United Nations
Educational, Scientific and
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UNESCO Institute
for Information Technologies
in Education

Recognizing the potential of ICT in early childhood education

Ivan Kalaš

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Analytical survey

UNESCO Institute for Information Technologies in Education

Author: Ivan Kalaš (Comenius University, Bratislava, Slovak Republic)

Contributors:

Elena Bulin-Sokolova (Centre for Information Technologies and Learning Environments, Department of Education of the City of Moscow, Russian Federation)

Maria Posicelskaja (Centre of Learning Technologies, Moscow, Russian Federation)

Natalia Tokareva (UNESCO Institute for Information Technologies in Education)

Maria Tsapenko (Department of Education of the City of Moscow, Russian Federation)

Irina Tuychieva (Kindergarten No 2558, Moscow, Russian Federation)

Vitaly Rubtsov (Moscow City University of Psychology and Education, Russian Federation)

Alexei Semenov (Moscow Institute of Open Education, Russian Federation)

Aleksander Veraksa (Moscow State University, Russian Federation)

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8 Kedrova St., Bldg. 3,
Moscow, 117292, Russian Federation
Tel.: +7 499 1292990
Fax: +7 499 1291225
E-mail: Liste.info.iite@unesco.org
iite.unesco.org

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Below is the list of all ECE centres we have been working with during this study. They go in the alphabetic order by country. The first column contains the reference codes we will use in the text.

C1	Brazil	Rio de Janeiro	Escola Parque Marquês de São Vicente Street 355, Gávea www.escolaparque.g12.br Teacher: A. Sobreira Torres (adriana@escolaparque.g12.br)
C2	Chile	Cunco Chico	San Francisco de CuncoChico Contact: P. Hepp, TIDE S.A. (pedro.hepp@tide.cl)
C3	Czech Republic	Prague	Mateřská škola Čtyřlístek Římská 27, Praha 2 www.ctyrlistek.biz Principal: Ms. D. Moravcová (rimska@ctyrlistek.biz)
C4	Cyprus	Maroni	13 Grigori Afxentiou, 7737, Maroni Principal: Mariangela Siakalli Contact: C. Papademetri, Dept. of Education Sciences, European University Cyprus (C.Papademetri@euc.ac.cy)
C5	Hungary	Budapest	Nyitnikék Óvoda, 1119 Budapest, Kanizsai u. 17-25 www.nyitnikekovoda.hu Principal: Pócsné Hermanics Mária Contact: M. Turcsányi-Szabó, ELTE, Budapest (tszmarta@inf.elte.hu) and O. Pasaréti, ELTE, Budapest (pasareti@gmail.com)
C6	Hungary	Budapest	Pitypang Óvoda 1181 Budapest, Kondor Béla sétány 12 www.pitypangovoda.hu Principal: Knizner Anikó Contact: M. Turcsányi-Szabó, ELTE, Budapest (tszmarta@inf.elte.hu) and O. Pasaréti, ELTE, Budapest (pasareti@gmail.com)

C7	Norway	Oslo	Linjen Barnehage, Haugenstuveien 52, 1084 Oslo Contact: N. Bolgan, Oslo University College (Nina.Bolgan@lui.hio.no)
C8	Portugal	Campo Maior	Centro Educativo Alice Nabeiro Contact: S. Correia, Cnoti, Coimbra (secundino@cnotinfor.pt)
C9	Portugal	Lisbon	Externato As Descobertas R. Capitão Mor Pedro Teixeira, 11, 1400-041 Lisboa Principal: J. Rangel de Lima (joaorangel@netcabo.pt; dir.descobertas@mail.telepac.pt)
C10	Russian Federation	Moscow	Child Development Centre – Kindergarten No 272 119454 Moscow, Vernadsky Avenue, 48 Responsible person: Irina Lebedeva Phone: +7(495) 431-19-95
C11	Russian Federation	Moscow	Educational centre No 627 115054 Moscow, Dubininskaya St., 42 Principal: Lyudmila Pavljuchenko (co627@mail.ru) Phone: +7(495) 235-71-44, www.co627.ru
C12	Russian Federation	Moscow	Kindergarten No 2483 Ostrovityanova St., 53, building 5 Responsible person: Natalia Gagarina Phone: +7(495) 420-90-01 http://ds2483.msk.ru
C13	Russian Federation	Moscow	Child Development Centre – Kindergarten No 2558 119261 Moscow, Leninskiy avenue, 76A Responsible person: Irina Tujchieva Phone: +7(499) 131-91-92
C14	Russian Federation	Moscow	Kindergarten No 1811 105203 Moscow, Pervomayskay St., 111 Principal: Aleksandr Ryvkin (aaryvkin@mail.ru) Phone: +7(495) 465-14-49, www.1811.ru
C15	Slovakia	Prievidza	Materská škola Ul. V. Clementisa, 251/12, 971 01 Prievidza Principal: Ms. E. Mujkošová (msclementisa@prievidza.sk)
C16	Slovakia	Bratislava	Materská škola Iljušinova 1, 851 01 Bratislava www.primaskolka.sk Principal: Ms. M. Králiková (riaditelka@primaskolka.sk)
C17	Slovakia	Bratislava	Materská škola Švantnerova 1, 841 01 Bratislava www.mssvantnerova.eu Pricipal: Ms. G. Strýčková (mssvantnerova.eu@mssvantnerova.eu)

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Foreword

Media, in particular, electronic media, has gained an astonishingly ubiquitous presence in the lives of the children around the globe. Research done on the learning of North American and European children has discovered that as much as 80 per cent of knowledge they gain by the age of 11 is learnt from the non-print media outside the classroom. There are at least three implications in this finding.

First, national education systems must reflect what is, without any doubt, an incontrovertible fact, namely, that the interdependence of the media and education is here to stay. Second, its force of unlocking of mankind's potential, while still imperfectly understood, must be analyzed and managed. Third and last, there exists no more fertile ground, on which the electronic media can become a force for good as much as for ill, than the mind of a child.

For many years UNESCO has been in the vanguard of multi- and bilateral agencies that promote early childhood care and education (ECCE). More than a duty, the Organization has argued, it is a moral imperative and solemn responsibility of all Governments that are signatories of Education for All and Child Protection UNESCO programmes. Indeed, in her address to the World Conference ECCE'2010 website, Ms. Irina Bokova, Director-General of UNESCO, stated that "early childhood programmes are an important means of guaranteeing the rights of young children. Strong foundations for children are also strong foundations for building more equitable societies."

The UNESCO Institute for Information Technologies in Education was created in Moscow in 1997 to serve a centre of excellence and provider of expertise as well as technical support in the area of information and communications technology (ICT) in education. In accordance with the Organization's Medium Term Strategy covering the period 2008–2013, IITE focuses its activities on enhancing the "capacity of Member States to harness the potential of ICT in education by means of evidence-based policies, teacher professional development and equity access for vulnerable groups." The recent targeting of ECCE is a new and highly promising programme activity of the Institute.

This publication, the record of a number of experiences in different parts of the world, illustrates how ICT is being integrated into early childhood education. With the first pages of the book the reader participates in a compelling journey through the labyrinth of innovative practices, educational policy, as well as constantly-changing culture of digital media. It is a result of the collaboration of educators, researchers and policy-makers. The work is, in many respects, exemplary and ground-breaking.

I would like to take this opportunity to express my appreciation and thanks to all those who contributed to this book. To start with the author Mr. Ivan Kalas who, having undertaken a comprehensive analysis of the topic, took the lead in the development of this publication. Thanks are due to Moscow experts Ms. Irina Tuychieva and Mr. Aleksander Veraksa; Mr. Alexey Semenov and Mr. Vitaliy Rubtsov, rectors of two leading Moscow universities, who participated in preparation of the

case studies, illustrations and related materials; Mr. Alisher Umarov and Ms. Natalia Tokareva, UNESCO staff, who coordinated the project; and of course, Mr. Qian Tang, UNESCO Assistant Director-General for Education, who provided support to our project activities. Mention must be made of the Department of Education of the City of Moscow (Russian Federation): its staff, primarily Ms. Maria Tsapenko, made it possible for our experts to visit Moscow kindergartens.

In closing, I wish to express the hope that the information presented in this book will contribute not only to raising awareness of specialists involved in ICT integration in early childhood education, but also will further promote the conditions required for development and prosperity of digital nations to be attained.

Dendev Badarch,

UNESCO IITE Director, a.i.

Executive summary

This study was commissioned by the UNESCO Institute for Information Technologies in Education (IITE). Its goal is to better understand the phenomenon of information and communication technology (ICT) and its potential for *early childhood education*, which means, to promote a more advanced development of children before they go to school[1]. Respecting requirements and challenges of the 21st century we strive to identify different aspects, which are relevant to the phenomenon, recognize its powers and risks, and reveal the trends of its further development. We want to frame preliminary principles and recommendations, which can help teachers, parents and school policy decision-makers to project further development in this field and outline another new agenda for the related and much needed educational research.

We focus exclusively on institutional early childhood education (ECE) – in kindergartens or centres, excluding the application of ICT at home. However, we are interested in various forms of partnership between centres and parents of the children – involving and concerning ICT in the learning process of children. Thus, the study does not fully neglect the role of ICT at home.

We have utilized three sources of information: (a) communication with a sample of 17 ECE centres from nine countries around the world; (b) review of the literature, which explores how ICT can enhance the learning environment in ECE, and how it can be integrated into a range of everyday ECE practices; and (c) experience of our own professional development and research projects in the ECE and ICT context.

We are aware of immense and hardly predictable dimensions of this task – and most of all, the occurrence of the so-called **digital divide**[2]: ICT is not equally approachable by all children in all continents, neither in institutional ECE centres nor outside them – at home. Nevertheless, we believe it is our obligation to study the phenomenon to understand better how to project it today and to harness its huge potential tomorrow. Our belief is proved by one of the ECE centres in the poorest region of Southern Chile. All children there belong to the Mapuche Indian community; their parents are mostly illiterate and have no access to ICT – yet they appreciate what their children do at the centre and trust the teacher when she says:

> *We believe in the power of ICT to motivate and challenge children, expand their perception of the world, their language and thinking, and develop their values as being indigenous. We see ICT as an important component of today's learning process, particularly so in poor surroundings.*

What does the literature say about ICT in ECE

Chapter 2 concisely introduces a short but dynamic history of the idea of exploiting new technologies in education – especially in early childhood education – for effective, authentic and attractive meeting of its learning objectives, whenever it is appropriate... Many education authorities believe that ICT can help children develop their competencies already in their early years. A number of researchers concerned with the proliferation of ICT have proved that new technologies considerably influence young children's lives.

---

[1] In different countries, *early childhood education* or *preschool education* may have different interpretations in terms of the age of children. In our study, we concentrate on the age groups from around 3 to 6–7.

[2] See Glossary.

Other studies warn of several perceived risks in this area. Many of those concerns result from the mostly incorrect belief that ICT in ECE encourages children to be **passive recipients**, or solitary computer game players **isolated from social interactions** in learning and playing. However, snapshots from ECE centres, which we present in Chapter 3, and numerous cases quoted in the literature, indicate that in real settings computers and other ICTs **integrate** into ECE learning experiences **alongside with many other kinds of activities**. Regrettably, some safety issues, like risks to eyesight from projectors associated with front-lit interactive whiteboards (IWBs), are often neglected or left unexamined.

A guiding principle in much of the literature on ICT in ECE is the concept of the **developmental appropriateness**, which provides a useful general framework for practitioners to develop their skills in recognizing and applying the most appropriate ICT products, forms and procedures. We cite an example of such framework that identifies nine general criteria for determining the appropriateness of the ICT applications and tools to be applied in ECE.

It is highly probable that ICT will continue to be a significant presence in children's learning environments throughout their schooling and into their adult lives.

Snapshots of practice

Chapter 3 consists of a kaleidoscopic mosaic assembled from the reports of the ECE centres we have been working with. The episodes, which we have extracted from the reports, give a rich insight into various aspects and approaches to creative integration of ICT into innovative early childhood education. The snapshots we have managed to represent an exciting collection of pedagogical interventions. They indicate the trends and help us recognize the potential of ICT in early childhood education, thus contributing to the main goal of this study.

This is my present to you (Diana, age 5)

Various aspects of the process

We have structured intentionally the collection of snapshots in such a way that they illustrate different approaches, designs and activities. The goal is to inform the reader about abundant possibilities and complexity of the area of interest. We then proceed with an in-depth analysis of the reports from ECE centres, which we confront with the findings from the literature and our own experiences. The intent is to identify and examine different aspects of the process of integrating ICT into early childhood education, namely:

- How this process is **initiated**, what is the motivation behind it?
- Which **categories of ICT** are used in the centres (and which are not, when compared with practices reported in the literature)?

- How are these technologies being implemented and used, how do **teachers organize activities with ICT** – indoors and outdoors, how are ICTs accepted and exploited by children, what are successful activities and recommended organizational forms?
- What is the actual level of ICT competency of ECE teachers, and how is their **professional development** organized?
- What role do parents play in this process, why and how should we create and support the **centre/parents partnership**?
- What are the areas of concern about **children's safety and health in the digital world**, how can we exploit ICT in favour of children's development in all domains?
- What are other roles of ICT in ECE centres?
- How can ICT be used to **support children with special education needs**?
- What kind of **ICT curriculum** are we constructing? What are our educational and developmental goals and instruments to achieve them, and how do ICT influence these?
- What are the most frequent **obstacles of this process,** and how do we cope with them? Where are we at present and where do we go from here, what are our plans for **further development**?

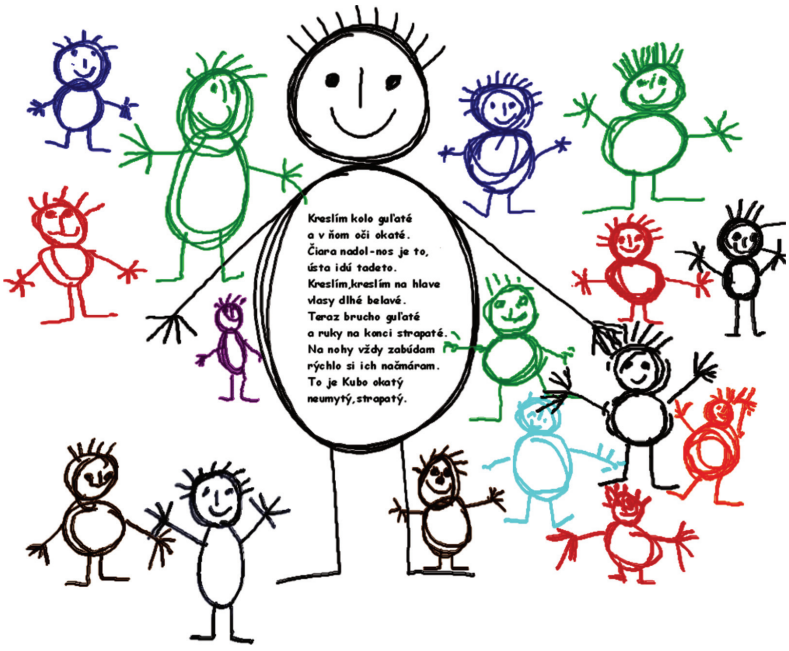
We examine how various categories of ICT are exploited in ECE centres and make two important conclusions: (a) the most (and only) productive way to minimize the perceived risks connected with ICT in the early childhood education is to integrate several ICTs into other activities; and (b) out of a broad palette of different categories the ECE centres usually exploit only a few – some challenging categories or types of tools are overlooked or '*undiscovered*' so far. Most frequently used are computers with educational software applications, often mediated by interactive whiteboards. We know that the well-designed on-screen applications help develop creativity by supporting a wide variety of possible inputs and responses of the children. However, **programmable toys may provide still greater possibilities**. This is valid for other categories of ICT: such tools can be **extremely motivating factors in children's learning**. They can be the tools children are willing to share and engage with, and can promote problem solving in addition to learning in the ways that were not possible before. For example, just think of the ways we can develop learning – indoors or outdoors – with ordinary **digital cameras**.

Children use different tools for digital recording with unprecedented ease and joy

A strategy for developing ICT capacity in your ECE centre

Based on previous findings we finally formulate a sequence of recommendations for a principal of an ECE centre, who has just decided to initiate the process of integration of ICT into the way children learn and play. We also hope to address a principal who strives to boost the already started transition, who wants it to go further, become more efficient, intensive and productive, enhanced with new ideas, new partners, new tools and goals.

We shape these recommendations as a series of eight steps: develop your potential; classify your position; set up your goals and objectives; build your environment; promote professional development of your staff; integrate, observe and reflect; build networks, plan further development. Their order, however, is not obligatory or unchangeable. Moreover, the sequence is not linear: some steps may run in parallel or iterate in cycles.



The use of IWBs serves many purposes, including the development of children's grapho-motor skills. The teacher prepared the poem and the matchstick boy in the centre. Then children added other figures.

1 Introduction

This study was initiated by the UNESCO Institute for Information Technologies in Education (IITE). Its goal is to understand better the phenomenon of information and communication technologies (ICT) and their potential for a more comprehensive development of children before they go to school. Respecting expectations, requirements and challenges of the 21 century we strive to identify different aspects relevant to the phenomenon, recognize its powers, and predict possible trends of development. Based on those, we want to frame preliminary principles and recommendations, which could help teachers, parents and school policy- and decision-makers to project further development in this field and to outline a possible future agenda for the related – and so much needed – educational research.

We are aware of immense difficulty to predict dimensions of this task. It appears even more complicated because of rapid changes in the field and the so-called **digital divide**: ICT is not equally approachable by all children in all continents, be it in institutional early childhood centres or outside them – at home. Yet, we believe it is our obligation to study the phenomenon in order to understand better how to describe it today and to predict it tomorrow so that we could harness its huge potential. As another dimension of the complexity of this task, we identify and acknowledge considerable differences in the structures of institutional education around the globe. On that account, we have endeavoured to include different voices in our study.

To understand the objectives of this study better, let us formulate some basic concepts we will work with.

Early childhood education

In different countries *early childhood education (ECE)* or *preschool education* may have different interpretations in terms of the ages of children. In our study, we concentrate on the age groups from around three to six or seven – before they go to school[3]. Throughout the study we use the terms *early childhood education* or *ECE* or *preschool education* as synonyms.

We decided to focus our study exclusively on **institutional early childhood education**, excluding the role of ICT at home. However, we are interested in various forms of partnership between ECE centres and parents – involving and concerning ICT in the learning process of their children (thus, the role of ICT at home is not completely neglected in our study).

Information and communication technology or technologies

Although frequently used nowadays, this term has different interpretations in different contexts. We will concentrate our attention on studying ICT in the context of education, where it usually refers to *implementing ICT tools, techniques and equipment to support teaching, learning and other cognitive activities*.

[3] According to UNESCO ISCED classification, we refer to children in their *pre-primary stage of life*, or ISCED 0 level, which is *initial stage of organized instruction designed primarily to introduce very young children to a school-type environment, i.e. to provide a bridge between home and a school-based atmosphere. Upon completion of ISCED 0 programmes, children continue their education at level 1 (primary education)*, www.unesco.org/education/information/nfsunesco/doc/isced_1997.htm.

In section 4.2, we present a more detailed classification of these *tools, techniques and equipment*. For now, however, it is sufficient to understand them as computers and educational software applications, data projectors, electronic whiteboards, digital cameras, digital tools for communication, programmable toys and other similar devices.

Note, however, that ICT – even in the context of education – is often perceived from two sides, or as having two wings: the technology as an **information medium** and the technology as a **construction medium**. As S. Papert[4] points out (Papert, 1999), education itself has two wings which also could be called **informational** (getting information and skills) and **constructional** (creating, discovering and constructing knowledge). Although both wings are equally important, the constructional side is sometimes undervalued. Therefore, more and more authors use the term **digital technologies** instead of ICT to emphasize the need for a balance between informational and constructional sides of their integration into education. In this study, therefore, we understand ICT in a *broad and well-balanced sense that includes both informational and constructional* sides and use ICT and digital technologies as synonyms.

Similarly to ICT, in this study we consider **ICT competencies** in equally broad and balanced terms as *competencies necessary for appropriate, productive and safe usage of digital technologies for learning and discovering* and use this term as a synonym to the often-used **digital literacy** (for more detailed definition see Glossary).

Figure 1.1 My friends (Martin, age 5)

Strategy and instruments of the study

The study started in May 2010. To meet its goal we decided to extend the group of the ECE centres with which we had been already working on a regular basis. In a short time, we managed to constitute a network of 17 ambitious and responsive ECE centres in nine countries and regions, with different cultural, educational and economic backgrounds. Though they are different in many aspects, there is an important common unifying factor – they all belong to the most innovative ECE institutions in their countries or regions with respect to integrating ICT in the play and learning processes. This *purposive sampling* (Cohen et al., 2007), has been established through the recommendations of the education and research authorities in different countries[5]. When we relate geographical diversity of the centres to significant consistency of their attitudes collected through the reports, we may consider this sample as a valid representation of actual innovative trends in the context of our interests.

[4] The author of **constructionism**, a theory of learning.

[5] Complete list of the ECE centres involved in this study, together with their precise identification and contact information, can be found in the Acknowledgements section

We communicated with the principals or leading teachers of the centres. Our strategy was to collect detailed accounts from those institutions, then analyze the data using the qualitative research methodology[6] and enhance our findings by a literature review and the experience from our own research projects[7]. As we note in section 2.1, the area of integrating ICT into early childhood education is relatively young. However, several researchers are already established in the area (see publications: Hayes, M. and Whitebread, D. (2006), Price, H. (2009), Reed, M. and Canning, N. (2010), Siraj-Blatchford, J. and Whitebread, D. (2003), Siraj-Blatchford, I. and Siraj-Blatchford, J. (2006), New Zealand Council for Educational Research (2004), Byron, T. (2008), etc.). They clearly represent the up-to-date state of knowledge in the area of ICT in the early years, and were extensively used in this study.

