Cross-National Policies on Information and Communication Technology in Primary and Secondary Schools: An International Perspective

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Abstract

The use of ICT in primary and secondary education has gone through a number of different phases over the last decades. Alongside rapid technological developments and changes in pedagogical paradigms, ICT policies have proven to be one of the main driving forces behind the implementation of ICT in education settings. The following chapter examines the relevance of such policies, plans, and frameworks from an international perspective, focusing thereby on the primary and secondary school sectors. In doing so, it provides valuable insights into international ICT policies. Aiming to provide a holistic view, it presents analyses of cross-national international policies as well as cross-national policies

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in different parts of the world. Given the multiplicity of education systems around the world, education policies regarding ICT vary considerably. Nonetheless, the analysis of cross-national studies uncovers a number of common core topics, directions, challenges, and potential future directions for ICT policies in primary and secondary schools. This compilation and examination of findings from international studies and their implications for ICT policies in turn reveal and reinforce the need for research-based and research-informed policies and strategies. The chapter concludes by collating the different lines of reasoning and developments and deducing potential directions for the development of powerful and responsible policies toward the use of ICT and its implementation in schools and school systems.

Keywords
ICT policy · Current developments on ICT in education · Future challenges · National and international plans

Introduction

In view of their responsibility to prepare students for what is commonly referred to as the digital age, education systems have assumed a key role in imparting digital competencies to future generations. The core questions in this respect revolve around the potential of technological developments to change and improve students' learning processes and outcomes, thereby ensuring their participation in a digitalized society. While the former concerns both the technological potential and the meaningful integration of ICT into teaching and learning scenarios, the latter addresses overarching aims of education and education policies such as equity and successful participation in all areas of society. Education policies on the use and implementation of ICT in schools and school systems play a crucial role in this context. In contrast to the other chapters in this section, this chapter does not look at such ICT policies in specific regions of the world. Instead, it aims to provide a more holistic view on the scope and topic of ICT policies for schools and school systems by adopting an international perspective. In so doing, the first part of the chapter endeavors to characterize ICT policies by defining categories to describe and analyze them. The second part elaborates and discusses the role of ICT policies formulated by international organizations. Commonalities in ICT policies in different parts of the world are outlined in the third part of the chapter, which also elaborates on the key challenges addressed or to be addressed in ICT policies. Findings from international initiatives and studies on ICT in schools and the implications drawn for ICT policies bring research and policies together in the fourth part. The chapter concludes by emphasizing the key role that ICT policies play as drivers for educational change and pointing to the responsibility that education stakeholders and researchers have to improve primary and secondary education in the digital age.

Characterizing Educational Policies Toward ICT in Primary and Secondary Schools

Education policies focus on overarching decision and planning strategies as well as on setting goals for education systems. Ideally, they forge a bridge between education plans and practice, shed light on the necessity for change, and provide both the solutions and the means for meeting and overcoming current or future needs in education. Analyses of education policy look both at how it has evolved and how it has been implemented and evaluated (OECD 2017). Comparisons of education policies in individual countries have to review corresponding trends and actions on the student level, e.g., in terms of student outcomes (especially equity and quality), preparation for the future, evaluation and assessment, or the quality of improvements to schools. They also have to look at such trends on the system level, e.g., how education systems are organized in terms of governance and funding to deliver education policy (ibid.). When it comes to policies on the use of ICT in primary and secondary education, Moonen (2008) points to the potential impact of ICT-related evolution on education policy. Seen from this perspective, ICT policies aim to improve and optimize the impact of the use of technologies in schools at regional, national, and international level. Moreover, it is assumed that they take the socioeconomic, educational, and cultural context of their respective education system(s) into account (Kozma 2011; Roumell and Salajan 2016), an aspect that affects their substantive and strategic impact: "The diversity of the technological, pedagogical, and cultural situation in a region has, most probably, a profound impact on what kinds of policies can be possible" (Moonen 2008, p. 1077).

