Research-informed strategies to address educational challenges in a digitally networked world

Summary Report
(1 to 2 October, Washington D.C., USA)
Foreword

EDUsummIT is a global community of researchers, policy-makers and educators committed to supporting the effective integration of Information Technology (IT) in education by promoting active dissemination and use of research. Since the first Summit in 2009, the EDUsummIT community has established a growing network of stakeholders that connects research, policy and practice.

Under the theme “Research-informed strategies to address educational challenges in a digitally networked world”, the goal of EDUsummIT 2013 was to define joint strategies at regional, national and international levels to address successfully the challenges educational systems face in a digital and networked world.

EDUsummIT 2013 consisted of interactive working group sessions during which participants engaged in an active dialogue around eight themes/areas (see Box 1). Within each thematic working group, conversations focused on the identification of current needs and concrete recommendations for action that could contribute to effectively address the identified needs.

<table>
<thead>
<tr>
<th>Box 1. Themes addressed during the EDUsummIT 2013</th>
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The EDUsummIT 2013 welcomed more than 100 researchers, policy-makers, educators and representatives from the corporate sector from the United States, Africa, Asia, Europe, Latin America and Oceania. The discussions generated before, during and after the Summit have resulted in an Action Agenda that aims to inspire and guide future efforts to address the challenges educational systems face in a digital and networked world.

This report contains a compilation of all the documents developed in preparation for and as a result of the EDUsummIT 2013.
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Programme EDUsummIT 2013
# Research-informed Strategies to address Educational Challenges in a Digitally Networked World

## PROGRAMME

### Monday September 30th

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<td>Programme Committee meeting</td>
<td>Library of Congress, James Madison Memorial Building</td>
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<td>6.30 p.m. – 8.30 p.m.</td>
<td>Opening reception</td>
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### Tuesday October 1st

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<td>8.30 a.m. - 9.00 a.m.</td>
<td>Participant registration</td>
<td>Library of Congress*, Madison Building, 8th Floor</td>
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<td>9.00 a.m. - 10.30 a.m.</td>
<td>Welcome &amp; Introduction of EDUsummit 2013 Theme</td>
<td>Library of Congress, James Madison Memorial Building, Montpellier Room</td>
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<td>10.30 a.m. - 11.00 a.m.</td>
<td>Coffee break</td>
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<td>11.00 a.m. - 1.30 p.m.</td>
<td>Breakout sessions in Thematic Working Groups: Identifying needs</td>
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1.30 p.m. - 2.30 p.m.  
Plenary session: *Thematic Working Groups presenting needs*

2.30 p.m. - 4.30 p.m.  
Breakout sessions in Thematic Working Groups: Towards recommendations for a Call to Action

*4.30 p.m. – 5.00 p.m.*  
Thematic Working Group leaders’ meeting

7.30 p.m.  
Social Event

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**Wednesday October 2nd**  
*George Washington University, Jack Morton Auditorium and Breakout Rooms in Marvin Center  
805 21st St., N.W., Washington, D.C.*

9.00 a.m. - 9.30 a.m.  
Plenary session: *Synthesis of conclusions and recommendations from Thematic Working Groups*

9.30 a.m. -12.00 a.m.  
Breakout sessions in Thematic Working Groups  
9.30 – 10.30: Cross-fertilization  
10.30 – 12.00: Formulation of action plans

12.00 a.m. – 12.30 a.m.  
Plenary session: Update on action plans

12.30 p.m. -1.30 p.m.  
Working lunch, finalizing plans

1.30 p.m. – 3.30 p.m.  
Plenary session: *Synthesis of Thematic Working Groups’ action plans  
Closing ceremony*

3.30 p.m. – 4.00 p.m.  
Closing reception, next steps and networking

*4.00 p.m. – 5.00 p.m.*  
Thematic Working Groups leaders’ meeting

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**Thursday October 3rd**  
*George Washington University, Marvin Center  
800 21st St. NW, Washington, D.C., Suite 505*

**Outreach to NTLS (only TWG leaders and Steering Committee)**

9.00 a.m. – 1.00 p.m.  
Group Leaders from EDUsummIT meet with Leaders from NTLS to hand off recommendations to National Association Leaders from the USA
List of Thematic Working Groups (TWG)

TWG1: Towards new systems for schooling in the digital age
    Birgit Eickelmann, Ola Erstad

TWG2: Advancing mobile learning in formal and informal settings
    Kwok Wing Lai, Ferial Khaddage, Gerald Knezek

TWG3: Professional development for policy-makers, school leaders and teachers
    Peter Albion, Alona Forkosh-Baruch, Jo Tondeur

TWG4: Digital equity and intercultural education
    Paul Resta, Therese Lafferiere

TWG5: Assessment as, for and of 21st century learning
    David Gibson, Mary Webb

TWG6: Advancing computational thinking in 21st century learning
    Punya Mishra, Chris Dede, Joke Voogt

TWG7: Observatories for researching the impact of IT in education
    Margaret Cox, Dale Niederhauser

TWG8: Digital Citizenship and literacies around the world
    Mike Searson, Marsali Hancock
EDUsummit 2013 Action Agenda
EDUsummIT 2013 was held in Washington D.C. (United States of America) on 1 to 2 October. This invitational Summit brought together a group of 100 researchers, policy-makers, teachers, journal editors, and representatives from the corporate sector from more than 30 countries to reflect on emerging issues concerning the integration of information technology (IT) in education. Under the theme “Research-informed strategies to address educational challenges in a digitally networked world”, the main goal of EDUsummIT 2013 was to define joint strategies at regional, national and international levels to meet the challenges educational systems face in a digital and networked world.

The Summit consisted of interactive working group sessions during which participants engaged in an active dialogue around eight themes/areas (see Box 1). Within each thematic working group, conversations focused on the identification of current needs and concrete recommendations for action that could contribute to effectively address the identified needs.

