10, 2011 from http://www.cse.edu.au/Publication.aspx?p=398.
16   Eickelmann, B. (2011). Supportive and hindering factors to a sustainable implementation of ICT in schools. Journal for Educational Research Online/Journal für Bildungsforschung Online, 3 (1), 75–103.
17   Schulz-Zander, R. & Eickelmann, B. (2010). Teacher Professional Development - An Empirical Analysis of ICT-related Teacher Cooperation from a School Improvement Perspective. Proceedings of Society for Information Technology & Teacher Education International Conference 2010, pp. 1626-1632.
18   Derndorfer, C. (2010, October). OLPC in South America: An overview of OLPC in Uruguay, Paraguay, and Peru. The Educational Technology Debate (ETD). Retrieved April 31, 2011 from http://edutechdebate.org/olpc-in-south-america/olpc-in-south-america-an-overview-of-olpc-in-uruguay-paraguay-and-peru/
19   Davis, N.E. (2010). Strategic leadership for online and blended teaching within and across schools and teacher education: Part of the future for teacher education and school leader preparation. Paper and presentation to 2010 Symposium on the future of teacher education and school leader education, Sydney, Australia, July.
20   McLeod, S. (2011). Are we irrelevant to the digital, global world in which we now live? UCEA Review, 52(2), 1-5. Available: http://www.ucea.org/storage/review/Summer2011Review_lowres.pdf
21   McLeod, S. & Richardson, J. W. (2011) The dearth of technology-related articles in educational leadership. Journal of School Leadership, 21(2), 216-240.
22   C.P. Lim, C.S. Chai, D. Churchill (2011). A framework for developing pre-service teachers' competencies in using technologies to enhance teaching and learning. Educational Media International, 48, pp. 60-8.
23   Eickelmann, B. & Schulz-Zander, R. (2010). Qualitatsentwicklung im Unterricht–zur Rolle digitaler Medien. [Improving the quality of teaching and learning–the role and relevance of digital media.] In N. Berkemeyer, W. Bos, H. G. Holtappels, N. McElvany & R. Schulz-Zander (Hrsg.), Jahrbuch der Schulentwicklung. Bd. 16. (S. 235-259). Weinheim: Juventa.
24   Davis, N. E. (2010, July). Strategic leadership for online and blended teaching within and across schools and teacher education: Part of the future for teacher education and school leader preparation. Paper and presentation to 2010 Symposium on the Future of Teacher Education and School Leader Education, Sydney, Australia.
25   UNESCO (2011). ICT Competency Framework for Teachers (version 2.0). Paris, France.
26   Twining, P. (2011, March). Effective CPD in the Big Society. Reading, Naace Strategic Conference.
27   International Society for Technology in Education (ISTE) (2009). Essential conditions: Necessary conditions to effectively leverage technology for learning.
28   Hooker, M. & Wachira, E. (2009). Essential conditions for systemic transformation of curriculum and assessment. Roundtable at the Africa Exchange III Workshop, Accra.
29   Wan Ali, W., Mohd Nor, H., Hamzah, A., & Alwi, N. (2009, March). The conditions and level of ICT integration in Malaysian Smart Schools. International Journal of Education and Development Using ICT [Online], 5(2). Available: http://ijedict.dec.uwi.edu/viewarticle.php?id=618.
30   Kozma, R.B. (ed.) (2003). Technology, Innovation and educational change: a global perspective. ISTE, Eugene, OR.
31   U.S. Department of Education. (2010). Transforming American education: Learning powered by technology [National Educational Technology Plan 2010]. Washington, DC: Office of Educational Technology, U.S. Department of Education. http://www.ed.gov/technology/netp-2010
32   TLRP-TEL (2011, January). What's next: The latest findings on how technology is transforming learning from the Technology Enhanced Learning Research Programme. The London Knowledge Lab, Institute of Education, London.
33   Looi, C.K., Zhang, B., Chen, W., Seow, P., Chia, G., Norris, C. & Soloway, E. (2011). 1:1 Mobile inquiry learning experience for primary science students: A study of learning effectiveness. Journal of Computer Assisted Learning. 27(3), 269-287.
34   McDougall, A., Murnane, J., Jones, A. & Reynolds, N. (2010). Researching IT in education: Theory, practice and future directions. Routledge: London and New York.
35   OECD/CERI (2001). E- Learning in post-secondary education: Trends, issues and policy challenges ahead. 7th OECD/Japan Seminar. Centre for Educational Research and Innovation, Organisation for Economic Co-operation and Development in Co-operation with the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the National Institute of Multimedia Education: Nime, Japan.
    McDougall, A., Murnane, J., Jones, A. & Reynolds, N. (2010). Researching IT in education: Theory, practice and future directions. Routledge: London and New York.
    Wilson, M., Bejar, I., Scalise, K., Templin, J., (2010). Perspectives on methodological issues. (Project on assessment and teaching of 21st Century Skills.) University of Melbourne: Melbourne, Australia.
    Zenios, M. (2011). Epistemic activities and collaborative learning: Towards an analytical model for studying knowledge construction in networked learning settings. Journal of Computer Assisted Learning, 27(3), 259-268.