What have we learnt from sample ECE centres? Through our semi-structured questionnaire[8], a kind of template for their reports, we received extensive reports of their real situations, equipment, teaching staff and ICT competencies, institutions' priorities, activities and practices, strategies and attitudes, reflections and plans for future development. We collected a mosaic of concrete episodes – *snapshots of practice*. Throughout this study, we present our findings from these reports, or we directly quote them. When doing so, we always use italic dark blue font as in the following excerpt, which we find rather significant for our study. It comes from an ECE centre in the poorest region of Southern Chile. All children belong to the Mapuche Indian ethnic group; their parents are mostly illiterate and have no access to ICT – yet they appreciate what their children do at the centre and trust the teacher when she says:

> *We believe in the power of ICT to motivate and challenge children, expand their perception of the world, their language, and develop their values as being indigenous. We see ICT as an important component of today's learning process, particularly so in poor surroundings.*
>
> *San Francisco de Cunco Chico, Chile (C2)*

Safety concerns

Throughout our study, we bear in mind the following question: *What are the **potential benefits** and **perceived risks** of integrating ICT into early childhood education?* While all enthusiastic educators in the field highlight numerous and productive forms of integrating ICT into preschool learning and play, there are many writers in early childhood education who present an assortment of *safety concerns*. As stated in New Zealand Council for Educational Research (2004) or Stephen and Plowman (2003), there is few clear evidence about the degree to which ICT assume a real risk to children. At the same time, most authors agree that early childhood educators need to be aware of the debate about ICT use by young children, and the need to safeguard children's health and development, particularly regarding the use of desktop computers.

Structure of the study

In Chapter 2, we introduce a short but dynamic history of the idea of **exploiting new technologies in education**, especially in early childhood education, for effective, authentic and attractive support of its learning objectives, whenever it is appropriate. We also present an abridged review of the literature about ICT in early childhood education.

[6] See Appendix 4 for the details of the research methodology.
[7] We reported about our research for example in (Moravcik, Pekarova, Kalas, 2009).
[8] See Appendix 4.

Chapter 3 consists of a colourful mosaic assembled from the reports of the ECE centres. The *snapshots of practice* extracted from the reports provided a rich insight into various aspects and approaches to creative integration of ICT into innovative early childhood education. The snapshots represent exciting pedagogical interventions. They indicate the trends and help us recognize the potential of ICT in ECE, thus contributing to the main goal of this study.

Chapter 4 includes an in-depth analysis of the reports, which we juxtapose with the findings from literature and with our own experiences. The intent is to identify and examine different **aspects of the process of integrating ICT** into early childhood education. For instance, we explore what categories of ICT are being exploited in the ECE centres, how they are used, what role parents play in this process, what risks should be perceived and what safety rules should be stressed. We also pay attention to the benefits of ICT for supporting ECE children with special needs.

In Chapter 5, we finally formulate a list of recommendations for an ECE centre, a kind of scenario, which may assist and guide the centre when initiating or boosting the process of engaging ICT. These recommendations have emerged from the snapshots, reports, literature and our own experiences from previous projects.

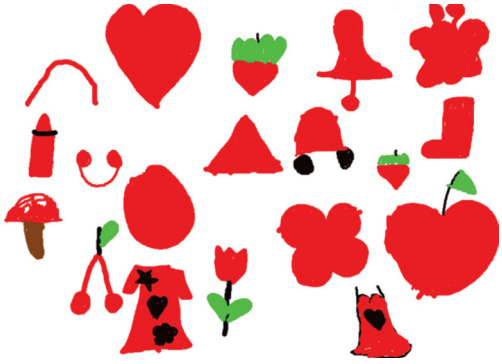


Figure 1.2 We like our new board so much…

This book includes several appendices. Appendix 1 contains background description of social interactions and ICT-based education. Appendix 2 explores other important aspects: if we strive to support the transition of ECE towards ICT use, how will the primary education react? Is it ready to benefit from these changes? Appendix 3 proposes a framework for the initial and advanced ICT-competency professional development programmes for the ECE teachers. Appendix 4 briefly presents the methodology used to conduct the study. Glossary provides definitions of key terms in the area of integrating ICT into education.

Completing this study we reasoned from the point that it is not necessary any more to prove that *ICT matters in early childhood education*. New digital technologies have entered every aspect of our reality, including families and lives of young people. They have already affected preschool children's play and learning as well:

> *ICT matters in early childhood education, because it already has an effect on the people and the environments that surround young children's learning and well-being. There is strong consensus across the literature that it is timely for the role and potential of ICT for the early childhood education sector to be critically examined, to guide future development and decision-making in this area.*
>
> *(New Zealand Council for Educational Research, 2004: 2)*

We should focus on the problems related to increased safety and efficiency of ICT use in ECE centres, collaboration with parents, promotion of teachers' professional development, etc. So let us conclude this reflection by an ECE practitioner's quotation:

> *The biggest challenge is to get enough time to develop personnel expertise. It is important to be able to do that... It is also important to highlight pedagogy and didactics, **focus on what we want kids to learn from this,** and why and how.*
>
> *C7, ECE Centre in Oslo, Norway*

2 ICT and early childhood learning

The main goal of the study is to better understand the use of ICT in early childhood education centres and its potential to support children in all developmental domains while they play and learn. We do not consider the arguments about whether ICT should appear in an ECE centre – scepticism about the appropriateness of ICT as a part of the educational provision for young children, is very rare today. As stated by Adams and Brindley (Hayes and Whitebread, 2006), those sceptics usually meant a passive child sitting mindlessly in front of a computer pressing buttons and being superficially entertained by fancy graphics on the screen.

In fact, the situation is very different today – and the reports of ECE centres presented throughout this study prove this. In many instances, the ECE teachers are enthusiastic advocates of the educational value of ICT. As Adams and Brindley continue *...by its very nature, being involved in the education of our young children is a creative and spontaneous enterprise.* ***Practitioners in this age phase are, perhaps more than in any other, confronted explicitly on a daily basis with the complexities and realities of learning***[9]*. As a consequence, they think deeply about it and are quick to identify experiences, which seem to be beneficial to the young children with whom they are working.*

At present, we witness not only an exceptional interest in creative integration of ICT into ECE, but also an unprecedented emphasis on the importance and quality of preschool education in general. We also see a substantial appreciation of the work of ECE teachers. We are well aware that they need to provide opportunities for children to learn and make sense of the world (Reed and Canning, 2010). They have to do this by developing an enabling environment, work in partnership with parents, protect children, understand a raft of policy initiatives and plan to meet the demands of the early years' curriculum.

Many countries have recently developed or are developing **ICT strategies for early childhood education**, others are currently creating such frameworks. So much attention to quality early childhood education has never been paid before. Challenging questions are emerging. For example, what is so extraordinary about how children play and learn in ECE centres or kindergartens? Some authors worry that primary school practices should not be allowed to penetrate into early childhood education. On the contrary, we should identify what is so special and efficient about learning in ECE centres, they say. We should preserve and support these strategies and implement them into primary and secondary schooling, or even in the life-long learning. This is the very main idea of the **Lifelong Kindergarten** project:

> *We should make the rest of school (indeed, the rest of life) more like kindergarten.*
>
> *What's so special about kindergarten? As kindergartners playfully create stories, castles, and paintings with one another, they develop and refine their abilities to think creatively and work collaboratively, precisely the abilities most needed to achieve success and satisfaction in the 21st century.*
>
> *Underlying traditional kindergarten activities is a spiralling learning process in which children imagine what they want to do, create a project based on their ideas (using blocks, finger paint, or other materials), play with their creations, share their ideas and creations with others, and reflect on*

[9] Highlighted by the authors of the study.

> *their experiences – all of which leads them to imagine new ideas and new projects. This iterative learning process is ideal preparation for today's fast-changing society, in which people must continually come up with innovative solutions to unexpected situations in their lives.*
>
> *(M. Resnick, 2009)*

We can hardly imagine an education institution (of any stage) today without any presence of ICT. More and more children encounter computer before they go to school, even before they go to preschool. It is then natural to notice that they are exposed to both positive and negative impacts of digital technologies. Therefore, ECE cannot ignore any of them. It must look for procedures and strategies how to engage ICT so that we achieve our learning objectives in a more effective, authentic and actual way, whenever there is a good reason for it.

Many educators believe that ICT can help children develop their competencies even before they go to school. As Siraj-Blatchford and Whitebread (2003: 19) point out, *young children today are growing up in a world, which not only contains but is also increasingly shaped by ICT. A number of researchers concerned with the experiences of childhood, with the spread of ICT, with cultural changes, and with early education, have made studies of the impact of the new technologies on the lives of young children. In broad terms, the following conclusions can be derived from these studies:*

- *new technologies are impacting considerably young children's lives;*
- *young children have very differential access to new ICT;*
- *parents are sometimes unaware of their children's exposure to these technologies and the material that can be transmitted via them;*
- *parents vary in their ability to provide appropriate experiences and support for their children;*
- *many children have much greater access to new ICT at home than they do in educational settings*[10]*;*
- *teachers are often under-informed and lacking confidence in relation to ICT;*
- *provision of ICT in early educational settings varies considerably, and is often very limited;*
- *communication between parents and educators about children's experiences in this area is often non-existent*[11].

It is not our goal to draw any general conclusions about ICT in ECE. In contrast, we have been working with purposive sample of innovative ECE centres so that we can examine the trends and try to set up a sequence of recommendations on how to start or boost the process. In this chapter, we, therefore, continue the literature review so that we can present the reader with a concise overview of how and when the idea of exploiting ICT in ECE emerged, what are the actual problems and issues studied and what attitudes are adopted concerning possible roles and goals of that process. In the next chapters, we utilize this overview for confronting or supplementing the attitudes of our sample ECE centres.

[10] This is not the case in any of the ECE centres from our purposive sample.

[11] As it is clearly indicated in section 4.5, this aspect has considerably changed since 2003, particularly in all innovative kindergartens.

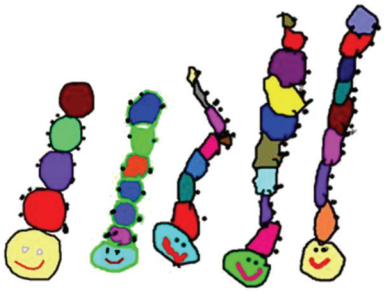


Figure 2.1 Caterpillars (Nicolka and Martinko, age 5, C17)

2.1 ICT in early childhood education: Short history, immense impact

Although serious and systematic research on the history of ICT in education would go beyond the scope of this study, we decided to include a short overview of how the idea of using ICT emerged, as far as we find it relevant and important for creating a complex picture.

French educator Célestin Freinet (1896-1966) was a real forerunner and precursor of using ICT in early education. He integrated the classical and modern pedagogical ideas and ICT existing in the 1930s to formulate a model of school that can be recognized as an educational framework for many modern applications of ICT in primary education and ECE. We reproduce here a quotation from the Freinet site[12] where additional references can be found:

> *In October 1924 Freinet introduced the technique of Learning Printing Technique. This meant that the children used a printing press to reproduce texts that they had composed freely. The pupils wrote down their own personal adventures, the incidents that they had experienced inside and outside the classroom, and so on. Usually these texts were then presented to the class, discussed, corrected and edited by the class as a whole before being finally printed by the children themselves working together. Freinet called this approach Free Writing ("Texte libre"). Later these texts would be assembled to create a Class Journal ("Livre de vie") and a School Newspaper ("Journal scolaire").*
>
> *From 1926 on, the productions of his class, particularly the School Newspapers, were regularly exchanged with other elementary school classes in France, whose teachers were also involved in innovative teaching. Freinet calls this the technique of School Correspondence ("Correspondance scolaire"). Later, this correspondence would spread throughout the world. The French teachers who used Learner Printing and others who were beginning to make and use movies and sound recordings with their classes came together in 1928 and founded the Public Educators' Co-operative (Coopérative de l'Enseignement Laïc, C.E.L.), soon to be known as "Freinet Pedagogy" or the "Freinet Movement". From 1932 they edited a magazine "The Proletarian Educator" (L'Educateur Prolétarien).*

The Freinet pedagogy is implemented today in schools of many countries. It is clear from this short description that modern ICT are 'tailor-made' for this pedagogy that is inherited by many educational systems from Ancient Greece to the 20th century. This means that ICT-school is not something completely new, foreign and invented

[12] http://freinet.org/icem/history.htm.

by manufacturers of computers, printers, and video cameras, but is the school needed by society and emerging within education. At the same time, as in other cases, ICT can move didactical approaches of Freinet to early ages.

The importance of ICT for education is not based on the modern chips used in them, but on the rich context they provide for activity of children and resulting cognitive development. In this broader context, Maria Montessori kindergartens from the beginning of the 20th century up to now, represent an approach to construct a learning-rich environment for early ages that influenced other developments, including applications of ICT. The same is true for Waldorf (or Steinerian) pedagogy which is commonly considered as 'technofobic', but in fact can mutually fertilize ICT-rich education. To summarize, ICT can and should be integrated both in the sense of environment and of pedagogy into a more general context of child development.

Back in the early 1960's, Moore and Kobler invented "The talking typewriter", a machine for teaching 3-year-olds how to read and write. Today we know that the machine itself was less important than the principles which guided its construction. The talking typewriter is just one of a large number of possible inventions which can be made using the theoretical context developed by the authors.

> *1. Perspectives Principle. One environment is more conducive to learning than another if it both permits and facilitates the taking of more perspectives toward whatever is to be learned.*
>
> *2. Autotelic Principle. One environment is more conducive to learning than another if the activities carried on within it are more autotelic.*
>
> *3. Productive Principle. One environment is more conducive to learning than another if what is to be learned within it is more productive.*
>
> *4. Personalization Principle. One environment is more conducive to learning than another if it: (1) is more responsive to the learner's activities, and (2) permits and facilitates the learner's taking a more reflexive view of himself as a learner.*
>
> *(Moore and Anderson, 1969: 585)*

The experiments with the Clarifying Education Environments based on these principles have shown clear educational effects. The Environment used a few rooms with the talking typewriter, copy machine as well as a meeting room.

It is noteworthy that the authors emphasize the development of learning skills and reflection.

> *… our goal as it is defined by the reflexive condition. We want the learner to see himself develop over time, to see his own personality as a whole. This means that he needs to see himself in perspective. …*
>
> *To be specific about this, imagine that we have 1,000 feet of sound-color motion pictures of a learner. Assume that in accordance with the reflexive condition we want to help him develop a sense of history about himself. So, let us place the learner in the position of a film editor. Let us ask him to select 250 out of the 1,000 feet for his own film library. Next, let us have the laboratory staff select 250 feet from this same 1,000. Next, let some significant person in the learner's life select 250 feet from the 1,000. (We have to be careful here so as not to violate the autotelic principle.) Let all of these selections be made independently – each "editor" is to act without knowledge of the others. Further, let both the filming and the editorial*

> *work continue over some reasonably long period of time so that the learner has had an opportunity to develop and increase his degree of skill and sophistication. Let us make one further assumption – we shall stipulate that each editor who selected from the basic film stock operated under the instruction to produce a film that is characteristic of the learner. We have now reached the point for the learner and the other editors to be patient to the consequences of the others' acts of agency. The learner will have the opportunity to see himself as others see him. We then can make it possible for him to make a new set of selections, that is, to make a new film, one that takes into account what others noticed about him. He may want to go back to the original footage and look for aspects of himself which everyone has neglected.*

It seems that today we fortunately have a technology that O.K. Moore was dreaming about fifty years ago.

> *All of the foregoing may sound hopelessly expensive and time consuming but with the advent of video tape and convenient editing devices this is not so impractical. In any case, in discussing the reflexive condition, as in the discussion of each of the other principles, the basic idea has been to illuminate possibilities. A clearer understanding of what is possible and desirable will undoubtedly have an effect on the development of appropriate technology.*
>
> (Moore and Anderson, 1969: 609.)

In the mid-1960-s, long before the advent of personal computers, at the time when a single computer occupied one or several big halls, Papert and Feurzeig[13] were pondering on the idea that **computers should be at children's disposal** so that they could learn in a different way. One of the products of their thoughts was Logo programming language for children[14]. Young doctoral student Kay visited them in 1968 and while flying back home from Cambridge, Massachusetts, he was writing and sketching… Now he is recalling that flight:

> *I had been working on a desktop personal computer in the late '60s. But on the plane ride back from Cambridge, I realized that the desktop computer was really just a phase, and that what we needed to be doing was working on a computer for children. For me, the potential of computers as an aid to learning was, in itself, a validation of them…*
>
> *Before I got involved with computers, I had made a living teaching guitar. I was thinking about the aesthetic relationship people have with their musical instruments and the phrase popped into my mind: "an instrument whose music is ideas."*
>
> *Well, when I sat down to think about it, I didn't worry about how long it would take. I just thought about things like, it better not be larger than this; it better not be heavier than that. I figured it should weigh about two pounds – any more and it would be too hard for a kid to carry. As to the dimensions, it had to be really thin, so you could carry other stuff at the same time.*
>
> *Excerpts from A. Kay (2002)*

Kay had envisioned the Dynabook, which he described as '*a portable interactive personal computer, as accessible as a book*'. The Dynabook would be linked to a network and offer users a synthesis of text, visuals, animation and audio. Kay drew an initial pen and ink sketch of this device, which is widely considered the prototype for the notebook computer, but in fact is much closer to today's iPad.

[13] Who in BBN represented bigger group of researchers.
[14] See also Glossary.

Some fifteen years younger are the first attempts to engage computers in institutional early childhood education. We will briefly mention two research projects from that time, which then inspired our interest in the area.

One of them is thanks to the French researcher Rachel Cohen, (1988) and (1994). From the mid-1980-s she initiated research in applying *...new technologies in the acquisition of written language and/or foreign language at an early age level*. She was using computers equipped with the voice synthesisers in the classes of children aged 3 to 6. Thus, children could hear the letters they typed, whole words when they pressed the space bar and the whole pieces of texts when they finished typing. Whenever they managed to type a word (using printed sheets of pictures with the corresponding words), the computer pronounced the word and the picture appeared on the screen. From such pairs of pictures[15] and corresponding words children created stories. Cohen reported most interesting observations from that time (Cohen, 1988, 1994):

> *(1) Children seldom went alone to the computer corner. Usually a group of three or four children worked together.* ***Interactions were numerous***[16]*, more than in other corners of the classroom. Children discussed what they wanted to 'draw', where to put the picture; they corrected one another... and cooperated in the task they had assigned themselves.*
>
> *(2) The pictures they chose became increasingly complex and well organized. The stories they typed became longer and longer. Starting off with a few words, the stories could be many lines long at the end of the year, sometimes even pages.*

It is worth mentioning the second project, which dates back to 1984. We got its detailed description through one of the ECE centres from Hungarian researcher Marta Turcsányi-Szabó. It is most probably the first version of Logo programming language modified for the needs of the ECE children. Due to its thoroughly designed interface, children were able to exploit some the most powerful **concepts of the Logo approach** – distinguish process (a procedure) and product (the drawing), create their own procedures, give them unique names, reuse them and share with other children, (see Box 3.1 and Turcsányi-Szabó, 1997a, 1997b and 2010). Clemens (2002a: 163) later validated those experiments:

> *Logo sometimes can be difficult for young children to comprehend. However, when the environment is gradually and systematically introduced to the children and when the micro-worlds are age-appropriate, they do not show signs of any problems. Thus, there is substantial evidence that young children can learn Logo and can transfer their knowledge to other areas, such as map-reading tasks and interpreting right and left rotation of objects.*

Alternative view on this short but dynamic history of ICT in education could also emphasize significant transition from *'learn about ICT'* towards *'learn through ICT'*. Fortunately, early childhood education teachers carefully and continuously assess and distinguish *experiences, which seem to be beneficial to the children* from those, that are not.

This brief retrospective of ICT in education can be concluded by reminding the names of outstanding philosophers, psychologists and educators – Montessori, Dewey, Piaget, Vygotsky, Freire and many others who helped us understand how important the period of early years is. They have also taught us to respect children

[15] Children could move the pictures by pressing the arrow keys.
[16] Highlighted by the authors of this survey.

and their needs, to respect their personalities and to care about the quality of learning environments we are creating for them.

2.2 What does the literature say about ICT in ECE?

The literature review commissioned in 2004 by the Ministry of Education of New Zealand[17] laid the grounds for the new Government's ICT framework for early childhood education and influenced Te Whariki – the curriculum for early childhood care and education in New Zealand[18] (Ministry of Education, 2009), as well as several similar ICT frameworks in other countries. The report pays particular attention to ICT being exploited by children and summarizes that, when used appropriately ICT can be a productive tool for supporting young children's learning and development. *Studies suggest that ICT use can provide a context for collaboration, cooperation, and positive learning experiences between children, or between children and adults. However, this will not necessarily happen of its own accord. Research indicates that practitioners must be conscious of the kinds of learning interactions they would like to occur in the context of ICT use (including between adults and children, or between children), and adopt pedagogical strategies to support these.*

This indicates the essential imperative, which makes the process of integrating ICT into early years productive and authentic, is **professional development for ECE educators**[19].