**Box 1. Themes addressed during the EDUsummIT 2013**

- 9. Towards new systems for schooling in the digital age
- 10. Advancing mobile learning in formal and informal settings
- 11. Professional development for policy-makers, school leaders and teachers
- 12. Digital equity and intercultural education
- 13. Assessment as, for and of 21st century learning
- 14. Advancing computational thinking in 21st century learning
- 15. Observatories for researching the impact of IT in education
- 16. Digital citizenship and literacies around the world

The major recommendations for action identified by the various working groups are listed in the next section. While some of the issues addressed in these recommendations for action are new, others reveal that a number of actions already identified in the past are crucial to facilitate the integration of IT in education and therefore still warrant attention.
All of the recommendations for action have themes or issues which cut across the various working groups discussions. These common themes acknowledge the need for:

- Identifying what works and what does not work pertaining to the integration of IT in education;
- Locating best practices within each thematic working group area to inspire research and practice;
- Bridging formal and informal learning;
- Developing new forms of technology-based assessments;
- Encouraging collaboration within and between constituencies;
- Using previously successful collaborative research strategies (e.g. design-based research) to foster the integration of IT into teaching and research;
- Making research accessible to a broad range of constituencies.

### RECOMMENDATIONS FOR ACTION FROM THE THEMATIC WORKING GROUPS

**TWG1: Towards new systems for schooling in the digital age**

- Encourage technology-based personalization strategies and bring up best practice and models for new forms of schooling.
- Provide incentives for new forms of schooling, develop concepts how to sustain them right from the beginning.
- Develop curricula towards new systems of schooling that integrate informal and formal learning.
- Develop education and technology, hand in hand (co-evolutionary) instead of only equipping schools with technology.

**TWG2: Advancing mobile learning in formal and informal settings**

- Develop criteria for identifying best practices and models of mobile learning which are evidence-based, culturally sensitive, curriculum centered, flexible and scalable.
- Develop guidelines and strategies to tackle challenges of mobile learning, including bring your own device (BYOD), interface design, cross platform applications, assessment, equity, culture, health and safety issues, teacher preparation issues, and quality of learning outcomes in order to bridge learning across settings and contexts.

**TWG3: Professional development of policy makers, school leaders and teachers**

- Include technology in professional training as an integral component of the educational setting.
- Create and promote communities of practice (CoPs), professional learning communities (PLCs) and professional learning networks (PLNs) as professional development strategies.
- Include all stakeholders in teacher professional development decisions concerning teaching in 21st century environments.
**TWG4: Digital equity and intercultural education**

- Develop a conceptual framework and lexicon for digital equity and intercultural education.
- Create a database of research results and best practices from specific cases concerning digital equity and intercultural education and prepare digests of most relevant research findings; proposed to be hosted by UNESCO and/or Organization of American States.
- Evaluate pilot implementations using frameworks available on the database.
- Train educators in developing a habit of mind to seek the best research related to their educational problems.

**TWG5: Assessment as, for and of 21st century learning**

- Focus on the development of assessments of collaborative learning in problem solving environments (e.g. PISA 2015).
- Develop theories for big data being used by educational researchers.
- Engage teachers in the design of learning analytic tools for instructional practices and involve teachers and students in interpreting and using results.

**TWG6: Advancing computational thinking in 21st century learning**

- Develop a conceptual framework to define computational thinking and build a common vocabulary around it.
- Develop measurable attributes to evaluate and assess computational thinking skills.
- Identify research approaches and opportunities, with a particular focus on what aspects of computational thinking transfer to problem solving/ problem seeking approaches in other areas.

**TWG7: Observatories for researching the impact of IT in education**

- Encourage interdisciplinary and international research collaborations around critical themes in technology-enhanced learning (TEL).
- Establish observatories to ensure:
  - The interdisciplinary composition of research teams to meet the cross specialist requirements of researching TEL;
  - The continuity of overlapping research programmes to build on a growing body of knowledge and expertise;
  - The translation of research methods and outcomes into policy and practice;
  - The robustness and cross-cultural relevance of educational research.
- Communicate the problematic issues (e.g. complexity beyond one page and 2 variables) to policy makers underlying what works and does not work.
- Employ research vignettes and visualizations to communicate findings to different stakeholders, cultures and nations.
**TWG8: Digital citizenship and literacies around the world**

- Create a model to gain insight into what digital citizenship implies from a global perspective.
- Develop a white paper to raise awareness of the definition of digital citizenship.
- Gather an inventory of acceptable use policies and case studies from around the world.

**Editors**

Alongside the working group discussions, the EDUsummIT 2013 engaged editors from various International Journals in active dialogue about possible actions to enhance the dissemination of research findings concerned with the integration of technology in education. The editors identified policy makers as a key audience that may not be adequately addressed through academic research publications and proposed the creation of a Blog to present relevant research in a format appropriate to the needs of policy makers. Editors of relevant journals will rotate responsibility for creating monthly posts that summarize major findings about key topics and engage in discussion about the posts. The first topic to be targeted will be research about creating and using mobile computing environments to help students develop critical thinking skills, problem solving skills, and citizenship skills.
TWG Summary Reports
1. Background: Setting up the stage

The aim of Thematic Working Group 1 was to identify the most effective policies and strategies to promote transformative and sustainable ICT-enabled changes in educational systems. This is important to help educational systems meet the needs of digital age learners and the challenges of a rapidly changing knowledge and technology-based global society.

Two essential questions were addressed during the EDUSummitIT 2013 and served as background for the work of TGW 1:

- Question 1: To what extent and how do recent developments of education and digital technologies challenge and change systems of schooling?
- Question 2: How can research inform us about the potential of new forms of schooling supported by digital technologies?

Different perspectives on new systems of schooling in the digital age have been identified and confirmed by TWG1 participants as relevant approaches to answer the two questions mentioned above. These perspectives are related to institutions, actors, and practices. Aiming for an expedient approach, Davis, Eickelmann & Zaka (2013) indicate the relevance of considering the co-evolution of pedagogy and technology. Because both education and digital technologies are evolving rapidly, the term co-evolution is adopted to describe the changing ICT applications and services as well as the changing scenarios leading to new systems and forms of schooling. In this context, co-evolution is defined by the interaction between the evolution of education and the evolution of digital technologies applied within education. Both education and digital technologies are evolving, and therefore changes in one have the potential to stimulate changes in the other one.

Examples of new technology developments that could have an influence on new systems of schooling include OER (Open Educational Resources) which are freely accessible, usually openly licensed documents and media that are useful for teaching, learning, assessment and research purposes. Another example are MOOCs (Massive Open Online Courses) which provide online courses aimed at large-scale open access via the web. Moreover, video-based learning settings as the ones implemented by the Khan-Academy or flipped classrooms illustrate how the use of new technologies enables more flexible forms of teaching and learning as well as new systems of schooling. Furthermore, a need has been identified to move beyond traditional
conceptions of formal vs. informal learning, online vs. offline activities, and to develop new conceptions of what defines learning spaces across different locations and contexts (Erstad & Sefton-Green 2013; Fullan 2012). This is important in order to help educational systems meet the needs of digital age learners and the challenges of a rapidly changing knowledge and technology-based global societies.