A look at ICT policies for primary and secondary education from a global and meta perspective reveals that education policies in general – and in particular those that address the use and implementation of ICT – are characterized by a number of different aspects:

1. *Target group*: Policies can be characterized by their target group, i.e., the group or actors in education and education systems that they deal with or to whom they refer. Education policies for ICT in schools most commonly relate to students' learning culture and the organizational culture of schools (Ball et al. 2012). In order to have an effect on such cultures, policies may target education decision-makers, teachers, or school principals. They may also provide recommendations for curriculum development and thus function themselves as addressees (Vanderlinde et al. 2012).
2. *Authorship*: Policies can likewise be characterized by their authors and their corresponding background and philosophy. The different roles and formal positions of these authors (e.g., political stakeholders, political bodies, or nonprofit organizations) in the education system determine how a policy is aligned to the content of policy plans and how ideas, concepts, and aims are rationalized.
3. *Obligation*: The degree of liability and obligation characterizes the placement of the policy.

4. *Understanding of teaching and learning*: In the case of ICT policies, the way in which teaching and learning with ICT are understood differs and therefore constitutes a central characteristic of policies.
5. *Geographical scope*: Similarly, the geographical scope and radius of the policies or corresponding strategies can have an impact on their implementation.
6. *Timeframe*: The designated timeframe is likewise important for the success and sustainability of ICT policies. Defining this timeframe can be more challenging than it might seem: policymakers work in legislatures, and longer-term ICT policies require ideas that disregard technological developments. Although developing such ideas is a challenge, the resulting policies do appear to have greater potential to be sustainable. Technology-based policies tend to be more concrete and incorporate current or upcoming technological developments, which can be advantageous, especially when they meet the need of pedagogical ideas.
7. *Means*: Last but not least, the means needed to support the realization of education policy concepts and plans, e.g., support for schools, teacher professional development, and funding, can form part of ICT policies (and indeed should if they aim to be successful). Indeed, policies based on education programs in which resources are aligned with policy intentions seem to be more successful (Cohen and Hill 2001).

All in all, characterizing ICT policies by identifying their particular mind-set can help to understand and analyze them. However, the different characterizing aspects are not always documented (or at least evident) in all policy concepts and frameworks to integrate ICT into primary and secondary education. This has two main implications for their potential effectiveness. First, gaining a sound understanding of the concepts and the reasoning behind them remains a challenge, which in turn makes them difficult to realize as intended. Second, the lack of clarity regarding the different characteristics can diminish acceptance and purview by pedagogical actors, both of which are crucial aspects if education policies are to have an impact and induce change. Policies are deemed to have failed to have an impact in the classroom when they have no explicit links to teaching practice and teachers are unable to recognize their implications for teaching (Cohen and Hill 2001).

In light of the above, it can be concluded that all of the aforementioned aspects have to form part of (and be addressed by) an ICT policy if it is to be successful, forward looking, and productive. This assigns a high level of responsibility for education systems and societies as a whole to those who are in charge of developing ICT policies for school systems around the world. With such policies, policymakers fulfill the need to ensure alignment between the development of ICT in society, its integration into schools, and its use in teaching (UNESCO 2011a).

ICT Policies Provided by International Organizations

Responsibility and the sharing of expertise in formulating ICT policies for education and school systems are often assumed by international or regional organizations. Cross-national policies are important for providing social opportunities, e.g., by