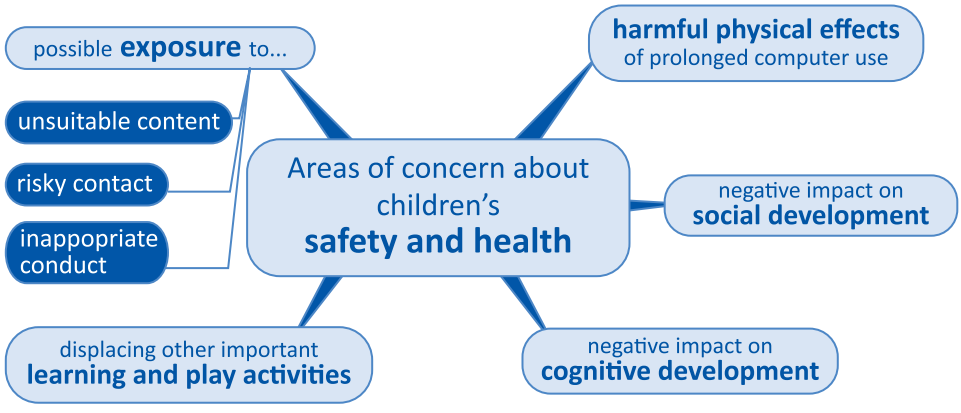


Figure 2.2.1 Different areas of concerns about children's safety and health as identified in literature

However, some researchers express **safety concerns** with respect to integration of ICT in early childhood education and warn of several perceived risks in this area. Based on (Byron, 2008), (New Zealand Council for Educational Research, 2004) or (Stephen and Plowman, 2003), we may classify them (Fig. 2.2.1).

These safety concerns are considered in Chapter 4 (mostly in section 4.7). However, we may already note the following:

- Most of the authors express their concerns in the context of using **computers**, in particular, **playing computer games**. Regrettably, many other important observable facts like using old monitors or risks to eyesight from projectors or engaging other digital technologies are often neglected, undiscovered or underestimated. These researchers often stick to belief that ICT in

[17] New Zealand Council for Educational Research (2004).
[18] *www.educate.ece.govt.nz/learning/curriculumAndLearning/TeWhariki.aspx.*
[19] This key aspect is thoroughly studied throughout this survey, particularly in sections 4.4 and 5.5.

ECE encourages children to be passive recipients, solitary computer game players isolated from social interactions in learning and play, deprived of movement, role playing, building things and other active experiences. However, reports and snapshots from the ECE centres presented and analyzed in Chapters 3 and 4, and numerous instances of other reports quoted in the literature, indicate that in real settings computers and other ICT integrate into ECE learning experiences **alongside with many other kinds of activities**. *ICT should not be seen as a way of superseding or displacing these kinds of experiences. For example, ICT use should not be at the expense of outdoor or indoor experiences that promote development of gross motor skills through running, climbing, jumping, swinging, and using wheeled toys* (Siraj-Blatchford and Siraj-Blatchford, 2006).

- To understand all safety concerns appropriately – those, which are considered in literature and those, which are not – a systemic, in-depth and actual research is required. However, the only efficient way to eliminate or at least minimize their effect in real settings is to involve a knowledgeable teacher. It is the teacher's responsibility to **appraise proper forms of ICT critically** and employ them **to support creative play and expression**, not only through the selective and supported use of particular software applications (including computer games), but also through the use of a range of different forms of ICT (for example, digital cameras and other tools for recording and communicating, programmable toys, educational robotics construction sets, or digital microscope, etc.), ... *both indoors and outdoors, for a range of different learning and play activities* (New Zealand Council for Educational Research, 2004: 23).

- A guiding principle in much of the literature on ICT in ECE is the concept of the **developmental appropriateness**[20], which provides a useful general framework for teachers and decision-makers to develop their skills **in recognizing and applying the most appropriate ICT tools** (hardware or software), see Table 2.1. This framework – well known as DATEC (the outcome of *The Developmentally Appropriate Technology in Early Childhood* project) – identifies nine general criteria for determining the appropriateness of the ICT tools (in the most general way) to be applied in the early childhood education. The authors say ... *we hope that these will not be interpreted in a simplistic way, but that parents and practitioners will use these points to engage in a discussion about each area and how it might fit into the general philosophy and practice of the particular setting. ... might be used as a tool to evaluate software programs or other ICT application* (Siraj-Blatchford and Whitebread, 2003).

[20] See Siraj-Blatchford and Whitebread (2003) and Siraj-Blatchford and Siraj-Blatchford (2006).

Table 2.1

The DATEC project criteria of developmental appropriateness

based on (Siraj-Blatchford and Siraj-Blatchford, 2006; Siraj-Blatchford and Whitebread, 2003)

The ICT tool should...

The ICT tool should be educational	Applications (tools) employed in the early years[1] should be educational in nature, and this effectively excludes all applications where **clear learning aims** cannot be identified.
The ICT tool should encourage collaboration	In the early years, we know that activities that provide contexts for collaboration are especially important. Working alone as well as in collaboration and in a range of other ways in interacting with technology is important too. However, *'joint attention'* and *'children learning to share'* and/or *'engaged jointly'* provides a better cognitive challenge for young children[2].
The ICT tool should support integration	ICT applications should be integrated as far as possible with other established early childhood education practices (play, project work) which make the curriculum relevant to the children. Another important reason for employing an integrated approach to ICT is the recognition that this is more consistent with the notion of **ICT products as tools**. Tools are designed to be applied for particular purposes when required; they are not usually designed for continuous use for their own sake... Equally inappropriate is the common practice of providing access to ICT as a reward.
The ICT tool should support play	Play is considered a 'leading activity' for young children; and it is widely considered to be a driving force in the child's development of new forms of motivation and action. Play[3] and imitation are primary contexts for representational and symbolic behaviour, and **role-play** is therefore central to the processes of learning in the early years. Artefacts, such as toys and other 'manipulables' (functioning or pretend), are important because they provide symbols for the children to play with. Computer applications also provide a means by which children may engage and interact with a much wider range of 'virtual' artefacts and environments than would otherwise be possible.
The ICT tool should leave the child in control	Generally, applications should be controlled by the child; they should not control the child's interaction through programmed learning or any other behaviourist device. While the evidence suggests that applications of this kind[4] may be effective in developing a range of skills including children's alphabet and phonic skills, counting and early number concepts, the approach is contrary to **popular conceptions of good educational practice**.
The ICT tool should be transparent and intuitive	As far as possible, we should choose only such applications, which are 'transparent' – their functions should be clearly defined and intuitive[5]. What this normally means in practice is that the application completes each clearly defined task in a single operation. The intuitive nature of the 'drag-and-drop' facility on a computer screen is a good example.

[1] By early years, the authors refer to the period of 3 to 5 year old children and their institutionalized education.
[2] See also Light and Butterworth (1992).
[3] In literature and in the ECE centres' reports one can find a lot of ideas and examples of potential value of ICT in terms of children's play.
[4] i.e., applications that control the child.
[5] We discuss this point in depth in section 4.2.

The ICT tool should avoid violence or stereotyping	Where applications fail to meet these criteria, it would be difficult to justify their use in any educational context.
The integration of ICT should support the development of awareness of health and safety issues	Where the use of computer is integrated with other activities, e.g., in socio-dramatic play, modelling, painting, etc. children benefit from greater movement and exercise away from the computer. DATEC... argues that the time spent using any desktop computer application by a child should be comparatively short, normally not extending beyond 10-20 minutes at a time in the case of 3-year-olds. DATEC suggests that this might be extended to a maximum of 40 minutes by the age of 8.
The integration of ICT should support the involvement of parents	Studies have shown that when parents, teachers and children collaborate toward the same goals it leads to improved academic performance. ECE centres report that children show a more positive attitude toward learning, and are better behaved. Home-centre links, or parent involvement, are, therefore, the components of effective early childhood education centres that merit special consideration.

From now on in our study we frequently refer to these criteria for **recognizing and applying the most appropriate ICT tools** (hardware or software), although, as it was clearly stated earlier, they should serve as recommendations and criteria for discussion and reflection, not as strict rules for assessment and evaluation.

Figure 2.2.2 A dog (Simonka, age 5)

The issues of how ICT can enhance the learning environment in ECE are also explored in literature (New Zealand Council for Educational Research, 2004). Research suggests that *...the value ICT can add to young children's learning environments depends on the choices practitioners make about which tools to select, and when and how to use these; and their understandings about how these tools can support children's learning, development, and play. ... They also need to be familiar with contemporary theories about learning and development, and recognize how these can be linked to the use of ICT.*

The role of ICT in supporting children with special needs is also studied (Siraj-Blatchford and Siraj-Blatchford, 2006). As Coles points out (Price, 2009: 105), *ICT ensures that all children regardless of ability or difficulty can be included in appropriate and meaningful learning opportunities*. ICT enables children with special education needs *...through various means, to access a broad and balanced curriculum, one that they might otherwise be denied.*

Literature moderately explores how ICT can support other aspects of early childhood education, like **planning, diagnosing, assessing and documenting**

children's development, administration and information management, sharing and exchanging information between centres and other institutions, etc., although there are few studies specifically devoted to the aspects of using ICT in ECE.

2.3 Using ICT to support child development and early learning

Children are curious and ask questions. They like to tell and listen to stories about themselves, other people and things. They like to draw houses, animals, trees, their parents, fairy-tale personages, etc. They like to make something, they like to play and interact with other people and animals. ICT can help children do many of the things mentioned. ICT can deliver content and activities that originate and support strong and productive emotions for children. Eventually they can serve as the environment and the tools for *development* of a child.

Vygotsky distinguished psychological tools from technical tools and provided

> *examples of psychological tools and their complex systems: language, different forms of numeration and counting, mnemotechnic techniques, algebraic symbolism, works of art, writing, schemes, diagrams, maps, blueprints, all sorts of conventional signs, etc. (Vygotsky, 1930).*

ICT tools are 'technical' tools in the Vygotsky sense as tools to change external objects, at the same time they can be integrated with psychological tools. According to Vygotsky:

> *By being included in the process of behavior, the psychological tool modifies the entire course and structure of mental functions by determining the structure of the new instrumental act, just as the technical tool modifies the process of natural adaptation by determining the form of labor operations.*
>
> *The inclusion of a tool in the behavioral process, first, sets to work a number of new functions connected with the use and control of the given tool; second, abolishes and makes unnecessary a number of natural processes, whose work is [now] done by the tool; third, modifies the course and the various aspects (intensity, duration, order, etc.) of all mental processes included in the instrumental act, replacing some functions with others, i.e., it recreates, reconstructs the whole structure of behavior just like a technical tool recreates the entire system of labor operations. (Vygotsky, 1930)*

Therefore educators are much interested to understand the role of ICT in promotion of ECE. Unfortunately, little in the way of systemic research and review has so far been carried out in this area. However, *if we are to use ICT to support early learning across the curriculum, then the technology should be integrated to support the development of positive dispositions toward learning. The most appropriate curriculum model to draw upon is, therefore, arguably an emergent one*[21] (Siraj-Blatchford and Siraj-Blatchford, 2006). We should encourage young children to apply ICT tools for their own purposes in their play. If we adopt an *integrated emergent* approach, we will be providing opportunities for children to develop in all areas of learning.

Siraj-Blatchford and Siraj-Blatchford (2006) identify four **key areas of learning** in ECE and reflect on how ICT could support them. These are:

- **communication and collaboration** – they naturally appear in collaborative problem solving, drawing, video recording, or construction, using scre-

[21] See Glossary.

en-based applications, in experimenting with programmable toys (that, but **adult intervention is often needed** to gain the most from the environments);

- **creativity** – to be creative, children need to acquire a repertoire of *schemes*, and they need the playful disposition to try out these schemes in *new contexts*. Well-designed on-screen applications assume a wide variety of possible responses from a child. They also allow a child to try things out and, if they do not work, to try something else. This can be regularly supported by innovative early years' practitioners using ICT... Perhaps most importantly, we should be provocative in our interactions with young children and keep asking them: *what if*...? There is an immense potential in ICT applications that offer the possibility of open-ended decision-making and problem solving. As Edwards and Hiler (1993) point out, in supporting creativity, we should encourage children to ♦ *look playfully for alternative ways of doing things,* ♦ *see that there is always a choice,* ♦ *make connections between things,* ♦ *make unusual comparisons, and* ♦ *see things from the points of view of others;*

- **socio-dramatic play** – there is an enormous scope for the integration of ICT into young children's play environments... successful experiments have been conducted using suitable software and touch screens in simulated travel agents, offices, and shop environments[22]. The possibilities are endless and the learning potential is considerable. While there is clearly a need for more in the way of ICT props – both software and hardware – to be developed, a great deal can be achieved by innovative practitioners working with the children in creating their own improvisations;

- **learning to learn** – there is a strong evidence that computers can be applied to help even young children *think about thinking* (as suggested by Papert, 1980), and that the ICT applications that support the development of metacognition and learning to learn are also those that most effectively support communication and collaboration and socio-dramatic play.

Hayes and Whitebread (2006: 22) look at the role of different ICT tools and their possible use in relation to the learning competencies of children, they study ...*holistic development of the child's disposition to learn*. Within this process, they examine the following areas of learning and how they could be enhanced by integrating ICT:

- ICT and literacy,
- ICT and mathematical understanding,
- ICT and science,
- Creativity, problem solving and playful uses of technology (games and simulations),
- Visual literacy and painting,
- Media education (digital animation),
- Learning of music.

As pointed out by Hayes and Whitebread, in order for ICT to make a contribution in these areas, it needs to be used by young children in ways which recognize and respect how they learn most effectively, and what is involved in helping them to become confident and creative thinkers (Hayes and Whitebread, 2006).

[22] Several examples based on the experience of the ECE teachers we worked with are presented in Chapter 3.

Using ICT to support literacy development

Development is the most general education goal for the earlier ages. Speech development is subordinated and generally coordinated with it. The formal (reading-writing) literacy on the one hand becomes less important in the modern world because of different types of automation of the activities – cf. Vygotsky above. (Most clearly, writing and reading are losing practical importance in the community of blind.) On the other hand literacy in a strict sense is dissolving now in much broader New literacy that embraces different media of communication and (very important) – their combinations.

Tim Waller argues that there are considerable benefits for learning when using ICT to promote this broader literacy.

> *Literacy is an area of learning that the use of ICT could greatly enhance. Moreover, the development of digital technologies has changed the nature of print-based literacy and led to the recognition of multiple literacies. (…) Current conceptions of literacy are not adequate when exposed to the light of technological advances such as online and networked ICT, which require us to redefine our understanding of the literacy curriculum. In addition, there is a growing recognition of the impact of digital technology on childhood and children's lives and the need to take account of the child's perspective of electronic media. (Hayes and Whitebread, 2006: 37) referring also to (Marsh, 2004), (Leu, 2000) and (Yelland, 1999).*

The benefits can be realized within the literacy curriculum and in most of children learning activities. ICT help children observe, fix, memorize, describe and share their impressions with other people, and to find answers to their questions. ICT shift and sometimes dissolve and eliminate borders between oral and written, between textual and pictorial, and even between internal and external.

Despite the recent increased funding of ICT resources in schools in many countries, there are still major issues concerning teachers' experience of ICT, access, curriculum application, management and resources that are hindering the realisation of the potential.

At the preschool age children usually play role games, and often the role inspires them to 'write' or 'read' something – a doctor's prescription when playing hospital, a pricelist when playing shop, a time-table at 'travel'. So, the activities of 'reading' and 'writing', how they look like, become familiar to them.

Children like to listen to the same book many times, look at pictures and follow mother's finger, when she points to a word she is reading at a moment (and even guess how she does it). In the mid-1980's "living books" (e.g., "Goldilocks and Three Bears") became popular. In these electronic books, the connection between

Figure 2.3.1 Creating a story (C6)

Figure 2.3.2 Combining different media in one story project (C10)

written (in the book) word and the pronunciation of the word was exploited. So, a child can listen to the book page-by-page, or guess what this word means, click on the word and hear how it sounds, or read fragments by her/himself, looking at the pictures. A 'living book' is a closed object – a child has not so much to do 'in it'.

In their drawings children mix letters or "letters" ('I write MAMA here') with pictures. These pictures are symbols of inner speech more than attempts to photographically represent reality (according to Vygotsky's theory).

These phenomena are in the base of ICT environments and instruments to support speech and literacy development of a child. The environments use the possibility of a computer to exploit the relations among:

- Object (or action, event, etc.),
- Picture (realistic fixation),
- Icon (symbolic picture),
- Oral name,
- Written name,

and opportunity to use one of these entities instead of another and to interchange them when it is needed and possible as well as to connect them with internal speech.

So, the next step is to have an instrument, an information tool that will help a child develop psychological instruments of literacy (not for formal reading and writing only, but for creation, understanding, and thinking).

An example of such information tool and environment is given by "Clicker" – created in the UK and introduced into most kindergartens and elementary schools in the country. This environment gives a child an opportunity:

- to listen to any written word or story,
- to link a picture, a written word, and a recorded sound of the word (and you can check the link you guess with the computer),
- to create ("write") a sentence with words, attached to corresponding pictures, or mixing words and pictures,
- to listen to a sentence read aloud by computer and then 'write' it – reconstruct it placing words in the proper order,
- to record the child's own oral word or text and to hear the recording,
- to input (draw, scan) new pictures, and type or assemble from letters on the screen new words.

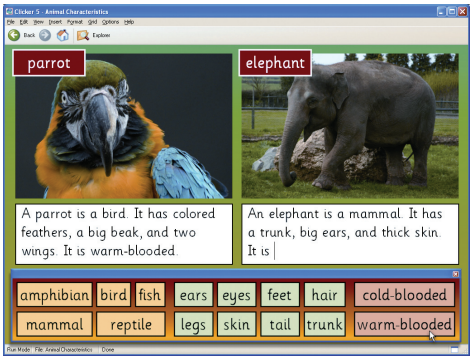


Figure 2.3.3 Learning to write with words and sounds

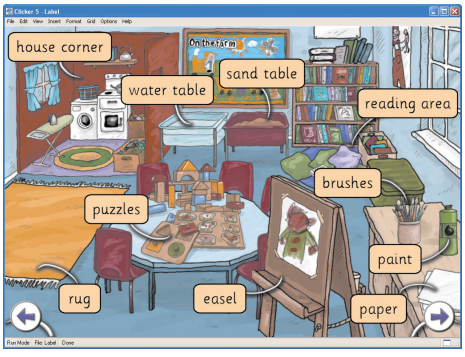


Figure 2.3.4 Linking pictures, written words and sounds

For example, an 'active reading' session of a short book (having paper and digital versions) can be divided into the following steps (different kids make different steps at the same time):

- Reading the book (by the teacher).
- Discussing the book and/or making a short performance based on it.
- Listening to the story once again, looking at illustrations and text on a big screen. This time children can see and hear any marked word.
- Listening individually when s/he can stop the story and click any word to hear it.
- Playing with words and phrases from the story on the screen and on the table. For example, place words "small", "medium" and "big" near corresponding objects or move them into proper sentences.
- "Writing" short texts using words and pictures from the story.

The play with words gives a child a pattern of written speech and communication before s/he will really know how to read and write correctly. It motivates a child to study speech and language. Vygotsky stresses the existence of a deep gap between oral and written speech and absence of motivation for writing as major obstacles in the process of learning to write. He also indicates drawing as a preliminary stage to writing. We can see how ICT can bridge this gap due to children's experience with linguistic objects (vocalized and written) and can increase motivation.

The described approach is naturally supporting various types of 'whole language learning'. It can be used also with children having learning difficulties and other types of special needs. (See Chapter 4 on 'going out' activity.)

Using ICT to support mathematical thinking and problem solving skills

Research carried out by Clements (2002a, 2002b) reports that computers can assist even very young children to develop mathematical ideas, provided teachers are able to choose and use proper software tools to explore mathematical concepts and relationships, in a way that scaffolds and extends young children's thinking, in particular, their higher-order thinking, by:

> *… allowing children to create, change, save, and retrieve ideas, promoting reflection and engagement; connecting ideas from different areas, such as the mathematical and the artistic; providing situations with clear-cut variable means–end structure, some constraints, and feedback that students can interpret on their own; and so allowing children to interact, think, and play with ideas in significant ways, in some cases even with limited adult supervision.*

While the **educational benefits** to young children of problem solving activities are widely recognized, organizing them effectively with young children often cause teachers a lot of difficulties, such as:

- for problem solving to be worthwhile, it has to be challenging, so that children often require fairly intensive help from a highly skilled educator;
- children's approaches to problems are inevitably varied; and the sheer variety of directions and activities embarked upon may be difficult to manage and resource;

- open-ended problem-solving approaches are difficult to timetable; the time that is taken to carry out particular tasks can be highly unpredictable;
- problem solving is often about trying out ideas and seeing if they work; through lack of experience children can, therefore, sometimes pursue ideas which are doomed to failure for a long time, and then experience severe disappointment;
- solving problems requires hard work and commitment from children, thus for the process to be effective, problems have to engage their interests and imaginations; 'off-the-peg' problems often suffer, as a result, in comparison with spontaneously devised 'real' problems; the later, however, require a huge organizational and imaginative effort from the educator (Siraj-Blatchford and Whitebread, 2003: 39).