In this context, the following needs and unresolved issues have been identified by TWG1:

1) Necessity to make education more open and flexible, thereby facilitating personalization and student-centeredness.
2) Necessity to integrate formal, non-formal and informal learning with the support of technologies.
3) A lack of teachers’ and policy makers’ access to and understanding of research findings on new systems of schooling and its impact.
4) A lack of public funding and incentives focused on sustainable solutions that combine new pedagogies with new technologies (instead of only equipping schools with technology).
5) Necessity to develop open education resources adapted to traditions in different countries, also available in different languages.
6) The need to open curricula to new approaches of schooling supported by technologies, and to develop new pedagogies hand in hand with technological achievements.
7) The lack of support for the development of 21st century competencies in traditional systems of schooling, e.g. by not covering them in assessment and central examinations. The need to provide funds for ICT infrastructure for students in poor areas/countries.

2. Recommendations

Recommendations for researchers

a) Elaborate systematic reviews of literature and research on new forms of schooling with a specific focus on their impact and effect conditions.
b) Develop further mixed methods approaches and good qualitative research.
c) Make research accessible and understandable for schools (e.g., teachers and principals), but also for policy makers (find funding to re-write research for non-scholarly addressees)
d) Focus further research on new forms of schooling:
   a. Short term research where results are quickly available and can be used to inform further developments in schools/projects.
   b. Longitudinal research focusing on long term and sustainable change supported by ICT and new pedagogies.
e) Exchange and facilitate research between countries

Recommendations for policy-makers

a) Acknowledge the co-evolution of ICT and pedagogies, instead of just equipping schools without giving space and incentives to develop education.
b) Make education more flexible and use ICT-assisted learning concepts to support this (thereby contributing to make education and schooling more successful, also in terms of decreasing drop-out rates, increasing motivation etc).
c) Keep yourself informed about new systems of schooling and recent approaches such us 21st century skills, lifelong learning, integration of formal and informal learning as well as personalized learning and student-centered learning.

**Recommendation for practitioners**

a) Develop and co-construct pedagogical knowledge about new forms of schooling and new forms of teaching in this new environments.
b) Exchange knowledge *within and between* schools (e.g., in school networks).
c) Move away from content-orientation to student-centeredness.
d) Make education more flexible with ICT, and thereby more successful.
e) Connect practice with research in order to develop concepts and strategies to learn from research findings.
f) Connect practice with research and develop concepts to learn from research findings.
g) Integrate informal and non-formal learning and by this take over the learners’ perspective.
h) School heads should leave room to experiment with new pedagogical approaches and back new developments up.
i) Involve parents, administrations, and other key stakeholders from the beginning and during the process of implementing new systems of schooling in your school.

3. Action plans

I. Encourage technology-based personalization strategies and bring up best-practice and models for new forms of schooling.

II. Provide incentives for new forms of schooling, develop concepts how to sustain them right from the beginning.

III. Develop curricula towards new systems of schooling that integrate informal and formal learning.

IV. Develop education and technology hand in hand (co-evolutionary), instead of only equip schools with technology.

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**Participants TWG1**

* Birgit Eickelmann, Germany  
  Ola Erstad, Norway  
  Smadar Bar-Tal, Israel  
  Christine Bescherer, Germany  
  Hans De Four, Belgium  
  Koos Eichhorn, The Netherlands  
  Don Krug, Canada  
  Hans Laugesen, Denmark  
  Pamela Moran, United States  
  Barbara Sherman, Cambodia  
  Barbara Sherman, Cambodia  
  Ralph Müller-Eiselt, Germany
1. Background: Setting up the stage

We note that there is yet no consensus on how mobile learning should be defined. Winter (2006) has summarised four main perspectives of mobile learning: (a) technocentric – mobile learning is primarily seen as learning supported by mobile devices, and the focus is on the technology; (b) mobile learning is seen as an extension or a subset of e-learning, and mobile learning research is primarily part of e-learning research; (c) mobile devices are used just to complement and augment formal education; and (d) mobile learning is student-centred and it is about mobility and context. We have seen a gradual shift of understanding of the theory and practice of mobile learning in the last ten years, from a technocentric perspective focusing on the attributes and affordances of the technology, to a learner-centred perspective focusing on the mobility of the learner (not just space and time, but also access to people and resources) and contexts (Kukulska-Hulme & Sharples, 2009). One example of such a perspective is provided by Sharples, Taylor and Vavoula (2007), who define mobile learning as “the process of coming to know through conversations across multiple contexts among people and personal interactive technologies” (p.255). Mobile learning is also understood as closely linked to informal learning, which is characterised by “personal ownership of codified knowledge, user-generated ideas, user-constructed contexts...personal and contextualised, and controlled by the learner” (Laurillard, 2009). Learner control and agency is thus at the heart of mobile learning and both personalised and collaborative learning opportunities can be afforded by mobile technologies. We have begun to see development of theories of mobile learning (e.g., Sharples, Taylor, & Vavoula, 2007; Laurillard, 2007).
The characteristics of mobile learning have been extensively researched (Kukulska-Hulme & Sharples, 2009; Looi, Zhang, Chen, Seow, Chia, Norris, & Soloway, 2010; Pachler, 2009; Sharples, Arnedillo-Sanchez, Milrad, & Vavoula, 2009), and research begins to document the relationship between motivation and mobile learning (Ciampa, 2013), and self-regulation (Sha, Looi, Chen & Zhang, 2011). Trends of research in mobile learning have been reviewed by Hwang and Tsai (2011) and Wu at al. (2012). While we see exemplary case studies of mobile learning practices (e.g. Naismith, Lonsdale, Vavoula, & Sharples, 2004), there is a lack of large-scale projects to document the use of mobile technologies to support learning activities in different contexts in formal learning. There is also a lack of mobile learning research in informal contexts (Looi, Seow, Zhang, So, & Chen, 2010; Wright & Parchoma, 2011). It is recognised that there are inherent difficulties in evaluating technology-enhanced learning (Livingston, 2012; Wellington, 2005) and researchers are currently developing new evaluation methods to assess learning outcomes of mobile learning (e.g., Sharples, 2009). Despite this rapid development there are still very few guidelines for developing mobile learning for a variety of scenarios that address both formal and informal learning contexts.