facilitating social participation, prosperity, and social cohesion. This is especially relevant in the case of ICT policies, whose function is to provide general orientation in a world that is becoming more and more complex. Cross-national policies support countries and regions in the development of national or regional policies and thus enable the development of specific cross-national ICT policies (Moonen 2008). The actual purview of such policies depends not only on the core ideas contained therein but also on their legal range. Since most countries are members of international or at least regional organizations (e.g., UNESCO or the OECD), multinational plans are developed to cover interests that extend beyond a single country or region. In this regard, global institutions and organizations such as the World Bank (cf., e.g., Trucano 2016) or UNESCO have long shown their commitment to exploring the potential of digital technologies for student and teacher education alike, e.g., in terms of the opportunities they afford for e-learning or professional development. UNESCO, for example, already began developing ICT policies at a very early stage. Indeed, one of its core current papers describes a competency framework for teachers (UNESCO 2011b). The paper updates the 2008 UNESCO document on teacher standards and is aimed at "helping countries to develop comprehensive national teacher ICT competency policies and standards, and should be seen as an important component of an overall ICT in Education Master Plan" (ibid, p. 1). It contains a description of the rationales and overarching aims of the policy, statements regarding its understanding of ICT in education (e.g., the link between education and economic growth), and a clear and differentiated modular competence framework with indications for its practical application by different groups (e.g., school principals). The paper shows some of the typical characteristics of cross-national papers: it demonstrates expertise, elaborates on research findings and pedagogical experience, sets out concrete ways for implementation, but is non-binding, i.e., does not establish any obligation. Although the latter is not the aim of such a paper, this lack of obligation clearly restricts its implementation into education practice. As far as the categorization system for ICT policy papers (see above) is concerned, the paper refers (at least briefly) to all aspects apart from timeframe (aspect 6).

The analysis of education policies of the seven regions included in this section of the handbook (Australia and New Zealand, Asia, Europe, Latin America and the Caribbean, North America, North Africa and the Middle East, and Sub-Saharan Africa) mirrors the role that this and other cross-national policies play and how they have been transferred into practice – or at least how their ideas have been included in regional or national policy papers.

Commonalities and Challenges of Cross-National Regional ICT Policies in Primary and Secondary Education

Given the multiplicity of education systems around the world, it is not surprising that education policies, in this case with regard to ICT, also vary greatly. Although there appears to be a common understanding of the potential of ICT for learning, its use can still differ to some extent in pedagogical practice in line with the conditions and

needs of an individual region or country. Against this background, the following part of this chapter offers an overview of the main developments in this context in the abovementioned seven regions. In so doing, it considers recent developments in ICT and ICT policies, the relevance of cross-national strategies for individual regions, as well as the corresponding challenges and prospects. Elaborating on the insights and findings in the regional chapters in this section, the analysis contrasts developments and identifies core cross-national and cross-regional developments.

The contributions from the different regions indicate various recent developments and initiatives in ICT policies and implementation. One such development is the recognition and acceptance of the need for and benefits of a national ICT integration plan. While such plans and policies do, of course, differ in terms of their content, goals, and obligatory nature, the common thread that runs through them is an aim to reach all students within their education systems and enable all young people to participate in the digital age.

In Europe, for instance, many countries have already developed their own guidelines and projects. These include the "National Plan for the Digital School" in Italy, the "Digital Literacy Green Paper" in Malta, the "Lehrplan 21" ["Curriculum 21"] curriculum in the German-speaking cantons of Switzerland, the "Fit 21" program in Austria, or the nationwide "Bildung in der digitalen Welt" ["Education in the Digital World"] strategy in Germany (cf. ► Chap. 87, "Information and Communication Technology Policy in Primary and Secondary Education in Europe" by Ottestad and Gudmundsdottir). Such strategy papers either pursue the aims of rectifying lower than anticipated performance, e.g., in ICILS 2013 (Germany), improving resource availability (Denmark), and focusing on newly emerging competencies such as computational thinking (Czech Republic, Finland) or simply emphasize the importance of ICT for personalized learning (Estonia).

ICT has also been incorporated into national curricula in other regions of the world, where the strong economies in particular have set objectives for specific periods of time (ranging from a few years to over a decade). In Asia, for instance, Malaysia introduced the "Education Blueprint 2013–2025" to promote Internet access and support special needs, Singapore published its third "ICT Master Plan" (covering the period 2009–2014) to develop both collaborative and self-directed learning, and Thailand's second "ICT Master Plan" (2009–2013) aims to improve thinking and problem-solving skills through ICT, as does the fourth phase of South Korea's "ICT in Education Master Plan" (cf. ► Chap. 82, "Information and Communication Technology in Educational Policies in the Asian Region" by Yuen et al.). Taiwan's 10-year infrastructure program, which was introduced in the 1990s, now includes digital literacy as an official curriculum component, demonstrating a trend to incorporate ICT into teaching and learning processes. This trend is likewise evident both in China's three 5-year plans to enhance its ICT infrastructure and integrate ICT into school curricula as well as in Japan's "Knowledge Construction with Technology 2010" initiative to transform didactic teaching styles with ICT. India's "CLASS" studies and "ICT@Schools 2004" project view the decade from 2010 to 2020 as a period of innovation. Hong Kong has already moved beyond the ideal of integrating ICT into teaching and learning that was promoted in its third "IT