ICT provide much richer context for children's problem solving, open-ended mathematical problems, projects integrating math skills and mathematical experiments. They also are helpful in extending school math beyond arithmetic and childish geometry to mathematics of reasoning, communication, and mathematics used in computer science. This mathematics can be presented to children in visual and palpable forms, and exploit opportunities given by screen objects, manipulations, processes and micro worlds. To summarize, ICT enormously extends an opportunity for preschool children to learn contemporary mathematics by giving her/him a chance to act in visualized mathematical micro worlds. We will give further evidence to this in the next sections and chapters.

Figure 2.3.5[*]*Arrange the pictures according to their sizes. The goal is to develop imagination, estimation and arrangement skills*

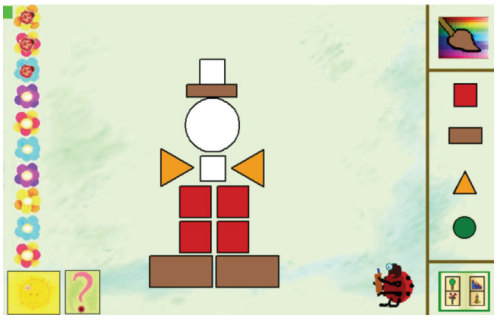


Figure 2.3.6 Colours and shapes. Colour identical shapes in the same colours. The goal is to recognize geometrical shapes and colours

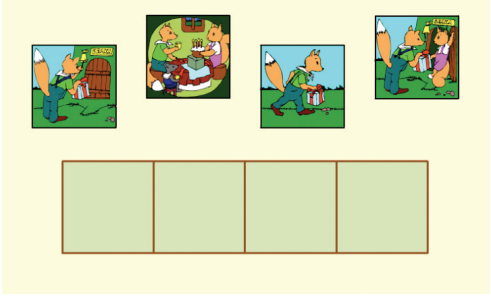


Figure 2.3.7 Place pictures from left to right in the sequence of events

Figure 2.3.8 Repeat the left picture in the middle using figures from the right. The correct sequence of moves is important

[*] Fig. 2.3.5 and 2.3.6 illustrate a Happy Ladybird software package produced by INFRA, s.r.o., Czech Republic. The pictures are the courtesy of INFRA.

Using ICT to develop controlling and planning skills

The important transition of humanity over the last century was a passage of 'an ordinary' person from a body in its social functions mainly controlled from the outside (metaphorically presented by Charlie Chaplin and Orwell) to an independent person making choices and decisions important for her/him and others – from family to nation and humanity. This choice and decisions are pieces of planning and controlling. The most important thing for a human is to plan own life and control it. How can we teach this? Of course, this is an important mission of the education as a whole.

The usual way to do this is represented by different kinds of games, for example tic-tac-toe, or card games, chess, domino, etc. ICT can extend enormously the scope of the games, including from one-hand side games that symbolically represent reality and imitate real events and choices, from another hand-side – games that include important elements of professional activity of algorithm design and programming. The ability to:

- control something happenning, and
- plan something to happen in a proper way in a variable environment with other active participants

is also called "algorithmic literacy".

It is remarkable that the ability to play a game against another person or nature is connected directly to the ability to understand logical (specifically – mathematical) statements of the form: for any *x* there exists *y*, such as for any *z*...

Programming of screen events

For computer environments used for development of algorithmic literacy at earlier ages one feature makes the task plausible – visibility of objects and actions. So, everything is "happening on the screen".

The first example of controlling screen events is given by a simple game of dressing a child for a winter walk. You can do it manually indicating clothes one-by-one, or you can programme it putting these clothes into a string (a *program*). Then you can push the 'run' button, see what is happening, and check if you were accurate in planning.

Figure 2.3.9 Dressing game

Figure 2.3.10 Robot in the maze

The actions are represented here by simplified graphical images (icons) of clothes. A sequence of actions is shown by a string of icons. Simple tasks start with direct control – choosing icons one-by-one. More compex tasks require planning – ordering of icons in a string.

The second example is the PictoWorld (or PictoMir – in Russian) environment. PictoWorld is developed by mathematicians from Moscow State University and the Russian Academy of Sciences. (Environments of this kind for teaching basic algorithmic literacy were invented in the 1980's independently by educators in Russia, Slovakia and the USA. The environment consists of the Robot being put into a maze. The task for the Robot is to escape from the maze, or to paint a part of it, or to do another presribed task. The mazes can be very sophisticated or even unknown while planning, but of a certain type known beforehand.)

The commands here are also presented by symbols. But the meaning of symbols now is not so immediate, familiar and intuitive. A child needs some practice to establish a clear association between left-turn sign and rotating of the Robot 90 degrees to the left, but this practice of immediate actions is happening in the visual environment.

As in the previous case, problems start with direct control of the robot and then programming is appearing. The programming problems here have a large spectrum of complexity (up to the level of real difficulty for high-school and university students and proofs of impossibility of certain algorithms.)

Supporting children from diverse cultural or language backgrounds

ICT may provide unique opportunities for scaffolding and supporting not only children with special education needs, but also children from culturally or linguistically diverse backgrounds. As New Zealand Council for Educational Research (2004: 32) reports, quality software can allow children to engage in self-exploration and tailor the software to their individual needs in a way that traditional print-based material cannot necessarily match.

Early research carried out by Cohen (1988 and 1994) reported in section 2.1 perfectly supports these ideas. Brooker and Siraj-Blatchford (2002) studied similar situation.

They describe computer use by three and four-year old children at an ethnically and linguistically mixed urban school:

> *The use of the computer by the bilingual children that we observed was especially valuable. It was frequently found that accessible language forms were being exemplified and supported through visual cues and animations, and that these were frequently repeated. Instances of language learning, and linguistic practice, in response to the software, were regularly recorded. The computer often provided a shared focus and experience for children, who didn't share the same spoken language, and this undoubtedly contributed toward the development of the very positive, collaborative, and language enriched multicultural learning environment that we observed*. (Brooker and Siraj-Blatchford (2002: 269.)

As pointed out in the New Zealand Council for Educational Research (2004: 33), ICT is a means of bringing children's home culture and experience into the ECE centre. In sections 4.1 and 4.2, we consider the Chilean CuiCui project with educational robotics in ECE centres, which strives to serve as a bridge between two cultures.

We will conclude this chapter with a selection of quotations from the reports of the ECE centres. They clearly illustrate that innovative ECE centres thoroughly reflect on the learning goals and possible benefits of integrating ICT into the learning, play and development of their children.

> *For our school, ICT has always meant* ***curricular integration*** *and* ***supporting cognitive processes****. Since the beginning, we perceived computers in school as powerful tools:*
>
> - ***To learn*** *– with the use of computers pupils can get information about many subjects. However, getting information does not necessarily mean significant knowledge. Giving lots of information to passive pupils is meaningless. On the other hand, computers are highly interactive, and if pupils take their own decisions, they can become active learners.*
> - ***To create*** *– computer is incredibly versatile and malleable. It is a device that comprises of many tools and uses different representations and data: texts, sounds, animations, images, photographs, diagrams – and any combinations of these. Computers allow children to express themselves, expand their knowledge while creating.*
> - ***To communicate and collaborate*** *– in small groups or over long distances, the use of ICT enhances quality and increases speed and diversity of communication. Collaborating in different teams and playing different roles is very important for us.*
> - ***To think*** *– children are remarkably active while interacting with computers. They can always change, extend, and review what they have done. They can try to test hypotheses, and evaluate "computer's reaction" to their actions. It is a powerful tool to make them aware of their own thinking.*
>
> *C1, ECE Centre in Rio de Janeiro, Brazil*

In C15, they add as learning goals also ...*look for information and critically analyze it; make autonomous and responsive decisions; and solve problems*. In C3, they believe that the obligation to engage ICT in ECE relates to the ...*necessity to develop children's skills to* ***accommodate, effectively communicate, be able and willing to communicate*** *and in future participate* ***in community and social matters and decisions.***

3 Snapshots of practice

This chapter of our study consists of a colourful kaleidoscopic mosaic assembled from the reports of the ECE centres we have been working with. The episodes, which we extracted from their detailed reports, give us a deep insight into various aspects and approaches to creative integration of ICT into innovative early childhood education.

Collecting episodes, which reflect *the emergent cognition in the field,* is a well-known strategy. For example, Siraj-Blatchford and Siraj-Blatchford (2006) present a collection of what they call *vignettes of good practice*. They pay special attention to vignettes in three distinct areas, namely *staff development*, *children's learning and their use of ICT*, and *working with parents*. We decided to present our episodes as *snapshots of practice*, trying to resist the persuasion that there already exists a generally accepted attitude to how we distinguish *good practice* or even *best practice* from less productive and proficient attempts. Nevertheless, the cases we have managed to collect constitute an exciting collection of pedagogical interventions into the territory of ECE. They indicate the trends and help us recognize the potential of ICT in early childhood education.

The first snapshot goes back to 1984 and proves what a powerful tool for children's self-expression a proper version of the **Logo programming language** can be. It also shows a surprise of the researcher who returned to the same classroom (and equipment) five years later…

The second snapshot verifies that ICT can be a highly efficient means of **humanization of the learning process** and a powerful tool for complex self-expression, which can be integrated into seemingly far differing activities.

Similar integration is illustrated by the third snapshot as well. It presents a *Space expedition* project, conducted by the whole class[23] divided into small teams.

The fourth snapshot shows children working with tiny **educational robots**. They first assemble them, and then program their behaviour.

The fifth snapshot is the only one to present a whole-class project, which not only lasted for more than one week but also got beyond the classroom and integrated the families.

The sixth snapshot deals with the families as well. It presents **exceptional cooperation of teachers and parents**. Their website represents a real portal of knowledge, cooperation and transfer of good practice among all actors of this important partnership.

The seventh snapshot is oriented towards **professional development of the ECE teachers**. It proves that probably the most efficient way of such development is the combination of initial external training plus one's *own learning by discovering* plus common peer coaching[24] with other teachers of the same centre and intensive engagement into a network of peer teachers from the whole region.

In the eighth snapshot, children became co-authors and producers of an animated cartoon movie. They took part in creating a script with objects of the folk craft as its characters. With a stationary camera they took single frames, converted them into a movie and dubbed the characters.

[23] In chapter 4, we find out that integrating ICT into a whole-class activity should satisfy strict requirements and is not frequently practiced.

[24] See also Glossary.

The ninth snapshot also deals with **collaborative creation**, this time a team of children uses a special open and unstructured digital story-telling tool, in which they scan their own backgrounds and characters – for example, *paper origami objects*. For these characters, children make up a plot, add written or spoken texts and build up a complex story out of single animated pages.

The tenth snapshot shows that it is the teacher, who learns – sometimes directly from children: their imagination and creativity is endless, when they look for new and unexpected contexts.

The eleventh snapshot illustrates the activities to support math thinking by employing alternative representations of basic math concepts – from tangible physical objects to their visual interactive computer models.

Finally, the twelfth snapshot closes the loop with an excellent experience of one of the most prestigious and influential Logo versions for the early childhood education.

By selecting and presenting these episodes, we want to help identify and illustrate the potential of ICT in all developmental domains of the ECE children. We are pleased to observe that our selection confirms unexpectedly rich possibilities of integrating ICT into everyday activities of the ECE centres. Furthermore, we believe that these snapshots still are only the first steps of the process.

Figure 3.1 Three, two, one… and off we fly into the Universe! (C16)

Box 3.1

Early childhood: Period of great explorations and revelations!

My son at the age of 4 accompanied me at an international conference. While I was preparing for my presentation, I let him sit in front of a computer running Logo and showed him the effect of "FORWARD" command, knowing that he was fond of numbers. He immediately started exploring it with different parameters to witness the distance the Turtle went forward. He first started out with familiar numbers of one or two digits, but later got more eager to enter much bigger ones. But, numbers with more digits did not produce notable effects, so he started to go backwards, writing smaller and smaller numbers. Suddenly, he shouted out: "*Mummy, do you know what 0 is? It is just NOTHING!*" This great revelation stayed deeply within him with the memorable content.

This made me develop a complex tool – KIDLogo – for ELTE University kindergarten in 1984 and got loads of revelations myself on the treasures that this age group was able to dig up and manipulate with. Estimation of lengths and angles meant no problem for kids as well as their fluent use to express exactly what their intentions were in terms of **self-expression** while drawing (Fig. 3.1.1).

They had no problem to understand and use the iconic drawing tool with 30 degrees of turns at a key press and even understood and changed the angle (experimenting to get the right value) when the drawing required that. They all took up a challenge in finding the right letters on the keyboard to write their names on the drawing or express their textual explorations and quickly mastered the fact that the computer was able to learn drawing different figures if they give their drawing procedure a name. At first they used their own names, those of their brothers/sisters and parents in sequence, but around the fifth attempt, they insisted on using the name that represents the drawing itself. They were well aware that these saved procedures could be reused from different angle settings and could also be modified by others for repeated use. They understood perfectly well the difference between **saving a drawing** with a file name (to be printed later) and **saving a procedure for drawing** (that is, the program) with a file name that can be later retrieved and further worked on or shared with others (Fig. 3.1.2).

After a year of experiment I left abroad and the only kindergarten teacher able to use this program left to another kindergarten. The project was thought to be left to die! However, returning after five years, I was shocked to find out that **everything was running on**: kindergarten teachers just allowed children to switch on computers (even if they were themselves not aware of what was going on), while working, **older children taught the younger ones how to use the program**, and thus, it went on and on for years quite swiftly. Collaboration was one of the buzz words, as this is how they were always helping each other attaining own goals and burning desire to grow up to a next challenge was the other secret key to success.

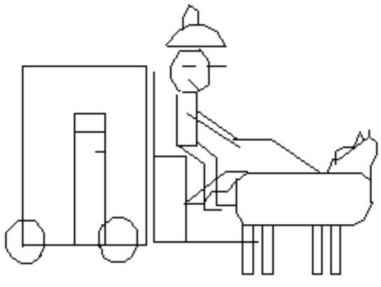


Figure 3.1.1 Self-expression, art and creativity

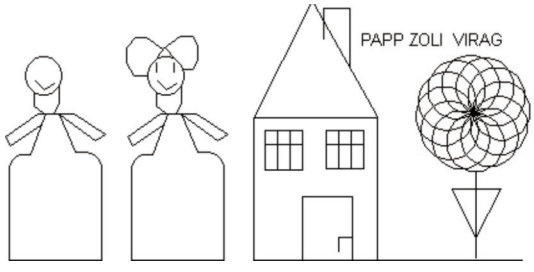


Figure 3.1.2 Reuse, angles and turnings

M. Turcsányi-Szabó, Budapest, Hungary, see also *www.slideshare.net/Turcsi/kidlogo-project*

Box 3.2

Dreaming and dancing with ICT: Developing creativity

I like to work with ICT because it enables me to see the results of my work in dynamics. At my sessions, I use **Dreamer's Magic Designer** (on the left). Creative environment of the program allows revealing **individual abilities of each child**. It is so interesting to observe how children create their images, buildings, how delighted they are during the process of working with the computer; it is interesting to guide them in search of new solutions in creating different compositions.

Recently, I conducted a session called *Waltz of the Flowers*. The beginning of the session was accompanied by famous *Waltz of the Flowers* by Tchaikovsky. Wonderful sounds of music were spreading all over the room while children entered the computer class, where a real flower gallery was waiting for them: floral bouquets, rose petals and flowers made of paper (Origami), photos of flower meadows, floral artwork made by children. The room looked magical, ready to spin in a rhythm of waltz.

Together with me, children recollected their summer vacations, nature and flowers: dandelions, daisies, roses, carnations. I asked children: *What are flowers for?* The children tuned into lyric mood by the waltz and room decorations answered: *to make beauty, to raise our mood, to smell sweet, to give them to mother, to make garlands*.

Then I invited children to take petals, throw them up and observe how they spin when falling down. I asked: *Do you think it looks like a dance of colours? Let's imagine how the flowers are dancing*. The children closed their eyes and started imagining the dance of flowers and rocking gently.

Finally, children started their work on computers: Using the Flower Fantasy workshop of Dreamer's Magic Designer every child started creating his or her own dance. While working on the computer some children silently dreamt about the dance having their eyes closed. One girl stood up, danced and sat back again to continue her work.

I admired the variety of solutions that children showed. In a dance of one child, small flowers were drifting around one large flower; second child made flowers dance in pairs; third child made a colourful kaleidoscope of flowers and petals of all types forming a ball.

These ideas could be used in a real dance. The drawings were passed to the teacher of rhythm. At a dance session each child showed his or her own dance to the teacher; dance, which he or she fancied and created with the help of a computer.

That is how **creative ICT applications, classical music and talent of a child turned children into young choreographers**.

Figure 3.2.1 Dreamer's Magic Designer

Figure 3.2.2 A fish. Composition at the interactive board

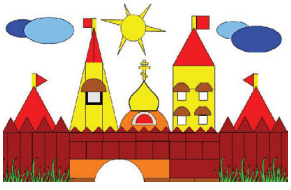


Figure 3.2.3 Moscow Kremlin

Figure 3.2.4 My family

C13, ECE Centre in Moscow, Russian Federation

Box 3.3

Complex activity for the whole class

Space has fascinated children of my class for a long time. One day I showed children several picture riddles – the real space photographs found on the Internet. Children had to guess what was on the pictures.

After the short introduction, children were divided into four groups, each of them having specific mission. Two children were drawing a picture with the Space topic in the ICT corner using their imagination (Fig. 3.1). They used a children graphics editor and a tablet as a tool for self-expression. In the Arts corner, a group of four children was building a space ship of large foam rubber kit. They made space suits of old T-shirts and shiny kitchen foil. Then they staged a drama – they tried to imitate the flight of a space ship, the movements of the astronauts in the space and so on. Four children played with a programmable toy. They sought for various alternatives of the routes for the toy, which should travel to imaginary planets. Children were enthusiastic to take pictures of other space travellers, played some dramatic pieces about the life on other planets, tried to find the rhymes and decode the alien's language.

Each planet offered different adventures – the players chose a picture card with a challenge and tried their best to succeed (e.g., find the rhyme for the word 'rocket', dance as a space monster, listen to and guess the solution of the riddle, imitate the motion and face expression of happy and sad cosmonauts). The planets differed by the colour which also determined the type of each challenge card.

The other group of children was constructing a flag for the spaceship and for the planets. They were drawing, cutting, pasting and crumpling the newspapers and old paper boxes. The last group of children relaxed in a special room called Dreamland. Children pretended to travel on a waterbed; watched space pictures projected on the wall and listened to meditative space music.

The groups are involved in each activity in turns during half a day or the full school day.

Figure 3.3.1 Building the Universe...

Figure 3.3.2 Planning a trip with a Bee-Bot

Figure 3.3.3 Role playing

Figure 3.3.4 Drawing a flag

Figure 3.3.5 Well deserved relax

Figure 3.3.6 Final reflection

C16, ECE Centre in Bratislava, Slovakia

Box 3.4

Iconic programming in inducational robotics for ECE

The main idea in educational philosophy of constructionism is to construct child's knowledge in the process of internally motivated construction of something relevant for him/her and for people around. This something can be a model made of LEGO bricks or a process of movement of a programmable toy, or a program of action for the Turtle in PervoLogo.

Robotic environment for little kids named WeDo combines all these three options for construction.

The WeDo activity starts with learning how to assemble a WeDo Robot from parts ('Lego bricks' including a microprocessor, motors, etc.). The learning material is presented to a child as a computer movie (but exists also as a printed matter). So, here the computer teaches the child.

At the same time, the task for a child is the opposite: to "teach" the robot to do something, for example, play soccer (football). The constructed model is wired to the computer. The 'teaching' (programming) occures at a computer screen. The icons there represent actions of motors and whistles, etc. The child tries different icons and sees what the robot is doing. Then the child constructs the plan of action (and in the more complex cases – interaction). This context is more abstract than direct work with programmable toys, so, to help young programmers, the teacher can first try to realize commands in physical activity of children. In the process of construction a child reflects on his/her own actions (as being the robot) and discusses this with the teacher.

To make a crocodile that closes the mouth when a hand is put on it, the child should use sensors and represent cause-effect relation in sequence of iconic commands. It needs a new type of reasoning 'what if', to program this interaction.

General doing and thinking strategies can be exercised in the activity and can be a basis for transfer and generalization later. These strategies include top-down (divide-and-conquer) analysis of the task and assembling the program from parts. The child should certainly follow the trial-and-failure procedure and not to be afraid of failures.

The critical factor of success is social interaction between participants, discussion with teacher, presenting results, including 'how I decided to …', etc., as well as the original motivating context of soccer championship, visiting the Zoo, etc., playing with constructed models, and including them into the context.

The minimal time, needed for the WeDo module can be 3 play-lessons of 30-60 minutes each. Every lesson includes short explanations of teacher, several group discussions, individual and group work.

Figure 3.4.1 The child "teaches" the robot that he has constructed to play football

Figure 3.4.2 Simple program for a biting crocodile

C10, ECE Centre in Moscow, Russian Federation

Box 3.5

My Town: Beyond the ECE centre

The aim of the *My Town* project was to develop different competences of the children by connecting education and real life experience with the help of their families together with children's own effort to find out more about their town, to observe, document, and present. Communication skills, collaboration skills and creativity were developed.

During the first phase of the project children found out what sort of information they were going to collect and how they were going to process and present that information. We agreed that everyone would choose three cultural landmarks of the town (out of those, we spoke about before) and would visit them with parents and take pictures with a digital camera during the next weekend. Afterwards, the second phase of the project was realized in our centre – for about an hour every day. Using a computer with a mouse and tablet, data projector, video camera, Internet and printer, children were creating a presentation out of the pictures they had taken the weekend before (which they brought on USB flash drives) and other materials which they found on the Internet. The second task was to observe and comment on the presentations of other children. This should prepare them for the guided walk.