**Overview of needs/challenges identified by TWG2:**

Our group believes that mobile learning has huge potential in changing how, what, when, and where students learn and what they are able to learn. However, we have identified several challenges in designing and implementing mobile learning in education:

- Some schools not allowing students to use mobile devices in school
- Policies on students bringing their own devices
- Students not using mobile devices for intentional learning purposes
- The need to change assessment practices
- Equity issues in accessing mobile devices
- Cultural issues in using mobile devices in different contexts
- Cross platform issues in mobile applications
- Design challenges, e.g., size of screen
- Health and safety issues
- Balancing self-directed learning and maintaining privacy with teacher supervision
- Changing roles of teachers and students

**2. Recommendations**

Our group recommends that:

- Criteria be developed for identifying best practices and models of mobile learning. These criteria should be evidence-based, culturally sensitive, curriculum centered, flexible and scalable, and allow pedagogical changes and student directed learning, and applicable in formal and informal contexts.
• Guidelines and strategies be developed to tackle challenges of mobile learning, including BYOD, interface design, cross problem applications, assessments, equity, cultural, health and safety issues, teacher preparation, quality of learning outcomes, and bridging learning across settings and contexts.

3. Action plans

To realize the recommendations made by our group, the following actions will be undertaken:

- Developing a website to share best practices, criteria, models and resources of mobile learning.
- Developing a model to identify best practices.
- Publishing a number of papers for the academic, policy and professional communities on mobile Learning
- Collaborating among group members on future projects and research.

Participants TWG2

Rowland Baker, USA  
Bram Bruggeman, Belgium  
Rhonda Christensen, USA  
Gerard Dummer, The Netherlands  
Jörg Dräger, Germany  
Cathie Norris, USA  
Barry Quinn, United Kingdom  
Elliot Soloway, USA  
Nicos Valanides, Cyprus  
Melissa van Amerongen, The Netherlands  
Rivka Wadmany, Israel  
Paula White, USA
Thematic Working Group 3

Professional development for policy-makers, school leaders and teachers

Summary Report and Action Agenda

Peter Albion, University of Southern Queensland, Australia
Alona Forkosh-Baruch, Tel Aviv University, Levinsky College of Education, Israel
Jo Tondeur, Ghent University, Belgium

1. Background: Setting up the stage

A paper based on the work of TWG 3 at EDUsummIT 2011 (Twining, Raffaghelli, Albion, & Knezek, 2013) includes an update of key literature on TPD, with a focus on TPD aimed at supporting the integration of technology for the enhancement of learning and teaching across all disciplines. It is noted that quality teachers are the most important factor influencing student learning (Rivkin, Hanushek, & Kain, 2005) and that TPD should go beyond encouraging technology adoption for common tasks to a focus on improved learning and teaching. In this respect, effective teaching requires the effective use of technology (Ertmer & Ottenbreit-Leftwich, 2010) and should build upon the integration of knowledge across the domains of content, technology and pedagogy (TPACK) (Mishra & Koehler, 2006).

Several studies (e.g. Liu, 2012; Postholm, 2012; Sun et al., 2013) recognize the potential of TPD that is tailored to local conditions and takes advantage of mutual support among teachers. Kopcha (2012), for instance, noted the benefits of TPD that was situated in the local context and responded to needs by transitioning over time from mentoring by an outside expert to teacher-led communities of practice (CoPs). Matching TPD to local needs has also been managed using a design-based approach that was successful in promoting generative teacher knowledge and ICT integration (O’Hara, Pritchard, Huang, & Pella, 2013). Beyond the local school, Holmes (2013) reported on the success of TPD facilitated through an online learning community that crossed regional and national boundaries. Communities of practice have also been used to provide PD for school leaders (Bouchamma & Michaud, 2013).

TWG3 at EDUSummit 2011 identified several obstacles to effective TPD, such as a lack of consistent vision for (technology integration in) education; poor matching of TPD to needs of teachers; failure to engage all stakeholders in decisions; and lack of harmony among context, policy, practice, and research. Consensus developed around a particular concern that research-based knowledge for effective professional development is not adequately disseminated in a manner that impacts policy or practice. Proceeding from this base and considering the recent research noted above, we propose that TWG3 at EDUSummit 2013 initiate its discussions around the following:
1. Despite progress in some areas, a major challenge remains to engage all stakeholders in developing a shared vision about the role of ICT in education with a focus on TPD in order to realize this vision.

2. School-based communities of practice and professional learning networks have been effective in TPD for building ICT integration capability. The related challenge is to engage more teachers in these forms of TPD.

3. Teachers are required to exhibit effective teaching, using effective models for TPD. Hence, there is a need for vignettes of effective practices, which can be assembled into models for TPD for pre- and in-service teachers.

4. Leadership and management conditions for TPD need to be defined and researched, as principals and leading pedagogic staff are considered arrowheads for facilitating technology-enhanced educational innovation.

5. The gap between educational research and the practice of teachers in classrooms has been noted previously. There is a need for educational research that is more closely connected to, and informs, the practice of teachers and vice versa.

6. Teacher educators should be included in the TPD scheme - usually the target population is in-service teachers; hence, training is in many cases a top-down process. Teacher educators are part of the academia, and as such are involved in training the new generation of teachers. As researchers, they may have many recommendations for policymakers as a result of their studies and experience - this should be utilized for enhancing TPD.

2. Recommendations

Vision:

1. There is an urgent need to develop a joint vision that facilitates technology enhanced learning for pedagogic transformation rather than assimilation of technology into current pedagogical settings.

2. Notwithstanding it is also necessary to develop a local school vision (bottom-up) of ICT implementation, as an integral component of the general pedagogical PD in accordance with specific needs and emphases.

3. Technology integration should be seen as an integral part of teacher education al large; hence, a change of approach to teacher education altogether is a prerequisite to implementing technology enhanced learning as an integral part of TPD (e.g. Finland).

Policymakers:

1. An education master-plan for TPD – 21st century skills rather than IT skills – top-down, combined with encouraging bottom-up initiatives - should be laid out for pre-service and in-service PD.

2. All stakeholders should be Included in decision-making processes for a TPD masterplan facilitating technology-enhanced learning. It is imperative to be attentive to different voices focusing on diverse needs.