in Education Strategy" (2008–2013); its fourth strategy now focuses on the promotion of computational thinking (in analogy to the developments observed in other countries around the world).

In the Middle East and North Africa region, Kuwaiti and Jordanian approaches to ICT policy incorporate related skills at all levels of education (e.g., "National ICT in Education Strategy," Kuwait, 2008), with both countries also taking their policies beyond the mere provision of indispensable infrastructure (▶ Chap. 86, "Information and Communication Technology and Educational Policies in Primary and Secondary Education in the Middle East and North African (MENA) Region" by Alayyar et al.). Jordan, as a role model for the Arab world for the implementation of digital media in the school curriculum, has developed a policy framework that is continuously updated to meet the requirements and challenges of the ever-evolving technological domain. Saudi Arabia, on the other hand, has adopted an approach that involves numerous annual ICT releases instead of a stand-alone ICT policy. Like their counterparts in Egypt, Saudi students only learn ICT skills in secondary school; such skills have not been made a priority in primary schools in these education systems. While the funds for purchasing the necessary infrastructure are available in Saudi Arabia, other countries have cut funding for technology in education. This is the case, for instance, in the USA, where the "Enhancing Education Through Technology (EETT)" initiative was dropped in favor of a modernized "E-rate" program that lays the foundations for digital learning in conjunction with the "National Educational Technology Plan."

While some countries enact these policies at national level, others make a clearer distinction between states, provinces, or territories. In Canada, education remains a matter for the individual provinces, despite current national initiatives for online instruction. The province of Alberta, for example, has adopted the "Alberta Learning and Technology Policy Framework," which specifies the following (and other) priorities: student-centered learning, research and innovation, professional learning, access, infrastructure, and digital learning environments (▶ Chap. 84, "Information and Communication Technology and Educational Policies in the United States of America and Canada" by Davis et al.).

Many countries in Latin America and the Caribbean have likewise initiated digital agendas, most notably Uruguay's "Plan Ceibal," which goes beyond equipping primary and secondary schools to also install computers in private homes (▶ Chap. 88, "Information and Communications Technology and Educational Policies in Latin America and the Caribbean" by Castillo-Valenzuela and Garrido Miranda). Other education systems in this region have paid particular attention in their ICT policies to the professional development of teachers, e.g., those in Argentina ("National Teacher Training Plan") or Brazil.

While South Africa has made the integration of ICT a priority at all levels of schooling, other countries only have formal recommendations in place, the success of which varies greatly. The highest variance in the establishment of ICT policies developed and realized by national plans can be found in Sub-Saharan Africa (▶ Chap. 85, "Information and Communication Technology and Educational Policies in the Sub-Saharan African Region" by Tilya). Although all countries in

Sub-Saharan Africa have policies to guide the provision of education, not all of them have a policy on ICT in education. Those that do place particular emphasis on improving the quality of subject teaching and learning. One conclusion to be drawn here is that the most basic requirements (like ICT equipment and electricity) cannot be taken for granted in some of the countries in this region, resulting in poor conditions for digital learning. Their approaches to ICT are likewise manifold: ICT is taught as a school subject in Tanzania and Madagascar (from secondary school level), Kenya has developed an "ICT Trust Fund" to provide schools with the necessary equipment, while the Seychelles and Botswana both have an "ICT Master Plan" and a "Revised National Policy on Education" that includes digital media. In contrast, Burkina Faso and other countries in the region do not even have any formal recommendations in place regarding ICT in education.