The children were divided into teams. The first team was working on the computer. Children were already familiar with some basic steps necessary for browsing and searching for information on the Internet. They run key word search (the key word was given by the teacher); they were able to work with a page view and to find full-size pictures. Children were able to copy, print or delete those pictures. With a little help, they managed to find other pictures of the towns they had visited during the previous weekend. They were talking to each other, trying to persuade the others of how special the landmark they had chosen was.

Another team of children played with a programmable Bee-Bot. Under a transparent mat, they put pictures of the most famous landmarks of the town that the bee should visit. They developed their algorithmic thinking when planning the shortest and the longest journeys. Other children recorded their classmates with a digital camera; they made interviews about their experience: *I liked the view from the castle. I didn't like the scaffolding which we saw on the way to Apollo Bridge. I liked the new pedestrian zone*.

Some other children were drawing their own experiences or remaking pictures of Bratislava using a tablet. Another group created their own sheets in a graphic program, they also tried to build the famous landmarks out of some basic geometric shapes. During the next school year we plan to add a new phase to our project – documentation, which will be created by children and later presented to their parents.

Figure 3.5.1 Preparing a visit to the airport

Figure 3.5.2 Video documenting her peers

C17, ECE Centre in Bratislava, Slovakia

Box 3.6

Parents as important partners in modern education

Modern ICT used in education initiate a need for new forms of interaction between **teachers and parents**, consideration of parents' workload and their personal characteristics.

Our website contains not only in important information resources; it also acts as an effective mechanism for the regulation of cooperation of teachers with parents. Organization of distant collaboration helps ensure openness and attractiveness of preschool education for children and parents. It helps maintain targeted socio-cultural, psychological and educational support for families, increase the level of care provided by parents, ensure rapid feedback **between the participants of the educational process**: parents and teachers. It also offers parents the opportunity to participate in the life of our kindergarten.

Figure 3.6.1 Our website addresses parents' community, www.ds2483.msk.ru

Moreover, parents can use distant consulting service to communicate with the psychologist, speech therapist, teacher or doctor at any time, especially in the case of a child's illness or his/her inability to attend the centre regularly.

During the development of our kindergarten website structure we identified numerous productive opportunities for both parents and our staff: instant feedback from partners; an opportunity for parents to participate in the life of our kindergarten, promptly get information on upcoming events, provide information for parents on the issues of care, education and development and many more (Fig. 3.6.1).

The validity of our approach to website development has been proved. Julia and her parents went on holidays at the time when children prepared for the Victory Day. They were concerned that Julia would not participate in the celebration. At the request of the parents, "My Account" function was activated at the website where we collected all the materials for the preparation of the child for the celebration (poems, songs, etc.). The hotel where the family lived had an access to Internet. They downloaded the materials for rehearsing from the kindergarten website. So, the possibilities offered by the website of preschool educational institution are useful for parents and staff.

C12, ECE Centre in Moscow, Russian Federation

Box 3.7

Teachers teaching teachers: Peer coaching in ECC

Teachers in our kindergarten were excited but also a little bit worried when they learned that we would get **several new interactive whiteboards**. Our pedagogical staff is of different age, so I expected that the motivation and effort to use ICT as a tool for their professional development would also vary. I, as a principal, was surprised by their interest in taking a ten-hour course on the use of interactive whiteboards and Activprimary. Since September 2009, we have started our own project *Let's explore and discover the world with computer and an interactive whiteboard,* which we developed to fit with the state educational programme.

Our teachers started to integrate new ICT into cognitive processes of children. The teachers helped each other – but the children were helping themselves too! My colleagues started to use innovative methods. Techniques for developing projects, interactive writing books were created individually but also by groups. Slowly, we started to **explore the potential of the interactive whiteboard** and the program Activprimary. We used the knowledge we obtained in the course and during the very first conference for the ECE teachers "Modern Education in Kindergartens", which took place in our city.

After one year of practicing, our teachers and children proudly presented their ICT skills to parents. During their school years, parents never experienced anything like that. They are eager to come to our classes and observe their children – sometimes they even want to join (Fig. 3.7.2 and 3.7.4).

Our teachers meet regularly to share information and experience about how to use ICT for complex development of the children, which policies and regulations they should follow for a safe use of ICT and how to evaluate the content and quality of educational programmes. We cooperate with other ECE centres in our city and during the year we learn from each other by using presentation panels, open lessons and workshops.

In our centre, we have assembled a portfolio of ICT projects. It was published as an educational DVD called *In a Fairy Tale Land We Discover the World through an Interactive Board.* It contains the most successful projects: *Autumn in the Garden with Winnie the Pooh, Colourful World, Little Musicians, Farm Animals and their Pups* or *Secrets of the Space with Winnie the Pooh,* etc.

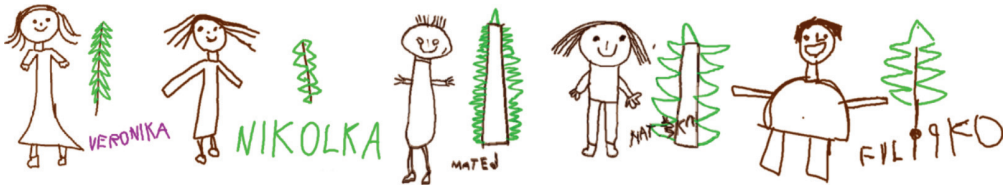


Figure 3.7.1 Children's drawings on the IWB on the subject of Me and a Tree

Figure 3.7.2 Parents learning together with children

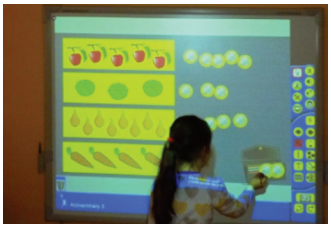


Figure 3.7.3 Solving the tasks

Figure 3.7.4 Parents learning together with children

C15, ECE Centre in Prievidza, Slovakia

Box 3.8

Making animated cartoons

Integrated sessions meet one of the main requirements of preschool didactics: education should be small in volume, but capacious in opportunities for learning.

With the group of senior preschoolers, a Gzhel (a folk ceramics craft) session with the use of multimedia technology was aimed at the creation of an animated cartoon in PervoLogo and BTV PRO for Macintosh software applications. First, children recalled the history of Russian folk art, learned about different technologies of creating folk crafts objects, in different styles of folk painting, and created virtual objects in multimedia environment of PervoLogo.

The teacher demonstrated folk art techniques: dishes from Gzhel and Khokhloma, boards with Gorodets paintings. Then children made folk art objects: Gzhel painted teapots, cups, spoons, a house built in the style of the Golden Khokhloma. Children drew the objects on the paper, coloured and cut them out. All these objects became the heroes of a fairy tale, the plot of which was composed by children and the teacher.

For implementation of this project the following specialized equipment was used: ♦ *video camera or digital camera* ♦ *tripod on which camera is mounted* ♦ *computer with software installed to handle the footage (it can be any program for video processing, the easiest option is to use one that you get when buying a digital video camera)* ♦ *any device for watching videos (DVD-player, projector with screen or computer monitor)* ♦ *disc(s) for recording and storing footage.*

We divided children into four teams to create a fairy-tale cartoon:

- team A (four children) created characters for animation, teapots, plates and cups. They drew them on paper, then cut them out;
- team B (two children) painted the virtual cartoon characters on Apple computer in PervoLogo;
- team C (three children) were shooting the cartoon frames using Single Shot technology in the BTV PRO for Mac on another computer: two children discussed the plot and moved characters according to it on the prepared background – a painted sheet of paper; the third one was taking each frame using BTV PRO;
- team D (two children) dubbed cartoon on the third computer using Quick Time to record sound effects – they were divided according to the roles; each was reading her/his own text.

Using Quick Time software makes it possible to gather frames designed by children, add soundtrack and show this intermediate result to the entire group. When using multimedia technologies with preschool children, they should be gathered in small groups. Creation of the cartoon promotes the development of speech, thinking, creativity, ICT competence, communication skills and individual abilities of children.

Figure 3.8.1 Children create characters and objects for animation

Figure 3.8.2 Children paint the virtual cartoon characters using Apple computer in PervoLogo

C11, ECE Centre in Moscow, Russian Federation

Box 3.9

Collaborative storytelling

Providing **digital storytelling tools** for the early childhood and elementary school years has been one of my constantly re-defined aims. The most recent tool I have developed is the **TeaMStory** editor, (Turcsányi-Szabó and Pasaréti, 2010) and also *teamese.inf.elte.hu*.

Children are able to create story actors and backgrounds digitally, as scanned figures or other art crafts (e.g., paper origami). They can easily assemble the story pages using the editor (Fig. 3.9.1 and 3.9.2) and supplement the pictures with a narrative in the form of written or spoken text. Kindergarten groups regularly produced collaborative stories long before computers were introduced. However, the new technology allowed new forms of expression to be combined with traditional ones and interactive storybooks could thus be **produced by children themselves**. Everyone was part of the story, and those children whose figures appeared on the screen commented and they replayed together again and again the story events by moving the figures around on the screen, each time giving it a flavour of those on turn to move the actors.

The whole story is narrated by the owl (the words appear in the text box beside the owl). The words of characters appear either in speech bubbles, or – which is more convenient for the children of this age – are recorded in advance and played. During sound recording (Fig. 3.9.3) children performed their parts in turn, listened attentively to the others and helped each other if one of them forgot the script. Listening the finalized story was just a celebration in itself. Children commented on the performance and backstage events a lot.

Recent transition to interactive whiteboards has been a revolutionary change. Children learned to be more persistent, they were very patient with each other, allowing everyone to take a turn. They had more space to act while drawing or performing story elements, while the others were watching the actions bewildered, more theatre-like. Children were always very proud not just of their own work, but that of the others too and considered it a 'team work'.

Figure 3.9.1 Story with scanned and digital drawings

Figure 3.9.2 Origami story

Figure 3.9.3 Storytelling

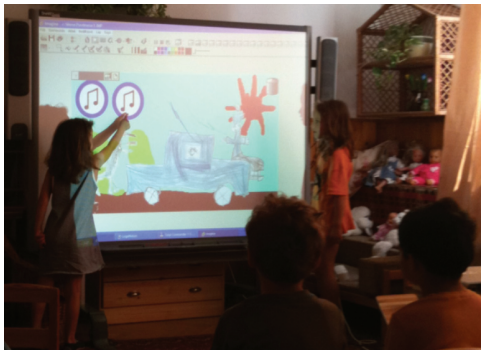


Figure 3.9.4 Replaying the story

C6, ECE Centre in Budapest, Hungary

Box 3.10

Giving creative context to cognitive development

Being as a teacher of computer art at the Moscow Centre for Child Development, Kindergarten No 2558, I have been using ICT in my work with children for 5 years. I like it because new technologies **create opportunities of interesting and creative learning** that captivate both children and adults. However, interest largely depends on the selected computer program. I find it interesting to use not only computer but also an interactive whiteboard and tablet. With the help of these devices, I can create interesting moments and captivating situations.

Once at the session children taught me a real lesson. The session was devoted to *Mind Games*. Together with children, we explored what kind of shapes could be made with the *Columbus egg tangram* and *Mongolian game*. Each game consists of a set of plane figures, which can be arranged in a certain way to get a new, often complex and unexpected shape of a man, animal, etc.

The main goal of the session was to develop children's **cognitive processes**, namely spatial and logical thinking with the use of ICT. Usually such sessions are conducted in the following way:

- at the beginning of a session each child solves a puzzle using one of the individual game sets,
- after remembering the characteristics of each shape in the puzzle game, children are asked to create their own image of a particular game puzzle on a computer in the Builder-architect workshop of the Dreamer's Magic Designer,
- as a result of the session each child creates his or her own image using given shapes; then children share their results, show their work to each other and we summarize the session.

This time things went quite differently. At first, everything went as usual. All children worked quietly on their computers. I came up to Pauline and I saw that the donkey she made was different from an ordinary one (that is, created in the *Mongolian game logical puzzle*, which she had chosen). Her donkey bent his head down. I asked Pauline for explanations, and she replied: *"He is hungry and wants to eat"*. Indeed, there was grass near the donkey. Pauline quickly created it by using the third (highest) level of the program. Then she added trees, sun and created a whole story around her sketch.

Children who saw Pauline's exercise quickly began to change their sketches as well. As a result, everyone made his or her own story about an animal. That is how – thanks to Pauline – the session turned from the logical exercise into creative one. Since then, sessions on the *Mind games* topic are organized following Pauline's scenario.

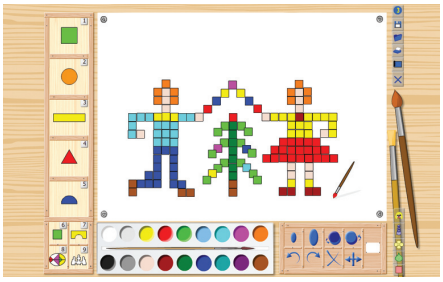


Figure 3.10.1 Computer mosaic

Figure 3.10.2 Logic exercise

C13, ECE Centre in Moscow, Russian Federation

Box 3.11

Supporting mathematical thinking and problem solving

Escola Parque is a private school in Rio de Janeiro, Brazil. We have got about 2.000 students, from 1.5 to 18 years old, including 388 children in our kindergarten. The main pedagogic strategy in the domain of mathematical thinking for the age group of 3 to 5 is to **create concrete situations** where children **use** math concepts, **talk** about such situations and then **represent** them in a wide variety of ways: verbal language, drawings, written text, graphs, etc. Thus, in the domain of developing math thinking we benefit from ICT as a tool to support thinking: children are very active while interacting with ICT. They can always **modify, repeat, and reflect on** what they have done. They can experiment, test hypothesis, and evaluate *computer's reaction* to their actions. It is a powerful tool **to make them aware of their own thinking**.

Many small activities are integrated in ordinary daily situations:

- Kids draw something to put on the notice board on the classroom wall. Teacher asks if the board is big enough to fit one drawing of each kid in this class. How can we be sure?
- We decorate the school for a party, hanging small flags of paper on a string. Teacher creates some rules for kids to build (or continue) a pattern of flags: 1 yellow flag, 2 green flags, 1 yellow flag... Rules can be more complex, varying colour, shape and size of the flags, depending on the age of the kids.

Other activities employ games or specific math material (wooden blocks of different colours and shapes, Cuisenaire rods, geometric mosaics, card games, dices, small objects to be counted). Many of those activities are conducted in small groups (2 to 4 kids), and usually different groups in the same class have different tasks and activities.

While planning the integration of ICT into math activities, we have had two principles in mind:

- Use computer to represent math activities alternatively. We want kids to have this special tool to present whatever they do, in the same way they use objects, drawings, numbers, diagrams, etc.
- Use computer in different classroom activities. While some groups of kids act using computers, others do the same (or similar) activity using concrete material, paper or the like.

In order to achieve the goals, we have been training teachers to feel comfortable using computers, projectors, document cameras and other resources without any help of Informatics teachers. We began by planning the activities and conducting them with the teachers, and then letting teachers assume more and more lead in the process.

We also developed special programs (*Logo Microworlds*), where kids could manipulate *virtual versions* of concrete material, similar to the activities teachers are used to do in class already.

Figure 3.11.1 Organizing blocks for other group (age 5)

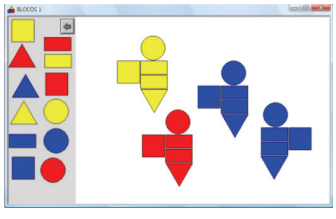


Figure 3.11.2 Compositions of virtual blocks

Figure 3.11.3 Transforming real composition into a virtual one

C1, ECC in Rio de Janeiro, Brazil

Box 3.12

The new literacy integrated

ICT can be used for intellectual and creative development at ECE including different kinds of 'intelligences' and 'literacies', such as: graphical, algorithmical, logical, numerical, spatial, and, eventually – verbal (oral and written). Logo is famous for having no thresholds. PervoLogo eliminates even the barrier of formal literacy existing in generic Logo. At the same time it offers a child a rich environment for creative activity to produce multi-media stories.

The teacher proposes a general theme and the children can use a simple graphical editor (draw lines, paint areas, etc.) and clip art (small graphical images – "shapes" prepared beforehand – supplied with the environment by the original authors, or made in the class or school beforehand, that can be modified by a student).

The Turtle itself can do very simple things: move forward, turn right and left and put his pen (he has one) down (or up). But a child can tell the Turtle what to do. (S)he can tell Turtle for how long it should move, to what extent to turn, and see what is happening. Then other things are explored: the Turtle can be told to do something a certain number of times, etc. The child can name plans (programmes) made for the Turtle. (Letters are really helpful for this.)

New more complex actions for the Turtle are not 'studied' 'lesson-by-lesson'. When a student meets a problem (s)he would like to solve, (s)he tries to solve it, asks other students and the teacher for help. The student can say: "I made these nice clouds. I would like them to fly. How can I do this?" Eventually with experiments, advice, and small inventions a way is found (sometimes not exactly that was expected at the beginning). The tool (iconic structured programming) almost eliminates 'syntactic' errors.

Numbers are important in Logo. They represent real-world space, time entities and their interpretation in the Turtle Microworld. In the commands of PervoLogo, numbers are presented iconically: distance with a ruler, turn with a rudder, time interval with a clock. Numbers are indicated as well. So, turning the rudder you can see the numerical value of the angle, etc. Projects naturally involve many participants and different materials of expression, including non-digital. PervoLogo can productively integrate material technology, such as Origami, making collages or clay figures.

Figure 3.12.1 Autumn postcard

Figure 3.12.2 Object and characters for the Andersen's story of Ugly Duckling were made with clue, paper, etc.

C14, ECC centre in Moscow, Russian Federation

4 Various aspects of the process

In the previous chapter we intentionally structured the collection of case studies or snapshots in such a way that they illustrate different approaches, procedures and activities. Our goal was to inform the reader about the abundance of possibilities and complexity of the area of interest. Thus, we are trying to identify better the potential of integrating ICT into new forms of learning, playing and developing in early childhood education. In this chapter, we again extensively exploit the reports from the ECE centres, which we confront with the findings from literature and our own experiences. Our intention is to examine different aspects of the process of integrating ICT into early childhood education, namely:

- How is this process **initiated**, motivated and encouraged?
- Which **categories of ICT** are used in the centres (and which practices reported in literature are underused)?
- How are these technologies being implemented and used, how do **teachers manage activities with ICT** – indoors and outdoors, how are ICTs accepted and exploited by girls and by boys, what are successful activities and recommended organizational forms?
- What is the actual level of ICT competencies of ECE teachers and how is their **professional development** organized?
- What role do parents play in this process, why and how should we create and support the **centre–parents partnership**?
- What are the areas of concern about **children's safety and health in the digital world**, how can we exploit ICT in favour of children's development in all domains?
- What are other roles of ICT in ECE centres?
- How can ICT be used to **support children with special education needs**?
- What kind of **ICT curriculum** are we constructing, what are our educational and developmental goals and instruments to achieve them?
- What are the most frequent **obstacles of this process** and how do we cope with them? Where are we at present, and where do we go from here, what are our plans for **further development**?

4.1 Initiation of the process

What are the driving forces that make the ECE centres integrate ICT, who is the initiator of this transition? We were interested in these questions, although there is little research, which specifically investigates this aspect. In the reports from our sample ECE centres we identified different approaches and alternatives (Fig. 4.1.1). In some cases, we also observed combinations of two or more initiating factors.

It should be noted that only one alternative represents **intrinsic motivation** – usually represented by the principal, often supported by (some of) teachers. Sometimes we noticed initial stimulus coming from parents of the ECE centre's children. However, even in such situations, the initiative was quickly taken over by the principal and teachers and after that they lead the process and impact attitudes and behaviours of the parents[25].

[25] The centre–parents partnership is studied in section 4.5.

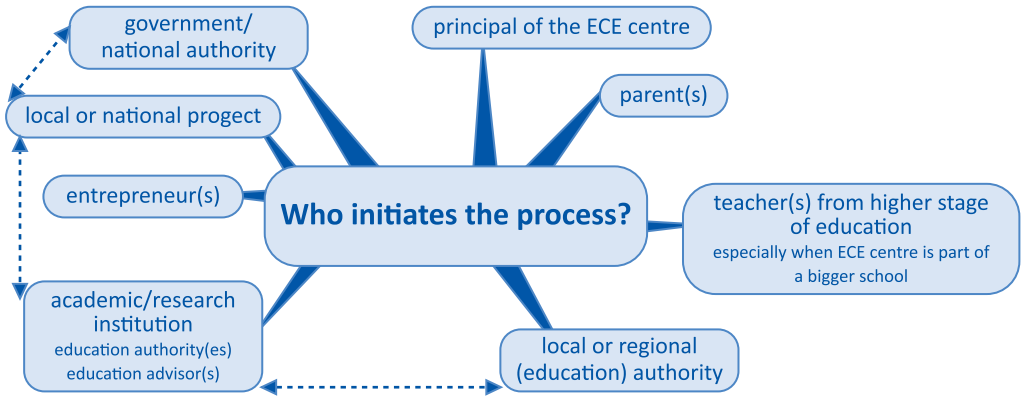


Figure 4.1.1 Driving forces of the transition. Note that if a project is the initial factor, usually an academic or research institution and education authority are also involved

Any of these alternatives cannot be considered better than others. **Extrinsic motivation** often has certain advantages, especially if it comes from an academic environment or in the format of a wider project (see below). However, it is beyond any discussion that for such process to sustain, the extrinsic initiation must win the intrinsic and continuous motivation, usually of the principal supported by (at least some of) the teachers.