3. The need for TPD is unquestioned; however, there is need for allocation of resources for effective TPD (e.g. time, including for participation in conferences, mentors and tutors etc.).
4. Professional standards and principles need to be set for education, with regards to technology-enhanced learning, e.g. teachers as designers of practice, innovations and research – as means of generating knowledge.

5. Local TPD needs to be developed, according to school culture, teachers' needs, stage of ICT implementation; hence, PD needs to be seen as a continuing process.

6. Cost-effectiveness of TPD should be measured. Therefore, a financial model for assessing TPD for technology-enhanced learning needs to be developed.

Practice:

1. TPD needs to be promoted according to specific educational-pedagogical needs, e.g. technology integration for special education (following inclusion policy).

2. Development of resources is vital to the effective implementation of TPD for technology-enhanced learning. These resources are in line with theoretical models emphasizing the need for accessible online best practices.

3. Training by commercial parties or NGOs is welcome and recommended in cases in which national training via MOEs is insufficient.

4. Usage of theoretical models (e.g. TPACK, SAMR) is necessary for practice as well as research focusing on TPD initiatives.

5. Implementation of PD in learning communities allows teachers to interact as learners, moreover, as lifelong learners. Teachers as learners is a switch of roles that has been mentioned in the literature. In these PLCs teachers can share practices (online and f2f) and professional experiences, including visits to schools.

Research:

1. Research and development should be promoted via design-based research and/or action-based research using blended approaches. Research should be executed by joint enterprises of academia and practitioners.

2. Research needs to promote global as well as local themes, and should reflect TPD priorities.

3. Promotion of masters programs in Technology in Education may serve as a lever in combining design-based research with practice, since many of the candidates will be in-service teachers; this is especially relevant for institutes in which the expertise is teacher education (e.g. education colleges).
3. **Action plans**

**Local-level actions:**
- Include technology in professional training as an integral component of the educational setting.
- Create local CoP for TPD, including technology as a component crossing all disciplines.

**National-level actions:**
- Establish policy for TPD including long-term development of ICT-based effective implementation models.
- Use models for assessing TPD for technology integration, e.g. the LOGIC model, SAMR model.
- Allocate funding for action research and/or design based research around TPD for technology integration.

**International-level actions:**
- Call for action to international organizations (e.g. UNESCO) for establishing international CoPs of teachers and faculty teaching pre-service teachers.
- Exchange programs for teachers worldwide, supported by MOEs and international organizations.
- Support translation of white papers to several languages and adapt to local cultures - via international NGOs.

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**Participants TWG3**

Peter Albion, Australia  
Alona Forkosh-Baruch, Israel  
Jo Tondeur, Belgium  
Cristiana Assumpcao, Brazil  
Sara Dexter, USA  
Salome Essuman, Ghana  
Jef Peeraer, Vietnam  
Juliana Raffaghelli, Italy  
Dina Rosen, United States  
Debra Sprague, United States  
Dana Uerz, The Netherlands  
Hans van Bergen, The Netherlands
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Digital equity is a social concern. As emphasized at EDUsummIT 2011,

“Technology has transformed all aspects of society, including the teaching-learning process. It is critical that specific groups within our society not be excluded from the benefits of these new developments. Not only must digital equity continue as a priority goal of all nations, but efforts to move toward digital equity also must be mobilized, focused, and coordinated to prevent the development of a permanent underclass in global society.” (Resta, 2011)

Digital equity involves more than access to a device and connectivity to the Internet. It also involves access to meaningful, high quality culturally relevant content in local languages and educators who know how to use digital tools and resources.

2. Background: Setting up the stage

In 2001, OECD defined the digital divide as differences between individuals, households, companies, or regions related to the access to and usage of ICT. Digital divides exist between countries, including between women and men, rural and urban areas (NTIA, 1995), young and old people (Becker, 2000; Fox & Madden, 2005), poor and rich people (Eamon, 2004), persons with or without disabilities, indigenous and “foreign” people, and ‘haves’ and ‘have nots’ (Resta, 2011; Warschauer, 2003; Warschauer, Knobel, & Stone, 2004), etc.

Although a very promising trend has been the rapid growth of mobile subscriptions in the developing world within the past decade (see Figure 1), there remain stark differences in use of the Internet between developed and developing countries (see Figure 2).
As stressed by van Dijk, Hacker and Strover (2003), the digital divide is a complex and dynamic phenomenon, one that is multifaceted. DiMaggio and Hargittai (2001) suggested five dimensions along which inequalities may exist: 1) inequality in technical apparatus; 2) inequality in autonomy of use; 3) inequality in skill; 4) inequality in the availability of social support; and 5) variation in the purposes for which people use the technology. Researchers have inquired into these dimensions, but the task is cumbersome. Regarding dimension three, for instance, Reilly (2011) remarked that
“the ability to use digital media without grasping how it works contributes to its apparent ease of use as Dilger (2008) explains, this knowledge deficit deskills users, widening the divide between the experts who have technological know-how and mere users who passively receive media as served, but cannot customize, troubleshoot, or participate in creating it” (p. 1).

As for dimension five, Wei and Zhang (2008) found out that network knowledge has an influence on the user’s intentions when using the Internet.

We suggest adding a sixth dimension: Variation in the patterns of effective adoption. Effective adoption depends on skills and also on socio-cultural reorganization stressed van Dijk (2005) when pointing to a widening digital divide as he analyzed diverging trajectories of adoption.

Such observations have led to an emerging consensus among scholars says Hilbert (2011): The key question is not access to technology or connectivity but “how to extend the expected gains from new ICTs”. Examples of recent international research/policy/practice initiatives that felt short of the initial promises are the One Laptop per Child (OLPC) initiatives in Peru (Trucano, 2010), Uruguay (Trucano, 2011) (See also Kraemer, Dedrick and Sharma, 2009; Nugroho, & Lonsdale, 2010; Severin & Capota (2011) and Gabon (Bibang-Assoumou, 2013). In the latter case, while electricity was a problem at times, it was the teachers’ perception of the little margin the official curriculum was leaving them for letting students “experiment” with the XO that was the key obstacle.

What may ultimately have the greatest impact is the development of national policy which considers these factors and recognizes that the investments in these resources are essential for the nation’s educational and economic development.

3. Issues/unresolved questions/concerns

It is likely that digital equity will be a concern for a very long term to come. Hilbert (2011) argues that the digital divide is best defined in terms of a desired impact. He adds: “Since the impacts of ICT are diverse, the definitions of the digital divide are as well. Therefore, questions like “what is the best definition of the digital divide?” or “when is the digital divide closed?” do not make sense by themselves, but have to be formulated on the basis of a conditioning variable:

- Given the desired impact, who, with which characteristics, connects how to what?