Preparation of the EDUsummIT Report

This report is the result of input of EDUsummIT participants, working group rapporteurs, and an editorial meeting.

Editorial Meeting of October 13-14, 2011

David Gibson, USA
Gerald Knezek,USA
Paul Resta, USA
Mike Searson, USA
Joke Voogt, The Netherlands
Mary Webb, UK

Working Group Rapporteurs

TWG1
Restructuring Educational Systems to Move into the Digital Age

Niki Davis, New Zealand,
Birgit Eickelmann, Germany
Renate Schulz-Zander, Germany

TWG2
Student Technology Experiences in Formal and Informal Learning

Gerald Knezek, USA
Kwok-Wing Lai, NZ
Ferial Khaddage, AU
Rowland Baker, USA

TWG3
Teacher Professional Development

Peter Twining, UK
Peter Albion, AU
Don Knezek, USA

TWG4
Global Awareness
Paul Resta, USA

TWG5
Assessment to Move Education into the Digital Age

Mary Webb, UK
David Gibson, USA

TWG6
21st Century Learning

Joke Voogt, The Netherlands
Ola Erstad, Norway
Punya Mishra, USA
Chris Dede, USA

TWG7
Barriers to Successful Implementation of Technology Integration in Educational Settings

Michael Searson, USA
Thérèse Laferrière, Canada
Roumen Nikolov, Bulgaria

TWG8
Researching IT in Education

Margaret Cox, UK
Takashi Sakamoto, Japan
Anne McDougall, AU
Nancy Castillo, Chile
Sindre Røsvik, Norway

EDUsummIT 2011 Participants

Edem Adubra, France
Victor José Afanou, Belgium
Ali Abduklhalig A.Alkarni, Saudi Arabia
Zaid Al-Shammari, Kuwait
Bent Andresen, Denmark
Charoula Angeli, Cyprus
David Atchoarena, France
Rowland Baker, USA
Mihaela Banek Zorica, Croatia
Haif Bannayan, Jordan
Carolina Belalcazar, United Kingdom
Christine Bescherer, Germany
Rhyan Bloor, Australia
Roberto Borromeo, The Philippines
Pascal Boulerie, France
Dele Braimoh, South Africa
Neil Breslin, Angola
Alain Breuleux, Canada
Marieke Brugman, The Netherlands
Eric Bruillard, France
Nith Bunlay, Cambodia
Simion Caisin, Republic of Moldova
Nancy Castillo, Chile
Alain Chaptal, France
Xin Chen, China
Miroslava Cernochova, Czech Republic
Claudio Cimelli, France
Alastair Clark, United Kingdom
Barbara Combes, Australia
Margaret Cox, United Kingdom
Charles Crook, United Kingdom
Hall Davidson, USA
Trina Davis, USA
Niki Davis, New Zealand
Geraldine De St Pern, France
Hj Abd Rahim Derus, Brunei Darussalam
Sara Dexter, USA
Paul Drijvers, The Netherlands
Josep Maria Duart i Montoliu, Spain
Gavin Dykes, UK
Birgit Eickelmann, Germany
Ola Erstad, Norway
Sally Essuman, Ghana
Alona Forkosh-Baruch, Israel
Terry Freedman, United Kingdom