Although extrinsic impulse does not create sustainable intrinsic motivation, following the case of Prievidza, a Slovak town illustrates the opposite: the initial decision and consistent pressure of the regional head education authority initiated a whole town sustainable transition of a whole town:

> *In July 2008, there was a meeting of the principals of 11 ECE centres and first grade teachers from our city. They presented their experience of using IWBs with their students. At the end of the meeting, the head of the regional education department asked us whether we would suggest trying to use the IWBs in kindergartens too. This triggered a dispute of the use of IWB in kindergartens: is it worth or not, in which particular kindergartens, etc. In the end, we agreed that it was important to use modern ICT in **all kindergartens in the city**. After purchasing new equipment in 2008, we stopped using old computers and we now cannot imagine our lives without IWBs.*
>
> *C15, ECE Centre in Prievidza, Slovakia*

An important factor of the transition for an ECE centre is integration into a wider **project**, which often:

- connects several or many ECE centres[26] into a unified framework, creates a network and, in one or another sense, controls the process,
- provides the whole or a part of the budget, equipment and methodology,
- provides expertise and consultants from academic/research environment,
- conducts or supports collection of data, research, reflection, publicity, etc.,
- however, when the project is over and the budget is spent, sustainability depends on how sound the project was.

Examples of such projects are presented in boxes 4.1.1, 4.1.2 and 4.1.3.

> *The stimulus for us was that we were creating original development programmes for preschool children for many years already. Positive experience in their implementation was the basis for an integrated methodology of exploiting ICT in early childhood education. The creative*

[26] Sometimes together with other institutions, schools or centres of other kind(s).

*process of using ICT in work with children is an independent initiative of our institution. Moscow Department of Education provides organizational and financial support in the frame of the **Kindergarten of the Future** project, namely its module **Modern Information Technology in Kindergarten**.*

C13, ECE Centre in Moscow, Russian Federation

It is worthwhile to consider how long each ECE centre works with ICT. Some of the centres have been innovative in this context since the mid-1980's, others started a year ago. Longer tradition certainly supports the process in many ways. However, recent start had its owm advantages: theoretical and practical aspects[27] have been developed, a lot of knowledge has been accumulated[28], new kinds of challenging ICT items have appeared, and we understand the ECE learning goals, learning process and teacher's development better…

More than 20 years ago we heard about Papert and his Logo language, we read his books and were totally surprised by the idea of using computers in a constructivist way. Logo was amazing: very powerful tool that seemed to fit all the ideas we had about kids interacting with knowledge objects. Our first results were so encouraging that we decided to use Logo in primary school. Few years later we ran an experiment in using text editors with kids learning to read and write. Results were quite positive. Since the early 1990's, kids of 6-7 have been using computers regularly.

C1, ECE centr e in Rio de Janeiro, Brazil

The first experience in using ICT we gained in 2000; when using an educational software for autistic children. It was the beginning of big changes. It was our own initiative – we were looking for modern methods for appropriate personality development of children with special needs in order to help their parents. A classroom with a computer, DVD and camera system was established for parents' usage; for observing activities of their autistic children inside the classroom. We used the camera for recording problematic educational situations. Afterwards, we were able to analyze these recordings together with other specialists on autism. Teachers saw the advantages of using ICT in a classroom of children with special needs. Later on we started using IBM KidSmart computer units in ordinary classrooms.

C16, ECE Centre in Bratislava, Slovakia

[27] Price (2009) is an example of such exceptionally influential practical guide.
[28] And shared through excellent web sites, for example, ictearlyyears.e2bn.org.

Box 4.1.1

The Kindergarten of the Future: Modern ICT in Moscow ECE centres

Despite the vast experimental and research experience accumulated over the years on the use of ICT in Moscow preschool educational institutions (PEI), the major obstacles in practical implementation of the programmes are a lack of systematization of computer developing software and absence of instruction support materials. To date, this is the only activity, which is not regulated by a special education programme.

In order to implement one of the priorities for Russia in informatization of education, the Moscow Department of Education initiated two projects, in which the use of ICTs in preschool education is an integral component:

- "Education in Moscow: from Infancy to School" – a joint pilot project of Moscow city and UNESCO; and
- "Kindergarten of the Future".

The first of the projects aims at the achievement of the first UNESCO "Education for All" objective, in particular, at the improvement of education and care of young children. The main objectives of the project, among others, are "all-round development of children from birth to 6 years" and "development of networking between PEI and resource centres in order to improve the quality of education". At the present stage of educational development these problems cannot be solved without the use of ICTs. Thus, within the project an electronic library is being created on the best practices in education, care and development of children from birth to 7 years. The e-Library is updated with the materials developed by Moscow pedagogical universities, resource centres, pilot projects and by the winners of such Moscow competitions as "Kindergarten of the Year", "Preschool Teacher of the Year" and "Moscow Kids". The e-Library materials will be available for Russian-speaking educational community worldwide. In future, the best practices are planned to be translated into English and French.

The project "Kindergarten of the Future" started in 2008. Its aim is to support innovations in the field of preschool education. Along with other activities on the creation of innovative educational environment, one of its key components is the module "Modern information technologies in public educational institutions". The basic idea is a harmonious combination of modern technology with traditional means of child development to form mental processes, leading spheres of personality, creativity. This is a new approach to the use of ICTs in work with children, which makes it possible to preserve the integrity and uniqueness of the national preschool education.

For example, in kindergarten No 2558 children together with their teachers fable a tale, then create the conceived characters and scenery in a special computer program, print and cut them out, and – they are now ready to play! They perform before their parents and younger kids.

In preschool department of school No 627, children together with their teachers make cartoons on Russian folk crafts and traditions.

Kindergarten No 2483 provides parents with psychological and pedagogical support via the kindergarten website, which is attended by 80% of the parents.

Box 4.1.2

CuiCui, Chilean project with robots as a bridge between cultures

The Cuicui project is an educational initiative striving to **improve the quality and pertinence of pre-primary and primary education in low-income schools with a high proportion of aborigine students**, by using learning material and low-cost robots. The learning material includes aids that integrate elements and knowledge from both the Mapuche and the '*Chilean*' culture. In that sense, Cuicui (which means *bridge* in the Mapuche language) works as a bridge between two cultures.

The robots have been designed for young children (above 3 years of age), who don't read. For teachers, the materials include printed and digital guides to learn about the robot's capabilities, to use it according to the Chilean curriculum and to create their own didactic material for the specific needs of their students (intercultural degree, motivations, etc.). The robot itself is an electronic, industrial and pedagogical product of a three-year research alliance between the Catholic University of Temuco and TIDE S.A. (*www.tide.cl*).

The project is presently in its evaluation stage in five schools. By the end of the year, more than a thousand of robots should be in use in more than 50 schools, particularly in low-income areas.

CuiCui
Robot y material educativo para contextos interculturales

Box 4.1.3

Building ECE Teachers' Digital Literacy in Slovakia

The important change in work of Slovak ECE centres is due to the reform of education defined in the school educational programme. When creating their own educational programmes, ECE centres have to comply with the state educational programme. However, they can include their own specific conditions, priorities and strategies according to the needs of their children. This modern transformation of Slovak ECE centres has brought changes in pedagogical approach of the teachers. It emphasizes their independence and responsibility. Early childhood education focuses on the development of the key competences of a child.

To make the work of teachers easier, in 2009 we launched a national project *Education of Pedagogical Staff in Kindergartens,* which is partly financed by the European Social Fund. The budget allocated for these activities is more than EUR 19 mln.

The aim of the project is to implement the educational reform of the content into practice via further education of kindergarten pedagogical staff. This will lead to creating of an effective system of lifelong education focused on the development of some key competences of ECE teachers consistent with present and future needs of the knowledge society.

At the expense of the project, 4.000 computers with educational software, 2.800 digital cameras, 4.000 digital programmable toys Bee-Bots, 3.340 LEGO sets and other teaching/learning assets were installed.

We believe that the national project will contribute to a wider application of new methods and innovative techniques assisted by modern digital technology.

My teacher is learning how to draw with computer! Yippee!

4.2 Categories of ICT

The reports from the centres show the awareness of the fact that the concept of ICT in education is sometimes pruned and misinterpreted as 'computer' and even 'learning about computer'. Literature confirms the same observation and warns that *…it would be a mistake if practitioners were encouraged to emphasise PC operating skills as their most desired outcomes* (Siraj-Blatchford and Siraj-Blatchford in Hayes and Whitebread 2006: 153). As pointed out by Price (2009: 5) *…we still hear that 'mouse control' and 'hand-eye co-ordination' is an aim! There is still a possibility that software on desktop computers is the sole provision in some classrooms. The result is that the technological equipment provided can act as a barrier to developing* ***ICT across the curriculum*** *because its use is limited. There is a plethora of ICT equipment which can be used successfully in the early years learning environment and which can be integrated.*

In this section, we will pay close attention to the whole spectrum of ICT, which is valuable in the context of ECE to reveal which of these technologies are present in the centres (and which are not), and what are the attitudes of teachers towards them.

Although it is not our primary goal, we will start whis trying to create a classification of this *plethora of ICT* – in the context of ICT. To do so we will apply two different perspectives (Fig. 4.2.1).

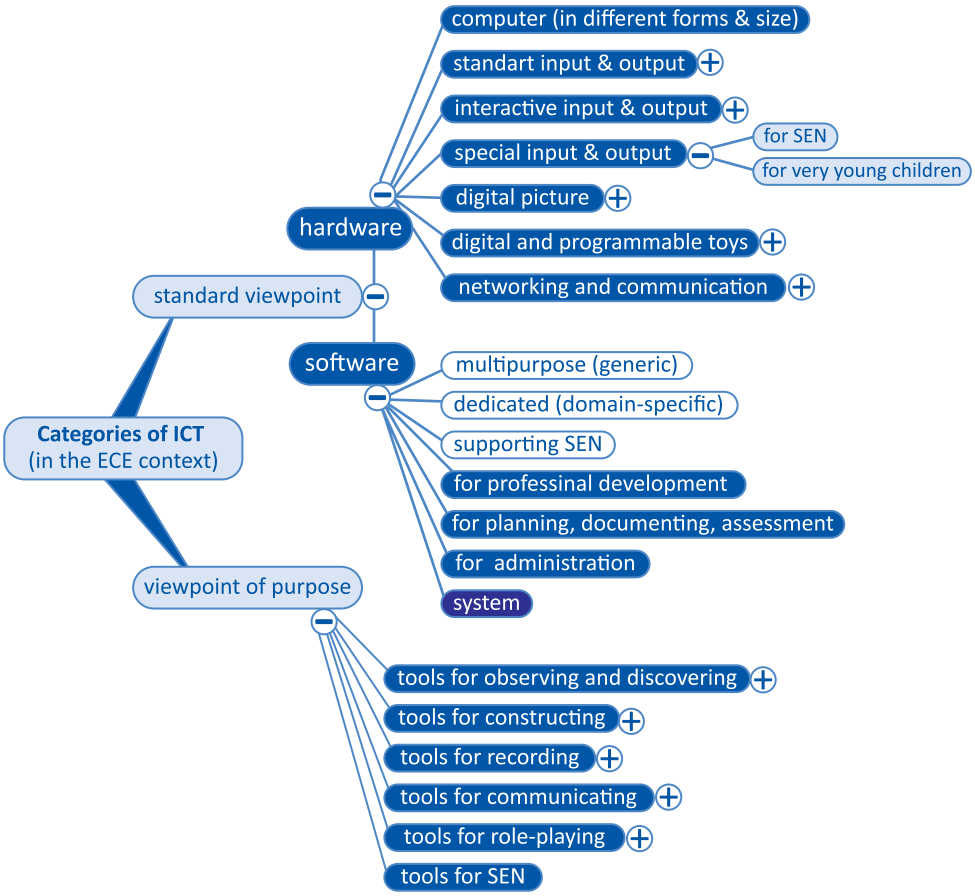


Figure 4.2.1 ICT can be classified into several categories from two viewpoints: (a) standard one, which recognizes hardware and software and their different subcategories; and (b) one, which respects different purpose of technologies in the context of ECE

ECE centres appreciate exploiting several kinds of ICT and their potential to foster collaboration:

> *We have had a strong focus on giving children knowledge and experience with various digital tools, and how they work together. What opportunities exist in **play and exploration**? In addition to the computer, we often use a scanner, digital camera and headset. There is a lot of laughter and good interaction. We find that children cooperate well on various tasks.*
>
> *C7, ECE Centre in Oslo, Norway*

Now we will browse through some of these categories and analyze their presence in our ECE centres.

Computers, projectors, touch screens, interactive whiteboards...

No special study was conducted on the appropriateness of particular form and size of computers in kindergartens. We observed that none of the ECE centres has commented the issue whether standard computers (desktops or notebooks) with standard input devices (keyboard and mouse) are an appropriate choice for early years' children (by their size, shape, weight, colour, surface, etc.). The reason perhaps is that they were not asked about this either before being supplied with the computers or after. Systematic research is needed to cope with these questions.

Apart from basic computer equipment, ECE centres most frequently – and proudly – report on interactive whiteboards, although some of them are aware of the fact that the new interactive technology raises several new questions, namely concerning its effective use, installation on the wall and related safety issues[29] (especially, if children stand in front of the beam of the projector...).

As we observed in C15, IWBs can be creatively used to develop prewriting skills on a large scale (alongside with other purposes). Some authors warn that whole-class use of IWBs may have both positive and negative effects, the later referring to the danger that some teachers may focus mostly on the presentation aspects as screens purely. We have to keep in mind that IWBs are interactive only when they are applied by educators using an **interactive pedagogy** (Siraj-Blatchford and Siraj-Blatchford, 2006).

Educational software

Most authorities consider the application of the so-called *drill and practice* software less appropriate in early childhood, although many of our ECE centres frequently use this kind of software. In fact, DATEC found that many of these *drill and practice* applications have very narrow educational aims (e.g., practising addition or learning colours). *Therefore, it is suggested that these should be used with caution as they promote a very directive form of teaching, normally with the use of an external reward (a smiling face, a tick or a funny sound) and over-reliance on these kinds of program might lead to a reduction in children's intrinsic motivation to learn* (Siraj-Blatchford and Whitebread, 2003: 8).

[29] In section 4.6, we present some simple safety rules to be followed when working with projectors and IWBs.

Figure 4.2.2 Children of age 5 to 6 use IWB every day (C15)

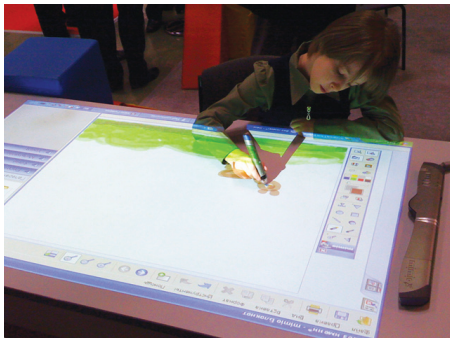


Figure 4.2.3 Interactive screen on the table – new cognitive experience

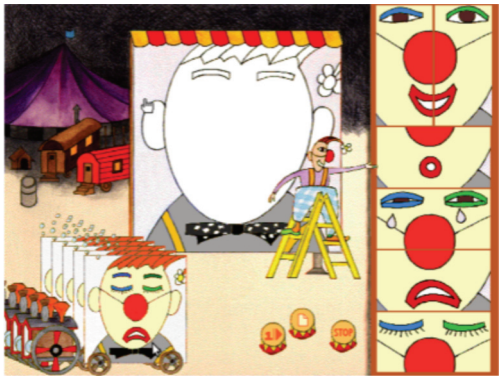


Figure 4.2.4 Funny faces: the first activity of 'Thomas the Clown' environment

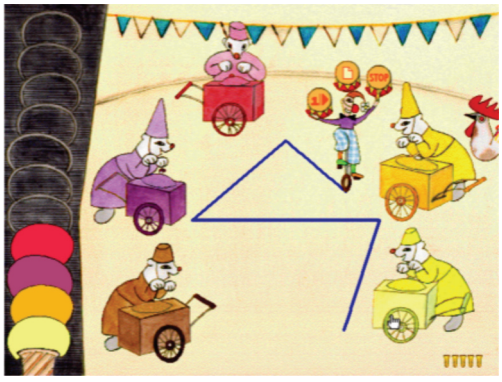


Figure 4.2.5 Route finding in the Ice Cream Break of 'Thomas the Clown'

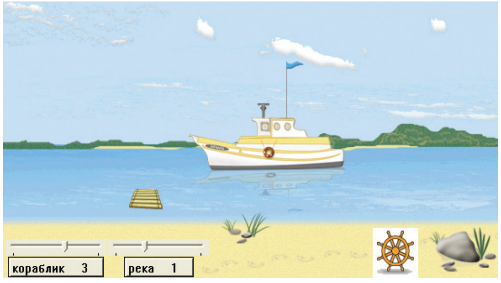


Figure 4.2.6 Classic word-problems – understanding of relative motion (boats in the river)

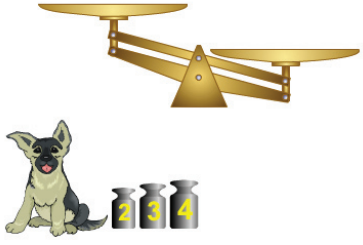


Figure 4.2.7 Virtual scale. Playing with scales a child becomes acquainted with the idea of comparing, and ordering things

As stated by Siraj-Blatchford and Siraj-Blatchford (2006) **multi-purpose** (or **generic**) **software** can be seen to much more potential than **dedicated** (or **domain specific**) **software**. Consider how many more things you can do (or design and make) with Logo micro worlds, or the graphics, word and number processing, or even with a floor turtle? Generic software provides us with 'tools' that can be 'applied' for a variety of purposes. At the same time, this software usually reflects a constructionistic developmental paradigm adequate for ECE.

Inside the 'domain specific' area, there are also more and less productive options. As Clements (2002b) argues in the context of developing **mathematical thinking**, *…drill and practice software can help young children develop competence in counting and sorting. However, it is questionable if the exclusive use of such software would subscribe to… mathematical literacy in a world where mathematics is rapidly growing*

and is extensively being applied in diverse fields. Other types of programs, including computer manipulatives and other problem solving programs, appear to hold more promise in this regard.

We were pleased to notice that the ECE centres are aware of the fact that applying any educational software in a productive and constructive way requires a great deal of mastery:

> *Teachers need time and training to use better and richer software and to integrate them into their pedagogical toolset. In general, teachers have hard time to find and integrate software by themselves, they cherish advice – preferably from other teachers working in similar settings – but have few opportunities to interact with them (Internet would be of great help).*
>
> *C2, ECE Centre in Cunco Chico, Chile*

> *We have chosen **creative software applications** where children can control what happens on the screen. **Drawing and animation** programs are widely used. Programs that offer drill and practice in basic skills like how to use the mouse (click-drag-drop) and various image and word processing where children play with numbers and letters are also used.*
>
> *C7, ECE Centre in Oslo, Norway*

> *We use regular **commercial software**, sometimes also **free software** (like Hot Potatoes, Pivot and HagáQuê – a cartoon editor) and some specific software (Imagine Logo). We also build many games and programs. The decision of using regular software instead of educational software was motivated by two main reasons:*
>
> - *We wanted children to have access to the same kind of equipment and software they have at home, so that they could at home recognize and use the skills and knowledge they develop at school.*
> - *Good educational software is hard to find in Brazil[30]. Most software does not fit our goals and our pedagogic guidelines. Drill and practice educational software only allow children to give correct answers, and their mistakes or hypotheses are discouraged by "sorry, try again" messages. We want kids to use software in order **to express themselves by drawing, writing, authoring, to explore and find out information, and to represent concrete activities**. The best way to do this is to create our own games, interfaces and activities.*
>
> *C1, ECE Centre in Rio de Janeiro, Brazil*

In C3 they report on using some computer games, usually simulation games: *Children learn while solving. They use their knowledge, if they fail they change their strategies in order to get better results, they learn to analyze situations and find solutions.... In our kindergarten children play under a supervision of their teacher, so we do not have to worry. The problems appear when children get home, where they can play and use the computer without any supervision.*

Another common problem, which we will tackle again later, is that many ECE centres regularly use software applications – of any kind – that were not specifically developed for children. There is an interesting strategy employed by some generic software tools (Fig. 4.2.8), which offer a high degree of customization, so that their interfaces can be considerably modified to respect a concrete situation and context.

[30] Identical notes appear in most of the reports..