Or, normatively speaking:

- Given the desired impact, who, with which characteristics, should best be connected how to what?”

If there is one ICT impact that policy makers and educational researchers are looking for, it is learning outcomes. In our own conceptualization (Resta & Laferrière, 2008) the issue of access must be addressed in the following five different areas for optimizing the use of ICTs:

1. Access to hardware, software and connectivity to the Internet
2. Access to meaningful, high quality, culturally relevant content in local languages
3. Access to creating, sharing, and exchanging digital content
4. Access to educators who know how to use digital tools and resources
5. Access to high-quality research on the application of digital technologies to enhance learning
Intercultural education is viewed here as an avenue (see also Gorski, 2004) for, on the one hand, affirming local learning cultures and, on the other hand, crossing their boundaries. To provide incentives for local teacher educators to participate, for instance, in online communities of practice or knowledge building communities and create content (Hargittai & Walejko, 2008) could be an important step to take.

4. Recommendations

As Working Group 4 considered the issues, unresolved questions and concerns similar to those mentioned above, it came to retain the four following actions:

I. To develop a conceptual framework and lexicons for digital equity and intercultural education

II. To create a knowledge database of research results and best practices from specific cases concerning digital equity and intercultural education, and prepare digests of most relevant research findings

III. To evaluate pilot implementations using frameworks available on the database

IV. To train educators in developing a habit of mind in use of the database

5. Action Plans

I. To develop a conceptual framework and lexicons for digital equity and intercultural education

- **Socio-cognitive dimension.** Digital equity (DE) and intercultural education (IE) lack a conceptual framework capable of identifying common terms, and link their respective principles and particular circumstances. A first action is to put together a paper that would integrate both components and a common lexicon, to be placed on the collaborative platform that the design group would retain.

- **Technology dimension.** Although there is a broad array of social media tools available, it would be important to identify social media tools whose affordances may best support inter-cultural collaboration. Tools to support the translation and development of multilingual culturally responsive and digital equity content by local and international groups is also a critical requirement.

II. To create a knowledge database of research results and best practices from specific cases concerning digital equity and intercultural education, and prepare digests of most relevant research findings

- **Socio-cognitive dimension.** Such a database does not exist. Neither do we have digests of research findings and best practices. It is recommended that a process be established to gather research results and integrate them into a digest. The digests would be modeled after those developed in the medical profession that point practitioners to the best known practices and the underlying research that affirm the use of these practices. See [http://search.ebscohost.com/login.aspx?authtype=uid&user=s4866916trial&password=trial&group=trial&profile=dynamened](http://search.ebscohost.com/login.aspx?authtype=uid&user=s4866916trial&password=trial&group=trial&profile=dynamened).

- The Digital Opportunity Consortium, for example, has an agreement with EBSCO to host such a digest on digital equity and multicultural education strategies and resources and eventually other digests on best practices in important dimensions of educational practice, at no cost at [www.digitalopportunityforall.org/library.html](http://www.digitalopportunityforall.org/library.html) (password = EBSCO)
The development of the database would include research vignettes, and different values would be ascribed to methodological approaches. This action would require work with ministries of education to co-create curriculum that integrates technology-supported intercultural communications and collaborations. Another need would be to develop local, national and international partnerships, linking this effort, for instance, with UNESCO’s initiatives to support indigenous knowledge, languages and cultures.

**Technology dimension.** UNESCO and/or Organization of American States (OAS) could promote use of and contributions to the platform. Both organizations have the visibility, and capacity to facilitate sustained access to the platform. In the immediate future, there is a need for a planning team to draft a concept paper for the development of the DEIP platform.

### III. To evaluate pilot implementations using frameworks available on the database

**Socio-cognitive dimension.** To achieve this goal requires the implementation of aspects of the concept paper by participating sites. This may include a social network for teacher educators and K-12 educators to locate cross-cultural partners to collaborate, co-design and co-teach on topics of shared interest, as well as to seek support for the collaborations. Concrete cases from teacher educators working in the areas of digital equity and inter-cultural education could also be made available. Of particular interest would be professional development that helps prepare teachers with an array of pedagogical strategies and tools to foster digital inclusion (e.g., strategies for reaching a mix of students with digital access and backgrounds) during class time and afterschool (e.g., community centers). Such implementations would be evaluated using the common conceptual framework, to assist teachers in development of pedagogical strategies and resources to support the integration of intercultural education into their own teaching.

**Technology dimension.** Resources would be made available by mobile devices.

### IV. To train educators in developing a habit of mind in use of the database

Although medical doctors are trained to develop a “habit of mind” to seek the best and most current research related to a medical problem they are attempting to solve, educators, similarly need to develop a habit of mind to seek the best research related to their educational problems. It is recommended that an international “habit of mind” initiative be established to equip future and current educators with the understanding of why and how to use online research databases to rapidly locate best practices key to their student learning priorities.

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**Participants TWG4**

*Paul Resta, USA*
*Thérèse Laferrière, Canada*
*Marcus Childress, USA*
*Gwang-Jo Kim, UNESCO (Bangkok)*
*Maïte Smet, OAS*
*Chad Ratliff, USA*
*Miri Shonfeld, Israel*
*Wai Man Tang, Cambodia*
References


1. Background: Setting the stage

Since EDUsummIT 2011, where the call to action (see: goo.gl/QSNt6) emphasised that to align 21st century curricula and learning environments assessment models must be revised, there have been a number of important changes in the assessment landscape. We have seen a stronger recognition among teachers and policymakers that assessments serve a range of formative and summative purposes and of the opportunities for IT-based assessments to serve 21st century learning goals including higher order thinking skills and deep knowledge. The importance of assessment as a learning context has come to the fore and is particularly evident in virtual performance assessment where the experience of the assessment can be a learning engagement. There are now a number of projects working on developing a new generation of assessments including some major projects (e.g. http://www.smarterbalanced.org/ and http://www.parcconline.org/) and many smaller initiatives including projects developing software tools to support assessment especially those enabling visualisation and analysis of ‘big data’ (e.g. http://www.solaresearch.org/).

One initiative, which represents a major step forward from the position identified in EDUsummIT 2011, is that the OECD PISA Project is planning to assess collaborative problem-solving skills in 2015 through computer-based assessment (see: http://atc21s.org/index.php/oecd-conceptual-framework-for-2015-pisa-assessment-of-problem-solving/).