David Gibson, USA
Michal Golan, Israel
Jorge Grunberg, Uruguay
Seija Jäminki, Finland
Shiyama Edirisinghe Jayasinghe, Sri Lanka
Arnold Jonk, The Netherlands
Janis Karklins, France
Ferial Khaddage, Australia
Alexander Khoroshilov, Russian Federation
Evgueni Khvilon, Russian Federation
Don Knezek, USA
Gerald Knezek, USA
Marijke Kral, The Netherlands
Keith Krueger, USA
Thérèse LaFerrière, Canada
Kwok-Wing Lai, New Zealand
Anissa Lardjane, France
Hans Laugesen, Denmark
Marcel Lebrun, Belgium
Matthijs Leendertse, The Netherlands
Florence Lefresne, France
Eeva Leinonen, United Kingdom
Massimo Loi, Italy
Johannes Magenheim, Germany
Tim Magner, USA
Joyce Malyn-Smith, USA
Bette Manchester, USA
Cristiana Mattos Assumpção, Brazil
Anne McDougall, Australia
Joost Meijer, The Netherlands
Fengchun Miao, France
Richard Millwood, United Kingdom
Punya Mishra, USA
Hajar Mohd Nor, Malaysia
Ludovit Molnar, Slovak Republic
Chris Montacute, United Kingdom
Steve Moss, United Kingdom
Kathryn Moyle, Austrlia
Wolfgang Mueller, Germany
Dale Niederhauser, USA
Roumen Nikolov, Bulgaria
Paul Nleya, Botswana
Lynn Nolan, USA
Cathie Norris, USA
Carl Owens, USA
Helen Padgett, USA
Kirsten Panton, Denmark

Davide Parmigiani, Italy
Don Passey, United Kingdom
Mariana Patru, France
Lucila Pérez, Ecuador
Sylvia Peters, The Netherlands
Vanessa Pittard, United Kingdom
Christina Preston, United Kingdom
Juliana Raffaghelli, Italy
Christine Redman, Australia
Paul Resta, USA
Nick Reynolds, Australia
Jean-Luc Rinaudo, France
Paolo Rocchi, Italy
Sindre Røsvik, Norway
Dina Rosen, USA
Somasi Saunand, India
Frans Schouwenburg, The Netherlands
Sarah Schrire, Israel
Renate Schulz-Zander, Germany
Michael Searson, USA
Michelle Selinger, Australia
Alexei Semenov, Russian Federation
Linda Shear, USA
Barbara Sherman, Cambodia
Miri Shonfeld, Israel
Elliot Soloway, USA
Shahjahan Mian Tapan, Bangladesh
Arthur Tatnall, Australia
Alfons Ten Brummelhuis, The Netherlands
Abdullah Ghalib Thabet, Saudi Arabia
Frank Tilya, Tanzania
Jo Tondeur, Belgium
Paolo Tosato, Italy
Cris Treacher, United Kingdom
Peter Twining, United Kingdom
Alexander Uvarov, Russian Federation
Niclos Valanides, Cyprus
Aike Van der Hoeff, The Netherlands
Maria Vasquez, USA
Joke Voogt, The Netherlands
Mary Webb, United Kingdom
Guus Wijngaards, The Netherlands
Dolores Zambrano, Ecuador

EDUsummIT 2011 Sponsorship

EDUsummIT 2011 was organized by the following organizations:

UNESCO

United Nations
Educational, Scientific and
Cultural Organization

Teacher Policy and Development Section,HQ, Paris

The International Society for Technology in Educa-

iste
www.iste.org

SITE Society for Information Technology & Teacher Education

Kennisnet

ifip

International Federation for Information Processing
WG 3.3 Research on Education Applications of In-
formation Technologies

The Association of Teacher Education

ATE

Journal of Computer Assisted Learning