Beyond the cross-regional trend to develop national ICT policy plans – be it with reference to overarching plans or not – some core ICT policy topics are common to many or even all regions:

1. Developing ICT infrastructures that reflect pedagogical aims, especially the fostering of one-to-one and BYOD ("bring your own device") concepts, often in combination with personalized learning
2. Focusing on access, equity, and participation
3. Reaching all students and improving teacher training
4. Bridging and linking formal and informal learning
5. Integrating the aims of (subject-specific) learning with ICT with more general education goals such as creating a skilled workforce for the twenty-first century
6. Introducing new topics (e.g., computational thinking) and modernizing curricula
7. Pointing to new potentials such as those afforded by new forms of online learning and online assessment as well as to risks and more critical issues like data privacy

These overarching topics can be rationalized by the challenges that education regions face with regard to the integration of ICT in primary and secondary schools. Like the other aspects of ICT policies and strategies discussed above, the implementation challenges are manifold and differ across education systems. While countries in Sub-Saharan Africa lack the essential prerequisites of basic infrastructure, hardware, connectivity, and electricity, other regions face less substantial but nonetheless still complex challenges. In North Africa and the Arab countries, for instance, a major focus needs to be placed on the pedagogical integration of ICT into teaching and learning processes. This meaningful use of ICT, along with teachers' digital competences and professional development, will likewise need to be a focus for further progress in Europe, Asia, and Latin America. The closing of the digital divide, both on a national and an international level, appears to be a global challenge in ICT policy and integration. The assessment of Latin American concepts points to a particular lack of coordination between global, regional, and national ICT policies, which can at times be contradictory or misaligned. Further emphasis should also be placed on personalized learning (e.g., in Australia, New Zealand, the USA, Canada, and Latin America) as well as on the responsible use of ICT, including issues of

cybersecurity (Asia) or privacy (the USA, Canada). The Asian contribution (► Chap. 82, "Information and Communication Technology in Educational Policies in the Asian Region" by Yuen et al.) also notes that a continuous measurement and evaluation of ICT literacy skills are imperative for improving student competencies and securing their participation in society. In contrast to the majority of the abovementioned education systems, Canada exhibits only minor issues in digital equity, while developments in the digital domain in Australia are largely "on track." The less-developed education systems do, however, still need to pay more attention in this respect, yet not be oblivious to the fact that digital technology – and consequently the potential that is linked with its integration into the education system – is an ever-evolving, dynamic domain that requires constant attention, development, and evaluation through ICT-related policies.

Research-Informed ICT Policies: The Role and Impact of International Research Initiatives and Studies

If we look back over the last decades, we can identify different driving forces behind the implementation of ICT in formal education. Alongside the more ambivalent discussion of economic interests, technological innovations (cf. Pereira and Pereira 2015), the potential for pedagogical change afforded by ICT, and the transition to an information and knowledge society (with its associated need for new forms of learning and new competencies) all call for a modernization of schools and school systems. Beyond political, social, and economic interests and aims, research findings provide evidence-based knowledge that supports the need for changes in education. The EduSummIT (International Summit on ICT in Education) initiative's 2013 working meeting focused, for example, on "research-informed strategies to address educational challenges in a digitally networked world" from an international perspective. It highlighted the relevance of basing ICT policy decisions on research findings and engaging in dialog with stakeholders and practitioners to interpret and turn these findings into pedagogical practice (Voogt et al. 2015). Two of the main findings were the need to identify what works (and what does not work) in the integration of ICT into education and to make research accessible to a broad range of stakeholders, thereby also improving the link between research and practice (EduSummIT 2013). Parallel to this, international studies have investigated ICT use in schools, hindering and supporting conditions in different levels of school and education systems and student achievement. The IEA's SITES 2006 (Second Information Technology in Education Study, module 2006) and ICILS (International Computer and Information Literacy Study) studies and some sub-areas of the PISA (Programme for International Student Assessment), PIRLS (Progress in International Reading Literacy Study), and TIMSS (Trends in International Mathematics and Science Study) studies have together established a huge international information base for ICT policies (e.g., Plomp et al. 2009). On an international level, ICILS and PISA both formulate recommendations for a future-orientated development of schools and school systems which can be understood as guidelines for policies on