Some challenges, identified in 2011, remain, including whether the following four perspectives on assessment: feedback information, improvement decisions, degree of engagement and understanding, and value judgments, can co-exist to the benefit of learners (Webb et al. 2013). Even with the increased possibilities that IT provides we have not yet found a way to say confidently that the multiple purposes for which some assessments have been used (Mansell et al. 2009) can or should be supported through the same assessment systems. This is because the impacts of some purposes interact with the validation processes for others. Therefore in considering assessment design for multiple purposes, users need to examine impact factors carefully in order to minimize negative impacts on learning and learners. Thus significant challenges remain for developing validation approaches that can take account of the complexity of learning experiences especially for group tasks in simulations, games and other problem solving environments. Furthermore, with the emergence of “big data” - defined as data that has very large numbers of records, of widely differing data types, and is rapidly collected for immediate action - the need to develop assessment literacy (Stiggins 1995) in teachers and other users has become even more important so that they understand the advantages and limitations of assessment types and processes and are confident in developing and analysing arguments from evidence based on current understanding of validation (Black et al. 2010).
We also identified a number of new and evolving challenges associated with recent developments including:

1. Assessing collaborative learning with analytic and visualization support.
2. Increased time taken for performance assessment which comes out of teaching time thus making it crucial that assessment supports learning (assessment as learning).
3. The importance of a "data culture" in which stakeholders understand how to interpret data.
4. Establishing a policy approach that aligns summative and formative assessment perhaps involving using a sampling approach rather than testing all students when the aggregation level needed is at the organisation level.

2. Recommendations

Discussions of TWG5 at EDUsummIT 2013 led to three main recommendations:

- Focus on the development of assessments of collaborative learning in problem solving environments.
- Develop theory for big data being used by educational researchers.
- Engage teachers in the design of learning analytic tools for instructional practices and involve teachers and students in interpreting and using results.

A focus on the assessment of collaborative learning is pertinent, partly because the decision by the OECD PISA Project to assess collaborative problem-solving skills in 2015 means that a spotlight will be on this important aspect of 21st century learning but also because it is a complex problem that would entail and entrain a great many other issues relevant to the use of IT in assessment. In particular this focus enables consideration of the importance of the context of assessment, the role of assessment in promoting higher levels of knowledge and performance, and the role of assessment in determining what someone knows and can do. Some questions that emerged in discussion were: Is an idea substantial if it helped shape the final product by eliminating competing ideas and is not mentioned in the final? Is someone’s role in collaborative work completely documented in the final product. What if there is no final product? Are we interested in the impact of someone’s collaborative skills, or is it sufficient that we can know something about which skills they used during the collaboration? These issues have implications for policy-makers, practitioners and researchers.

Developing theory for big data use in educational research is a major recommendation for two primary reasons. First, assessment of digital performances presents major challenges to traditional psychometrics. Secondly, working with ‘big data’ needs to be included in educational research preparation and practice. Indicators of progress on this action item would be expansion beyond statistics in educational research, to include data mining, machine learning, and other topics and methods of data science.

The third recommendation, including teachers and students in the design of tools and the interpretation and use of results, is important to ensure a balance in the assessment purposes to include the impacts of the contexts of assessments (‘as’) and their usefulness for promoting learning and performance (‘for’) in addition to their role in determining the extent and quality for external audiences (‘of’).

3. Action plans

To realize the recommendations made by our group, the following actions will be undertaken:

- The group plans to work together to create a document for policy makers explaining the recommendations and identifying state of the art examples and next steps.
• A paper for the EDUsummit 2013 special journal issue is being planned and will focus on approaches and challenges for assessing collaborative learning.
• The group plans to share research progress in these areas over the next two years.
• Some members of the group are planning a paper reviewing technical developments in relation to these recommendations.

Participants TWG5

David Gibson, Australia
Mary Webb, United Kingdom
Eugenia Kovatcheva, Bulgaria
Cheryl Lemke, USA
Tiina Mäkelä, Finland
Bette Manchester, USA
Esther Marquenie, The Netherlands
Wolfgang Mueller, Germany
Michaela Reich, OAS
J. Michael Spector, USA
Ronald Slomp, The Netherlands
Ruben Vanderlinde, Belgium
References


1. Background: Setting up the stage

It has been argued that “Computational thinking represents a universally applicable attitude and skill set everyone, not just computer scientists, would be eager to learn and use” (Jeannette Wing, 2006, p. 33). In addition, Wing argues that this new competency should be added to every child’s analytical ability as a vital ingredient of science, technology, engineering, and mathematics (STEM) learning. Several professional bodies and think tanks in the US, the UK, and the Netherlands have called for more attention to CT in the curriculum.

Despite this interest in CT there are a range of issues and challenges facing us as we attempt to integrate CT in the curriculum. They range from foundational issues such as even defining what we mean when we speak of CT, to what the core concepts/attributes are and their relationship to programming knowledge; how these concepts/attributes are to be assessed; how it should be taught to students; what its developmental progress is (if any); how teachers are to be trained to effectively integrate CT in their classrooms; and finally the kinds of research that needs to be done to further the CT agenda in education.

2. Recommendations

One of the fundamental challenges faced by CT is the lack of clarity about what we mean when we say CT. Thus at one level the group questioned the very name of the domain – by deconstructing what we mean when we say “computation” and what we mean when we say “thinking.” It was argued that CT was about problem solving, problem finding, analyzing data, representing data, using algorithms and so on. And it was also about being creative, collaborative, as well. This leads to a fundamental disconnect about the very idea of CT.
At the micro level, CT can be seen as learning to program the computer (using some specific programming languages) while at the macro level we have a broad set of “ways of thinking” (such as systems thinking, problem solving, algorithmic thinking etc.). The group argued that the former (learning to program) was too narrow while the latter (the ways of thinking approach) was too broad to be useful. Furthermore it is not clear how the ways of thinking approach can be usefully distinguished from other 21st century skills such as abstraction and creativity.