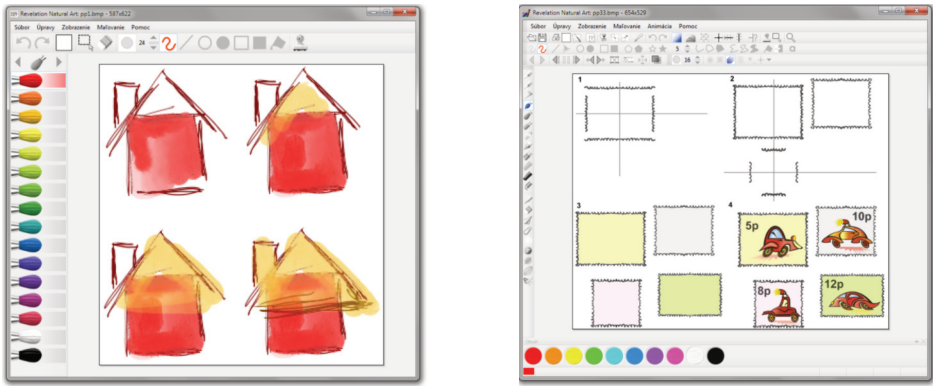


Figure 4.2.8 Painting program RNA (Revelation Natural Art) allows to customize the environment by setting different configurations, from Preschool (on the left) to Advanced (on the right)

We are also pleased to see that teachers from our centres rationally and critically ponder about the quality of the educational software. Some of them repeatedly point out the **lack of appropriate applications**, reporting about required properties and frequent drawbacks[31]:

- *...sound of some programs is of a low quality. It can provide an inappropriate speech pattern for children, which they can utilize (C3),*
- *...some programs are very "sensitive" and the child is not able to click on the right place. It often happens, that children think that they indicated the correct answer but the computer evaluates it as a wrong answer. This is a serious shortcoming, which confuses children (C3).*

In several of our centres we saw teachers and children using software interfaces, which are commercially distributed with the IWBs. Those interfaces were developed for different users and are improper for children (with control items that should be hidden from them, with small tolerance for clicking or selecting, letting a child enter technical modes, which leave her or him confused...).

The same problem is reported in literature. It shows that the effective use of ICT to enable creativity is dependent upon careful consideration of the **human–computer interface**. As Cook and Woollard point out in (Hayes and Whitebread 2006: 107), if the interface is *...designed well, children can remember activities associated with icons and become proficient in the use of software. Less well-designed icons can impede ICT-based creativity and the development of ICT capability. It is also important that the ICT activities are embedded in physical experiences to ensure that the relationships between functions and 'real' activities are appreciated.*

Several ECE centres state that their appreciation of ICT was formed or influenced by seminal writings[32] of S. Papert (1980, 1993, 1996) and Logo culture, which he promoted. Logo language together with Logo floor turtle – in various variants – has played a key role in research and building knowledge of efficient and productive integration of ICT into the learning processes of children.

> *That is why we use physical turtles (robots) and Logo when we work with preschool children. Logo is a **powerful tool to build space structures** and it is exceptionally suitable for preschool children as it permits them to "see" space topologically rather than in a Euclidian way. **Preschool children approach space topologically**. The Euclidian referentials come only later (around the age of 10).*
>
> *C9, ECE Centre in Lisbon, Portugal*

[31] Now we are referring to more technical criteria, not the ones of the DATEC kind, see Table 2.1.
[32] And **constructionism** – his theory of learning.

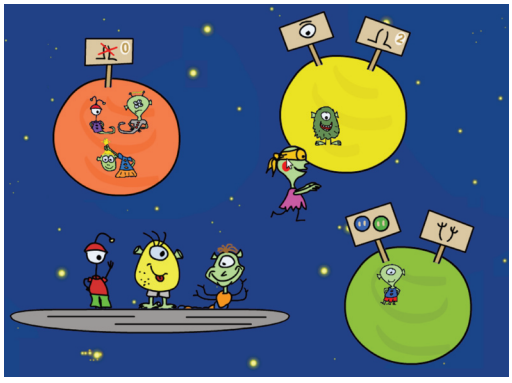


Figure 4.2.9 Screenshot of the experimental software environment, which our doctoral students develop and exploit in C16. We use iterative design of interface and functions, while children help in every iteration as evaluators (Pekarova and Moravcik, 2009) and apply the design-based research methodology (Wang and Hannafin, 2005)

Simplified versions of Logo floor turtle for early childhood education are different programmable toys, which are becoming more and more popular in the ECE centres.

Digital and programmable toys – planning and controlling technology

As stated by Siraj-Blatchford and Siraj-Blatchford (2006: 40), the well-designed on-screen applications help develop creativity by supporting a wide variety of possible inputs and responses of the children. **Programmable toys may provide still greater possibilities**. Many of the benefits gained from older pupils using Logo will be paralleled by young children's use of programmable toys. Problem-solving skills will be encouraged, and geometric concepts, collaboration, and higher-level thinking developed. In programming a toy **to behave in a certain way**, children have to see the problem from the toy's perspective. They have to decentre, adopting a body-centred system of reference which Papert (1980) termed *body syntonicity*[33].

Programmable toys are usually small floor robots with simple keys atop, which make it possible to give the toy commands *forward*, *back*, *right*, and *left*. A sequence of commands can be entered and then run (by pressing the *go* button, for example). There is a whole range of programmable toys available, some of which offer young children valuable control experiences. Several centres reported intense and successful work with Bee-Bots (Fig. 4.2.8) which turn 90° left or right and move in 15 cm steps. Others are, for example CuiCui (reported by C2), Roamer or Roamer-Too (*www.valiant-technology.com*).

According to the literature, ECE centres, which engage programmable toys, are satisfied with the results. They sometimes intentionally integrate the toys into complex activities, or they let children take them and freely use in their play. ...*we have seen that children really begin to understand the basics of programming and by the end of the year some children can perform fairly complex manoeuvres with the toys* (Price 2009: 34).

> *Nikolka wanted to send the Bee-Bot to where her friend Tanicka 'lived', which was five squares upwards. However, she programmed a toy to move only one step. Other children advised her what to do. Finally, Branko added four steps upwards for her. We have often observed that children – while the toy was moving – were **loudly and jointly counting the steps**.*
>
> *C16, ECE Centre in Bratislava, Slovakia*

[33] In the Logo context, this means identifying with the turtle.

Figure 4.2.10 TTS programmable floor robot Bee-Bot with various mats, jungle jackets and tunnels (www.tts-group.co.uk). Other kinds of clip-on covers are available so that they can be easily transformed into different identities or programmable LEGO WeDo robots with different sensors to control its behaviour

Figure 4.2.11 Children in groups building behaviours for the Bee-Bot from printed cards (C17)

Figure 4.2.12 Boys taking turns at making their Bee-Bot pass through the town track (C17)

Figure 4.2.13 The knowledge is growing, and so must our learning do! Here we see Mini Solar construction kit for children (www.owirobots.com). Some recent products will probably find their way into different aspects of modern ECE, such as learning about energy and its renewable resources. Mini Solar building kit shows children the benefits of solar energy while they create a movable toy that requires no batteries

A great many research questions arise, but one significant feature of many of these toys is that their behaviour has been programmed to 'develop' as they appear to learn from their play with the child. Often the 'learning' is more apparent than real but the effects that play of this kind might have on children is worthy of greater research attention. Meanwhile, our knowledge of (programmable) toys that are effective is growing but more needs to be done to support practitioners in developing strategies for their application.

Siraj-Blatchford and Siraj-Blatchford (2006: 42)

Web and e-mail

Most of our sample ECE centres have their own web sites, predominantly for effective communication and contact with parents and the public (we have already illustrated such partnership in Chapter 3 for the case of C12, and we study it further in section 4.5). However, some centres extend their web sites also in favour of their children's play and learning:

> *Regarding preschool education, it is always difficult to approach children with information and software through web when reading and writing are necessary skills to understand. With respect to this, our centre has developed a website – sanchomoura.no.sapo.pt – that through colours and symbols (animals, etc.) gives children the possibility to explore other sites on the Internet for play and education, acquiring at the same time more* ***autonomy in their choices or searches****. As an example, see the first site to visit – www.poissonrouge.com – a place full of adventure for ECE children who never had contact with the computer.*
>
> *C8, ECE Centre in Campo Maior, Portugal*

Most of the ECE centres we have been working with report that they regularly use e-mail for communicating with parents. However, only rarely they mention using e-mail with children. This may be a consequence of the fact that (nearly) none of the e-mail applications used in these centres were developed for children, and not all of them are ...*child-friendly. This means the children will need quite a bit of support, but it is worth the effort* (Siraj-Blatchford and Siraj-Blatchford, 2006: 31). Veronica Carter, one of the practitioners quoted by the authors, who has been using email with her 4-5 year old class children, says:

> *The key to its success is that the children are communicating with people who they genuinely want to communicate with, and who genuinely want to communicate with them. Messages are sent and received from mums and dads, grannies and granddads, uncles and aunts. ... A lot of parents have access to e-mail at work even if they don't have it at home, and using it from work does not seem to be a problem for them.*

Carter suggests many applications of e-mail to be applied in the ECE centres, including:

- Encourage the families of class members to e-mail the class periodically.
- Use e-mail within your school, between classes, etc.
- When visitors come to your class/school, or when the class goes on an educational visit, send thank-you e-mails with some follow-up questions.
- Keep in e-mail contact with relatives/friends of the children travelling abroad and use this to find out more about other countries.
- E-mail Father Christmas (Santa, Ded Moroz, etc.).

ICT as a tool for...

We will now take the other perspective on classifying ICT into categories, namely, we will think about the purpose, for which that particular technology is used. Thus, we can categorize ICT as tools for:

- recording and communicating,
- constructing (engaging educational robotics),

- observing and discovering,
- role-playing, etc.

The other engaging technologies are digital camera, digital video camera, imager, digital microscope and telescope, scanner, graphical tablet, telephone, walkie-talkie, voice and sound recorder, digital photo frame and talking photo album, players, ipods and amplifiers, musical keyboard, kinaesthetical music input (Soundbeam), printer, digital temperature, distance, light sensors, metal detector, construction robotic sets (LEGO WeDo, see Box 3.4 in Chapter 3), as well as the defunct and imitation technology used as role play tools. Some of them, namely digital cameras, scanners, printers and robotic sets, were frequently and explicitly mentioned in most of the reports, while others were noted rarely or were not mentioned at all.

Connectivity inside the room over the institution or to the Internet is an important issue for any educational institution. The wireless access is becoming more and more popular. For example, you can have one inexpensive antenna standing in the yard of ECE centre. It is enough to provide connectivity for all devices (including notebooks, projectors, etc.) and Internet access.

Figure 4.2.14 There is a whole range of ICT tools for communicating, recording and observing less frequently reported by the ECE centres (Wild Planet Kid Quest walkie-talkie, Polaroid Pixie SD Digital Video Camera, QX5 TTS digital microscope and Discovery Kids digital photo/video camera, MIMIO, Wedo, USB-link and sensors, digital graphic pad)

Figure 4.2.15 Adam the Strongman: digital photography may either document real events, or help to create fictitious compositions as well. We prepared several challenging topics for similar compositions – children themselves then suggested many others (C16)

From this perspective, the most frequently used technology is a **digital camera**: the same observation is proved by literature and by our sample centres. As reported by Grey in Siraj-Blatchford and Siraj-Blatchford (2006: 43) ...*the digital camera provided the activity with more focus; because the children were taking their own pictures, they seemed to be looking more carefully for things to photograph. Most could provide an explanation of why they were choosing particular shot and those who could not be given the opportunity to do so when we were viewing the images upon our return to the classroom. Most did this. In this way, I feel that the camera helped clarify and consolidate the children's learning*.

Price (2009: 74) suggests concise and authentic rules for choosing a digital camera, which would appropriately serve its purpose, and yet we would be prepared to put it in the hands of children without being too much nervous. She also suggests convenient procedure of introducing a camera to children:

> *The digital camera was the **gateway to ICT** for many people to think more about ICT. All employees in our kindergarten attended training in using the digital camera. Training increased their motivation and interest.*
> *In the beginning, most pictures were taken by us, but now it is children who are the **most eager photographers**. They document their daily life, and they expand their photography skills. They may be today's photographer on the trip or they ask to get the camera because there is something they just have to take a picture of.*
>
> *C7, ECE Centre in Oslo, Norway*

As reported by several centres, children make photo documentation and video records of their own work to present it later to their peers and parents. They use different tools for recording with unprecedented ease and joy. They also have **photo frames** (C7, C16, C17), which always display pictures taken by children within their activities.

We close this section with two short case studies about using ICT as a tool for recording (and thus expressing ourselves) in Norway and as a tool for constructing and controlling small robots in Chile.

Figure 4.2.16 Children make photo documentation and video for the projects. These records are presented later in the class to other peers and to parents during the parental meetings. They like to do it a lot, boys and girls equally (C17)

> *We wanted to give the children skills and experience in the use of scanner and audio recording. This was new for most of them. We asked them to sing a song they knew before and create a drawing of its content, but one kid suggested to record roaring instead of that. There was much laughter during the recording for it was so funny. When it was done, kids made "roaring images" like screaming siblings or roaring lions. Every kid scanned her or his drawing. It took some time, but curiosity and eagerness to learn was so great so all went well. Then we put together drawings and sound. Children liked the results and wanted to see it several times.*

*After this little project, children worked a lot with audio recording and scanning. Through the way they used their skills, they **showed great creativity**.*

C7, ECE Centre in Oslo, Norway

Most of our children have an aborigine (Mapuche) background; their main language is Spanish and they understand some of their native language (Mapudungun) but are not good in writing. During the class time, all children are eager to play with the robots and curious to realize that the robot works on a sheet with figures that relate their culture to the "Chilean" culture.

In the first few sessions, children find it easier to relate the figures with objects or situations from their culture than to manipulate the robots. It may be a question of time. Observations indicate that the teachers are first too anxious about the robots and do not give children enough time to familiarize themselves with their control mechanism.

A positive experience so far indicates that the robots are only a 'good excuse' to work around concepts, ideas and figures that are significant to the children. For example, while showing a figure with a Mapuche woman weaving on a simple wooden loom, the teacher asks the children to describe the scene. The children are amused and say that the woman is "weaving with wood" but are not able to describe the object as a loom (they surely have seen them at home) in neither language (Spanish or Mapudungun). The teacher explains the loom and thereafter the children are able to offer a more precise description of the scene, sometimes in both languages. In that way the teacher is gradually expanding their vocabulary and expression skills around significant objects and scenes.

Because the material provided with the robots mixes new and familiar figures, children are interested in learning and relating them to their life. They also tend to correct each other every time someone refers to a known object without mentioning its name, and have a good time doing it.

C2, ECE Centre in Cunco Chico, Chile

From all the reports, we may conclude that the more the centre exploits ICT in its processes, the more teachers reflect about the related learning goals and benefits for children. They can start with computer, then gradually expand their equipment with other ICT categories like printer, scanner and digital camera, more and more often interactive whiteboard, programmable toys and robots, tools for recording sounds, etc. It also holds that the more the centre devotes to engaging ICT and extending its digital equipment, the more effort it invests into consistent integration of these technologies across the curriculum. They clearly express their belief that only this way ICT will support their goals in the most productive way. Systematic integration also effectively prevents or minimizes many concerns, possible risks and dangers.

Figure 4.2.17 Young Mapuche Indian controlling the robot

4.3 Using ICT with and by children

In this section, we analyze the reports of the ECE centres from the perspective of children working with ICT – how they are engaging technology, and what they are doing. In particular, we concentrate on the following aspects:

- Who conducts the activity;
- The kind of activity;
- Organizing the space: computer corner or computer class;
- Working in teams: communication and collaboration;
- Class management and class scenarios;
- Using ICT indoors and outdoors;
- ICT and gender issues.

We are thrilled to observe that most of the reports explicitly comment an exceptional level of communication, collaboration and social interaction among children that emerge and develop when ICT is properly integrated in their activities.

Who conducts the activity

In the reports from the ECE centres we identified several different ways of how teachers – sometimes together with other specialists – conduct the activities involving ICT (Fig. 4.3.1). Most often, the first alternative, i.e. the teacher herself, was reported. This aspect clearly relates to how ICT equipment is organized in the centre: if the centre has a separate computer class, an ICT specialist usually conducts the activities there with smaller or bigger teams of children.

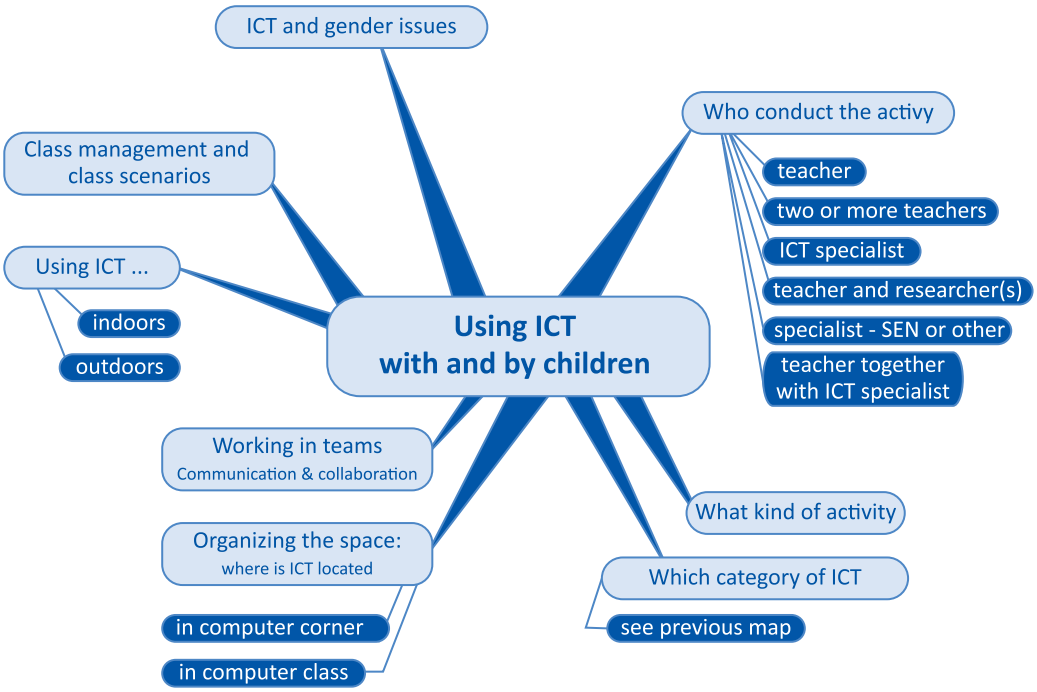


Figure 4.3.1 Different aspects of using ICT with and by children. We have analyzed different categories of ICT in the previous section, now other aspects are studied.

What kind of activity

It was of particular interest for us to learn what kinds of activities with ICT are conducted in ECE centres. The following compilation of short excerpts from the reports illustrates how rich, manifold and imaginative this repertoire is. With pleasure we noticed how high some reports evaluate the value of integration of ICT across curriculum, in various activities for all children, and often also into specialist's individual work or working with a small group of children with special education needs.

> ***Drawing*** *is the most interesting activity with ICT. When a child is drawing and others are watching, some are trying to guess what the drawing will be. Thus, others influence the drawing; the whole community becomes the "author" in such case. Children learn how to behave in front of the whole community.*
>
> *C5, ECE Centre in Budapest, Hungary*

> *Integration of ICT covers the following areas: the use of* ***multimedia*** *to create projects and teaching children the basics of* ***educational robotics*** *through LEGO technology.*
>
> *C11, ECE Centre in Moscow, Russian Federation*

> *The first benefit for us is an* ***improved sound****. It happened many times that we wanted to play some kind of music for children. The CD quality was not good enough, but with the speakers integrated into IWB we have excellent experience now. They have amazing sound and even children can hear the difference. Sometimes we use visual effects attached to music and we project this in our classroom.*
>
> *ICT gives us a chance to* ***project stories*** *and we can use it in social activities, e.g., after a celebration children can watch the video and see themselves. Another example is when kids started to be interested in the Universe – after they have seen the Star Wars movies. We could use ICT to* ***explore*** *the solar system, see pictures of planets and of the Earth.*
>
> *C5, ECE Centre in Budapest, Hungary*

> *Our main strength is our intensive use of IWB – in our ECE Centre we have got more of them and we use them as productively and effectively as possible together with all children in our centre; not only for* ***everyday playing and learning activities****, they are also used by the specialists when working with* ***children with special learning needs****.*
>
> *C15, ECE Centre in Prievidza, Slovakia*

> *Children's* ***photography*** *is now a part of everyday life in our kindergarten, and we see how our goals and working methods also change. We are now paying more attention to how children expand their skills as young photographers: allowing time for a novice to take a lot of photos and find out how photography works… Those that are more experienced are also more conscious of what they want to shoot: use the* ***zoom*** *or the* ***selection****,* ***take video,*** *etc. We often see examples of how children can help and guide one another.*
>
> *C7, ECE Centre in Oslo, Norway*

> *The advantage of* ***integration*** *is that children can use computers in any creative activity.*
>
> *C6, ECE Centre in Budapest, Hungary*

> *When children leave our centre around the age of 6, about 80% of them is able to switch a computer on and off, work with a computer mouse,*

sometimes even with a tablet, they can orient according to signs and symbols, arrows (left - right), they know how to play some computer games or listen to music from an MP3 player. They are able to ***take photographs with a digital camera, make a video or record sound, draw and print a picture****…*

C17, ECE Centre in Bratislava, Slovakia

Teachers use PervoLogo, a program, which is designed specifically for preschoolers and elementary school students. This program is presented in the form of an album. Unlike paper album, here the child can not ***draw, write*** *and* ***solve math problems****, but also* ***create animations*** *and other projects on any topic.*

C10, ECE Centre in Moscow, Russian Federation

…we ***record*** *stories, which we come up with, and we also* ***make our own film*** *(Fig. 4.3.12): That time we were making a film about a cruise of a yacht. One member of the crew fell off the board, but we managed to save him before the sharks came…*

C16, ECE Centre in Bratislava, Slovakia

Figure 4.3.2 Creative laboratory (C11)

Figure 4.3.3 Session with speech therapist (C12)

Organizing the space: computer corner or computer class

The ECE centres reported only the location of computers and large (non-portable) ICT like IWBs and wall- or ceiling-mounted data projectors. Small and portable objects like programmable toys, digital cameras or sound recorders are located at places where they are easily accessed for different activities, usually directly in the class.