ICT in schools (Fraillon et al. 2014; OECD 2015). More specifically, some of the recommendations of ICILS 2013 (▶ Chap. 6, "Students and Their Computer Literacy: Evidence and Curriculum Implications" by Ainley; see summary on pp. 24–25) point to the fact that the knowledge, skills, and understandings described in the Computer and Information Literacy (CIL) scale can and should be taught. Moreover, and regardless of whether young people are considered to be digital natives or not, the findings show that it would be naive to expect relevant ICT competencies to materialize without coherent learning programs. The study also concludes that policy planning should focus on increasing teacher expertise in ICT use. At school level, endeavors to implement supportive collaborative environments that incorporate institutional planning focused on using ICT and teaching CIL in schools should be supported. Some regions have also taken up the findings of the ICILS 2013 study on a cross-national level. They form the basis, for example, of the European Commission's ICT policy recommendations for EU member states (European Commission 2014). These recommendations, which include placing more emphasis on active teaching practices with ICT to equip teachers for effective pedagogical use of ICT, are directly addressed to policymakers. The commission also draws conclusions for its own future activities, e.g., follow-up work on a digital reference framework for learners and the development of a framework for educators (ibid).

While ICILS and PISA look at secondary schools, PIRLS and TIMSS address primary schools. Beyond their findings on reading achievement and primary school students' competences in mathematics and science, the most recent cycles of TIMSS (2015) and PIRLS (2016) provide an international comparison and assessment of ICT use. Classroom reading activities with ICT (e.g., reading online) vary from country to country within and across regions and are related to reading competence in different ways. This could be an interesting conclusion for policymakers and one that might move education systems into the digital age. On average, students read digital texts (19%), apply strategies for reading digital texts (13%), critique texts on the Internet (17%), look up information (25%), research a problem (19%), and write something (17%) in classrooms on a weekly basis (Mullis et al. 2017). Nonetheless, and despite the fact that such findings supply highly interesting insights into and a comparison of education systems, their pedagogical approaches, and efforts, few conclusions have so far been drawn with regard to their implications for future developments.

While these and many other findings of the abovementioned (and other) studies are of considerable interest for policy decisions to improve school systems around the globe, the link between research and policymaking, with a few notable exceptions (Bundsgaard 2016; Eickelmann 2016), remains largely untapped.

Conclusion: The Potential of ICT Policies to Move Education Systems into the Digital Age

The speed at which digitalization is currently affecting all spheres of life and work is still not reflected in how ICT is used in primary and secondary education. Although there are huge differences in how education systems around the world embrace the

potential of ICT to improve student learning processes and achievement and how they can help to establish modern school systems that provide everyone with access to knowledge and education, ICT policies can nonetheless function as a catalyst for educational change (Kozma 2011). The challenges facing education systems vary in different continents, countries, or even regions within countries. Developing appropriate ICT policies is therefore extremely challenging. Nevertheless, such policies play a key role in making sustainable changes, thereby empowering young people to participate successfully and autonomously in the digital age. The contrast between the rapid pace of digitalization and the slow pace of development of sound and well-considered ICT policies for school systems will remain a dilemma that can only be resolved when policies include not only different types of technologies but also overarching education aims such as participation, equity, and twenty-first-century competences. In this context, the PISA study provides both an in-depth analysis of ICT-related topics and research-based knowledge for policymakers (e.g., OECD 2015). Indeed, the OECD (2015) referred to PISA 2012 findings when formulating its "implications for digital technology for education policy and practice." These call on policy and practice to invest in skills to promote equal opportunities in the digital world, to raise awareness of the possible harmful aspects of internet use, to develop coherent plans (including teacher training) for the use of ICT in the classroom, and to learn from past experience to improve the effectiveness of future investments in technology.

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