The group at EduSummit2013 focused on CT suggested that the field needs to develop a better definition of CT, one that emphasizes the ability to not only solve problems with computers but learning to “speak” to computers. Thus CT was seen as being distinct from “working” with a computer (such as for creating a movie or writing a paper) to being able to “control” the computer. It was also suggested that CT needed to be more than learning to program and that the application of CT needs to be seen in diverse fields (not programming for the sake or programming) such as science, art, mathematics, robotics, etc. An important aspect of CT was seen as being the ability to augment human capabilities by learning to “manipulate” the abilities of digital technologies and beyond that to identify the appropriate technical and physical tools and understanding in how to apply multiple tools in appropriate ways to solve problems and/or develop solutions in a person/tool partnership (a form of distributed cognition).

The group also developed a “first draft” list of attributes of CT. These include:

- Analysis of problems & artifacts
- Algorithmic approaches to problem solving
- Movement between different levels of abstraction & representation
- Familiarity with decomposition, emphasis on modularity
- Development of computational artifacts
- An Understanding of data-structures and information structures
- Design thinking (reverse engineering) - how it is going to function
- Emphasis on debugging

Another area that the group focused on was how these attributes could be measured – i.e. could we identify behavioral co-relates to these attributes. One of the advantages of working with digital media is the “traces” that users leave behind. It was suggested that future work in the area develop techniques/analytics for “mining” these traces to assist in the evaluation and assessment of CT skills. Though there is still a lot to be done in defining CT (specifically in distinguishing CT from other cognitive competencies) the group believed that we had made a good step forward in this area through our discussions.

3. Action plans

A range of action plans were suggested. Broadly, the goals were as follows:

- Develop a conceptual framework
  - Define (what it is and what it is not)
  - Develop a common vocabulary
  - Identify “parallel” movements / organizations
• Develop measurable attributes
• Develop a scope and sequence, in order to achieve the most efficient and effective combination of steps and resources
• Identify research approaches and opportunities
  o In particular focus on what aspects of CT transfer to problem solving/problem seeking approaches in other areas
• Identify the audiences
  o Teachers / Teacher Educators; Computer scientists / Informatics specialists; Policy makers/Administrators; Maker movement and other informal learning groups; Industry

Participants TWG6

Punya Mishra, USA
Joke Voogt, The Netherlands
Petra Fisser, The Netherlands
Chris Dede, USA
Gaber Cerle, Slovenia
Miroslava Černochová, Czech Republic
Kinshuk, Canada
Sarah McPherson, USA
Richard Millwood, United Kingdom
Jon Price, Intel
David Slykhuis
Paolo Tosato, Italy
Tapio Varis, Finland
Participants EDUsummIT 2013

**TWG1 - Towards new systems for schooling in the digital age**
- Birgit Eickelmann, Germany
- Ola Erstad, Norway
- Smadar Bar-Tal, Israel
- Christine Bescherer, Germany
- Hans De Four, Belgium
- Koos Eichhorn, The Netherlands
- Keith Krueger, United States
- Don Krug, Canada
- Hans Laugesen, Denmark
- Pamela Moran, USA
- Ralph Müller-Eiselt, Germany
- Barbara Sherman, Cambodia

**TWG2 - Advancing mobile learning in formal and informal settings**
- Ferial Khaddage, Australia
- Gerald Knezek, USA
- Kwok-Wing Lai, New Zealand
- Rowland Baker, United States
- Bram Bruggeman, Belgium
- Rhonda Christensen, USA
- Jörg Dräger, Germany
- Gerard Dummer, The Netherlands
- Cathie Norris, USA
- Barry Quinn, United Kingdom
- Wadmany Rivka, Israel
- Elliot Soloway, USA
- Nicos Valanides, Cyprus
- Melissa van Amerongen, Netherlands
- Paula White, USA

**TWG3 - Professional development of policy-makers, school leaders and teachers**
- Peter Albion, Australia
- Alona Forkosh-Baruch, Israel
- Jo Tondeur, Belgium
- Cristiana Assumpcao, Brazil
- Sara Dexter, United States
- Salome Essuman, Ghana
- Jef Peeraer, Vietnam
- Juliana Raffagellli, Italy
- Dina Rosen, USA
- Debra Sprague, USA
- Lena Uerz, The Netherlands
- Hans van Bergen, The Netherlands

**TWG4 - Digital equity and intercultural education**
- Therese Laferrière, Canada
- Paul Resta, USA
- Marcus Childress, USA
- Gwang-Jo Kim, UNESCO Bangkok
- Maite Smet, OAS
- Miri Shonfeld, Israel
- Wai Man Tang, Cambodia

**TWG5 - Assessment as, for and of 21st century learning**
- David Gibson, Australia
- Mary Webb, United Kingdom
- Eugenia Kovatcheva, Bulgaria
- Tihana Mükel, Finland
- Bette Manchester, USA
- Esther Marquenie, The Netherlands
- Wolfgang Mueller, Germany
- Michaela Reich, OAS
- Ronald Slomp, The Netherlands
- J. Michael Spector, United States
- Ruben Vanderlinde, Belgium
- Joop van Schie, The Netherlands

**TWG6 - Advancing computational thinking in 21st century learning**
- Chris Dede, USA
- Punnya Mishra, USA
- Joke Voogt, The Netherlands
- Petra Fisser, The Netherlands
- Miroslava Černochova, Czech R.
- Kinshuk, Canada
- Sarah McPherson, USA
- Richard Millwood, United Kingdom
- David Slykhuis, USA
- Gaber Cerle, Slovenia
- Jon Price, Global (Intel)
- Paolo Tosato, Italy
- Tapio Varis, Finland

**TWG7 - Observatories for researching the impact of IT in education**
- Margaret Cox, United Kingdom
- Dale Niederhauser, USA
- Charoula Angeli, Cyprus
- Yessen Bidaibekov, Kazakhstan
- Ron Canuel, Canada
- Peg Ertmer, United States
- Sergey Grigoriev, Russia
- Vadim Grinshkun, Russia
- Lucila Perez, Ecuador
- Keryn Pratt, New Zealand
- Rosemary Samaniego, Ecuador
- Sarah Schrire, Israel
- Ann Thompson, USA
- Van der Ven-Padilla van Vliet, Jolanda
- Dolores Zambrano, Ecuador

**TWG8 - Digital citizenship and literacies around the world**
- Marsali Hancock, USA
- Mike Searson, USA
- Sohail Nusrat, Pakistan
- Bent Andresen, Denmark
- Carlos Macher, OAS
- Dave Edyburn, USA
- Mitja Jermol, Slovenia
- Carl Owens, United States
- Helen Padgett, United States
- Amanda Sherman, Cambodia
- Ira Socol, United States
- Adriana Vilela, OAS

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