Two different approaches can be identified in the reports: computers and other usual attachments are located either (a) directly in the children's classroom, usually in a **computer corner**, or (b) in a separate **computer class**. Although there is little research, which specifically investigates this aspect, according to some of the ECE reports and to the literature, the prevailing belief is that if ICT is located directly in the class, it is easier to integrate it directly into various activities across the curriculum.

As we will see later in this section, in some cases (at present quite rare) teachers sometimes carry notebook(s) within the centre to where the activity actually takes place (for example, Fig. 4.3.14).

Digital technologies (DT) are located in one classroom of our kindergarten where children have free access and a chance to use them on daily basis; as a part of planned educational activities, which are set in our curriculum. DT has its digital corner (we have corners devoted to other activities too, as in other kindergartens)…

C16, ECE Centre in Bratislava, Slovakia

We use both Apple mobile learning class and fixed computer class with MacBook laptops for each child, with a teacher's laptop and projector in front of the class. For the ICT sessions, each group of children is divided into subgroups.

C11, ECE Centre in Moscow, Russian Federation

Computers are in the groups' classrooms. From outside they are robust, they don't need any special protection. Kids are learning fast, they know after the first use, they cannot press the keys without any reason. They don't spill hot chocolate on the keyboard, so we don't need hot chocolate-proof keyboard. Other things we must be careful about are the light and the cords.

C6, ECE Centre in Budapest, Hungary

In our centre, there are three computer classes, each equipped with personal computers, interactive whiteboards and tablets. In one group, there is an additional interactive whiteboard. For individual work in ***speech therapy class****, there is a computer with special technical devices.*

C13, ECE Centre in Moscow, Russian Federation

I do not recommend establishing school-like computer classrooms in a kindergarten. In case that there are more than three computers in one classroom, children are working on their own. Technical problems, which may occur, need to be solved by the teacher. That means that instead of spending time with children, the teacher may be fixing a computer. One computer for one class is enough. It supports social skills and communication.

C3, ECE Centre in Prague, Czech Republic

Sessions are held in a special class with a subgroup of 6 to 8 children, two times a week in compliance with all conditions assigned by the sanitary rules and norms. Teachers use PervoLogo 3.0, which is designed specifically for preschoolers and elementary school students.

C10, ECE Centre in Moscow, Russian Federation

We have all stuff situated in corners. Thus, we have Art Corner, Reading Corner, Writing Corner, Math Corner, Computer Corner, Library Corner, Construction Corner, Doll House, the Market, the Hair Dresser, Board Games, Muppet Corner and Cooking Corner.

C4, ECE Centre in Maroni, Cyprus

Figure 4.3.4 Computer class and computer corner (C10)

Working in teams: Communication and collaboration

Many activities in the ECE centres are conducted in teams[34]. The ECE teachers know fairly much about how to gather teams. According to the reports from our centres, and in agreement with literature, we have no reason to believe that forming teams of ECE children for activities that exploit ICT differ in any sense from forming teams for other purposes. On the other hand, we have observed frequently that activities with ICT significantly support communication and collaboration among children as well as their development in the social domain. The same attitude has been clearly illustrated in several snapshots of Chapter 3 and in quotations used throughout this chapter.

The structure and size of a team (as well as individual skills of its members) significantly **influence the extent of interactions among children**. Teams assembled improperly need more time to overcome the communication barriers. Digital technologies are strong icebreaker (Druin 1999) which helps bring children of different natures and interests closer or give them opportunity to get to know their friends better and deeper. Children's creativity grows rapidly, if they are not isolated. Most children by their nature want to **share**, **show** and **use technologies together with others**.

> *… after being trained in the problem-solving strategy children start forming small groups while working on a problem (rather than working individually as they do during the beginning of the process) and start using communication for purposes of collaboration,* ***helping one another when facing difficulties, challenging one another, asking for help or advice from one another****. When acquiring mastery in the problem-solving process, children communicate more between themselves rather than with the teacher, making use of their peer's experiences in order to help themselves solve the problem.*
>
> *C4, ECE Centre in Maroni, Cyprus*

Team working can be based on the production of stop-motion animation. Children are excited about the miracle of creating the motion by making frame-by-frame pictures of the personages produced by them.

An award-winning example is given by the stop-motion animation Mukha-Tsokotukha (Buzzing Dung Fly by Korney Chukovsky) made by a group of children of different ages (with different limitations as cerebral palsy, etc.) at the Centre of Learning Technologies in Moscow. They made insect characters of glass beads. The process of movie production was video recorded by a group of students.

This activity can start at young ages – about 4, with the help of adults. Stop Motion, Make Me Animate or Movie Maker instruments are used.

[34] In the next part of this section we distinguish between an individual child, a small team of children (2 to 5 members), a big team of children (6 to 10 members), and a whole class as a team.

Figure 4.3.5 Outdoor activity: Making film in Moscow Zoo

Figure 4.3.6 Working in a team (C6)

Figure 4.3.7 Drawing the background

Figure 4.3.8 Creating handmade characters

Figure 4.3.9 Moving characters and producing the movie

Class management and class scenarios

In our long-lasting research collaboration with C16, we designed and conducted several kinds of activities. To classify them, we can group them, for example, along the two *variables*: **categories of ICT** and a **size of the team of children** using the particular ICT.

In the graph (Fig. 4.3.10), the horizontal axis represents five different categories of ICT; the vertical axis represents various sizes of teams of children we are working with in the classroom. Inside the table, each filled circle depicts that we have applied corresponding ICT with that particular size of the team of children in one or several activities.

Chapters 3 and 4 contain many examples of all sorts of activities: implementing different approaches to the class management, fulfilling different goals, exploiting various environments and categories of ICT, and different sizes of teams of children. Table 4.1 provides short characteristics of four types of scenarios according to different sizes of the team of children. For each type of scenario, we specify benefits, drawbacks and some related reflections. When analyzing single child scenarios, we consider 'one child – one teacher' situation, not a child working alone.

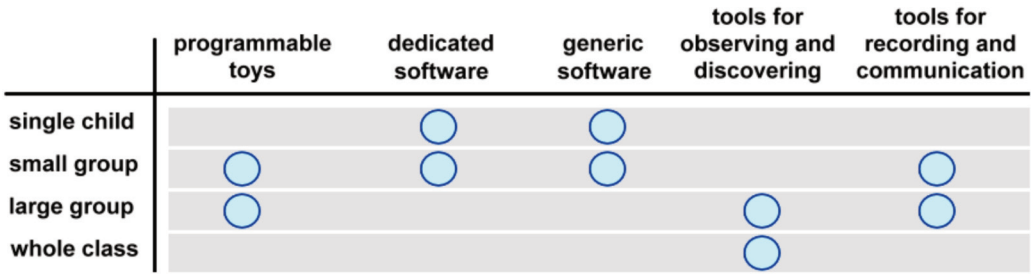


Figure 4.3.10 Activities, run at C16 ECE Centre, can be classified according to the two criteria

Table 4.1

ECE class scenarios

based on our research in ECE Centre C16, for more details see (Moravcik, Pekarova, Kalas, 2009)

Single child scenarios

Benefits	*Shortcomings*	*Reflection*
Although modern ICTs offer strong possibilities of interactivity and feedback, individual work of a teacher with a child and educational application **presents additional contribution to the child's learning**. Children's encounters with ICT are enhanced when practitioners use ***guided interaction*** (Plowman and Stephen, 2006) instead of *reactive supervision*. A teacher gets to know a child in a more personal way. This experience can help: • to adapt ICT and its settings so that it better suits individual needs of the child, • to define and elaborate the difficulty levels for the activities the child will undertake, • to integrate the work with the technology into a broader context so that the child can better grasp the abstraction set by ICT.	Individual work with ICT is problematic because of the need to provide activities for the whole class simultaneously. It requires active involvement of another teacher(s) or teaching assistant(s). Thus, such scenarios are hardly manageable in ECE centres and occur rarely and only on exceptional occasions. Moreover, frequent individual work might suppress development of such important competencies of a child as **learning to share** his or her (technological) toy with another child, **tolerate others' needs** as well as to **compromise in common problems**. The number of programmable toys or computers is also a limiting factor in the individual work with children.	• Individual work with children enables a teacher to carefully observe and understand children's personalities. He/she enough space for individual dialogues or studying their progress. Most children eagerly comment on what they like or dislike. • Many children get used to some advanced features of the painting program quickly (e.g., Undo function, cleaning up entire canvas, etc.). • Individual work with children gives a teacher a precious opportunity to consider the developmental appropriateness of the ICT application in use (see Table 2.1).

Small team[1)] scenarios

Benefits	*Shortcomings*	*Reflection*
Working in small teams gives children **the potential to acquire collaborative experience and build team relations**. The personality of each child and self-expression gets enough space[2)]. Working with one concrete technology a small team of children is easily guided by a teacher. One child can use the technology for some time, others watch him or her – they can learn, help the others or	Activities for ECE children should not take longer than 20 to 30 minutes. However, children working in a team may even not start to cooperate in such a short period of time at all. In this case, a teacher has to repeat the activity several times, or new teams must be created where children communicate more effectively. In comparison to individual work, children have to	• A teacher should give children an opportunity to present the outcomes of their collaborative work. In this way, the presenters and the audience develop their meta-cognitive skills. The common presentation can also promote stronger relations between team members.

[1)] From two to five children.
[2)] Especially in comparison to scenarios 3 and 4.

argue about the solution. This scenario **gives space to child-initiated and child-oriented approach**. The teacher coordinates taking turns among children, ensures fair opportunity to use the technologies for all. The teacher can monitor progress of each child with the technology use in detail. Most engaging scenarios conduct a whole class **complex project** in which **small teams take turns in different stands, one or more of them equipped with certain ICT.**	learn more than handling the device or software environment, they **need to communicate and cooperate with others**. This requires more time and better teacher's readiness to solve management and communication problems that may appear.	• If a teacher divides children into teams, each child should be clearly tagged by a coloured/ pictorial ´team badge' so that everybody knows to which team he/she belongs. • If a team of children is about to produce any outcome, they have to decide jointly on many things. Thus, a conflict may easily arise. We have been using a fair system of voting where major opinion would win. Children accept it very quickly and use it in other disputed cases as well.

Big team[3)] scenarios

Benefits	*Shortcomings*	*Reflection*
Working with a big team is possible only if **high level of collaboration is set among children**. Preschoolers are already able to concentrate for longer time, if there is a mutual support in solving the problems within the team. The (cognitive) skills of children in a big team, however, vary a lot. We have also experienced rich diversity of ideas, plans and suggestions on how to solve tasks. A teacher organizes activities easier if two halves of the class take turns in the work with ICT – probably working on one complex project. The outcome can be more complex than in the work with small teams of children, especially if everyone gets the space for self-realization.	Big size of team imposes several restrictions. First of all, if children have to share only one toy or one computer, they have fewer opportunities to take turns than in previous scenarios. Thus, they usually work for shorter periods and become observers of other child's work for longer time. A preschool teacher has to **prepare complementary activities** in addition to the work with ICT. Moreover, one teacher has to work with the rest of children in parallel.	• Whenever children are engaged in creating any product (movie, presentation, etc.), they should see the result immediately after the activity. • If this requires certain additional intervention of a teacher (editing the material in video-editor, etc.), he/she should finalize the product in close collaboration with children – all steps should be open to them. Children can always assist, e.g., by choosing music for the soundtrack, sequencing the pictures in correct order or recording comments and voices for the movie. • If children have been engaged in creating the product, they will like the result and would ask the teacher to show/display/ play it to them repeatedly within the weeks to come.

[3)] From six to ten children (or up to half of the class).

Whole class[4] scenarios

Benefits	*Shortcomings*	*Reflection*
All children, regardless of their gender, age or level of cognitive skills, have to **learn to collaborate, take turns, share their opinions, emotions and respect pre-set rules and principles**. A whole-class approach intensively contributes to the development of such **socially oriented competencies**. Necessity to share technology also helps children learn to respect specified rules and principles. Usually, only one teacher is needed to use the technology in the *whole-class-of-children* scenario. There is no need to think about organizing parallel activities for other children. A teacher pays attention only to one activity both in the phase of preparation and conducting the scenario and has better opportunity to fine-tune the details of the designed activity.	The use of ICT this scenario puts **high demands** on a teacher who has to organize whole group in the flexible and productive way. The teacher needs to keep children's attention during the whole time the activity is running. Thus, this approach is usually **more teacher- than child-oriented** and requires high level of the teacher's mastery of the class management. Sometimes a teacher has to play a role of an arbiter who precisely organizes activity of each child with the focus on educational aims of the planned activity. The space for self-expression of a child may considerably shrink. This space is often occupied by the most leading individuals, who advance their own interests and want to stay in the centre of events – they do not want to wait for their turns. A teacher plays essential role to decide in this case, he/she needs to guarantee fair sharing of ICT among all. Some teachers are not willing to do that[5].	• Activities based on the whole-class approach are hard to guide and monitor cognitive development of an individual child. • Children work spontaneously in the classroom; they create 'pacts of friends' and in many cases different sub-groups solve the same problems in parallel. • Achievements of children are often motivated by the praise that they expect to obtain. Many software applications also concentrate on the reward of children. However, this may support inadequate sense of competitiveness, which in many situations is unjustified. Whole-class activities can demonstrate to children that winning is not so important. A true winner is the one who learns to collaborate, understand, accept and enjoy the outcomes of other children.

Sometimes one complex activity combines more scenarios: at first we work in four smaller groups, later we make two groups out of them, … in the end we often work together as one group – when presenting the results and giving feedback.

C16, ECE Centre in Bratislava, Slovakia

In each scenario, the **closing reflective discussion with children** is of key importance. It is recommended to ask questions and stimulate discussion:

- What have you been doing?
- Which tools have you used?
- What was easy? What was hard?
- How did you proceed, what problems did you encounter? How did you solve them?

[4] In this type of scenario, a teacher is working with the whole class at a time, which may be up to 20 (depending on the country and other conditions).

[5] I haven't got programmable toys here. I find some of them are quite disruptive from the management point of view because there's an awful I want a go, I want a go! as opposed to looking what it teaches us, says a preschool practitioner (Siraj-Blatchford and Siraj-Blatchford, 2006).

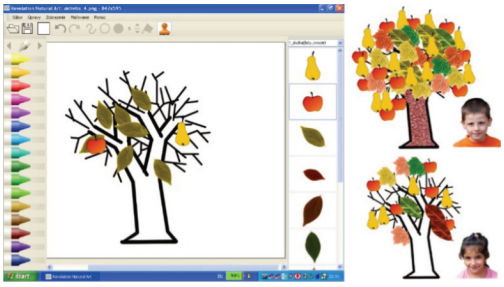


Figure 4.3.11 Children like to 'sign' their products either by their name or by its first letter or by picture of their face – if the software application offers such option

Figure 4.3.12 A team of children-actors plays an ocean ship. It is being taken frame by frame with a web camera

Figure 4.3.13 Children conducting a survey on the most favourite colours in the group. First, each child colours three balloons by three different colours. Then they take turns and enter their data – their selection of three favourite colours – into specific Logo microworld, which visualizes the results (C16)

In such discussions, it is also important to use proper terms and pay attention to the children's vocabulary when talking about ICT – this aspect is often neglected, which may result in building disorderly ICT language.

Using ICT indoors and outdoors

Most of the snapshots, presented in Chapter 3, and most of the quotations from ECE centres illustrate the activities conducted indoors[35]. However, as we are warned by literature, it would be a major loss not to exploit exceptional and productive opportunities of using ICT in the outdoors as well, either entirely or partially, as explained in Chapter 2 (a specific example we saw also in the snapshot from C17 in Box 3.5). Based on experiences from our long-lasting cooperation with the ECE centres C16 and C17, we believe that the potential of the outdoors opportunities with ICT will be gradually discovered and adopted by more and more ECE centres everywhere.

> *At first glance, ICT and the outdoors do not appear to go well together. Technological tools are generally not suited to the outdoors: often needing a power source, failing in the damp and dying in the rain, rarely robust enough to withstand the more open environment of outdoors. Why, then, incorporate technology into outdoors learning when it does not seem to be suited to the outdoors?There are two overriding reasons that I would argue compel us to* ***incorporate technology into outdoor play****. The outdoors is where some children learn best and technology can offer motivating, captivating and new ways into that learning.*
>
> *H. Price (2009: 69)*

[35] Small exception was one of the snapshots, namely the one titled My town: Beyond the ECE centre (reported by C17) where one phase of the activity took place outside the centre. Some other centres have also reported using digital camera by children when outdoors.

The website of The Early Years Foundation Stage[36] describes the following advantages of outdoor activities:

- Being outdoors has a positive impact on children's sense of well-being and helps all aspects of children's development.
- Being outdoors offers opportunities for doing things in different ways and on a different scale than when indoors.
- It gives children a first-hand contact with weather, seasons and natural world.
- Outdoor environments offer children freedom to explore, use their senses, and be physically active and exuberant.

Price (2009) draws attention to the fact that using ICT outdoors can be an **extremely motivating factor in learning** for some children. It can be the tool children are willing to share and explore, it can promote problem solving and add to learning in the ways that were not previously possible. For example, just think of all ways the learning process can develop now with the immediacy of still and moving digital images.

Figure 4.3.14 Using ICT outdoors (C6)

Let us, in this context, reconsider the technology, which is probably the simplest and most natural to start with using outside – **digital camera**, provided children have already learned how to operate it indoors. We should, however, start by setting up *the rules for using camera outdoors* and familiarise children with them (where to fetch a camera from and return it to, how to handle it safely, etc.). There are limitless ideas for using a camera outside[37] as a means, which can easily utilize all benefits of outdoor play and at the same time support all domains of children's development. Each of these thoroughly designed activities (creating an interesting composition of natural objects and taking its photograph, etc.) will provide us with several exciting opportunities to interact with children after we get indoors: attach a camera to a computer, select the photos you like, print them and display, discuss the contents with children, ask them why they created these very compositions, etc.

A natural follow-up would be **making video** (with the same digital camera). Let us observe the children's use of the camera and software, and gradually lead their investigations into making small movies together. Price also suggests other ICT technologies to be productively used outside:

- outdoor wireless camera, positioned in places of interest; picture can be picked up through a monitor indoors; thus, children can observe the natural world more closely without disturbing it, for example, capturing birds nesting;
- remote controls and programmable toys;

[36] *nationalstrategies.standards.dcsf.gov.uk/earlyyears.*
[37] Dozens of inspiring ideas for using digital images (indoors and outdoors) can be found in (Price, 2009).

- CD players and MP3 players;
- microphones and sound recorders.

Evidently, the value of outdoor learning can be even enhanced by using ICT. *It has a transforming and powerful effect, allowing for greater opportunities to extend, reflect upon and discuss experiences* (Price, 2009: 85).

We describe now a generic holistic project, based on outdoor activities. It is oriented mostly on literacy (in the broad sense) development, but also involves study of the world (science), creativity, problem solving and playful applications of technology (games and simulations), media education (digital video and music), collaboration, etc.

This Project can be done with a same-age or multi-age group – where elder and younger children work together. Involvement of adults can vary considerably depending on children experience and relations in the group. The Project is divided into several steps (some steps can be omitted). We describe it with references to specific events as a visit to the Zoo ('video' implies 'still' pictures as well, when appropriate):

- **Preparatory step**. Each child has to have an experience with a digital camera before, e.g., making picture of a teddy bear or video of another child walking.
- **Discussion about the future event.** Children express their intensions, expectations, and questions. They can record these comments (with a microphone), or a teacher can type them and display on the screen (with a projector), for example: "Pete: *I want to visit the Zoo, because I like monkeys a lot. I will make a picture of orangutan*. Ann: *I want to see a wolf, I will know if it is bigger than my dog, or not*". The level of grammar accuracy vs. authenticity and discussion about language can vary. Even if some children cannot read and write, they can observe how the teacher and other children create and use the written text for constructive purposes (the texts will be used later again).
- **The event.** During the visit to a place of interest (a monastery, or a lake near the kindergarten, etc.) children are looking around, asking questions, expressing their wishes, and discussing their observations and next steps. At the same time, they record scenes, and events around, and themselves as well. It is important to involve all children into the process of recording, in holding camera, finding the best position, etc. The teacher can help some children individually, others can work in parallel, or make groups to work together and to help each other. Usually only video is recorded, without sound, but in some circumstances sound is important and possible to record (a special case is oral comments on site and animal voices). The recording can include analogue or digital measuring, for example, of water temperature under ice and the air temperature above it.
- **Records and editing.** We have now a lot of recorded material. Each fragment has its author, a time-stamp, and the content, of course. They all have sense for the children, especially the fragments that a child made by her/himself. They can use these clips to tell about the event. To use movies in this way you need first to edit them. The editing process implies joint activity of children and adults. They produce clips eliminating spoiled or non-understandable parts, name them and arrange in a structure.
- **Video as a message, comments.** To show a video is a way for a child to tell something to the group, the teacher, their families and others. It is natural for her or him to extend the video with text comments. These comments can be made in oral or written forms (as subtitles or separate frames). The actual

speech in the situation is a combination of visual, oral, and written speech. It is important to combine oral and written speech in the zone of proximate development of a child, as well as speech of the child and others, the text with visual images, etc. For example, written comments can be composed (in an oral form) by a child, and then added (in the written form) by an adult.

- **Planning and organizing speech**. The clips can be organized in structured essays – linear presentations or non-linear hypermedia. This overcomes and to some extent destroys psychological barriers between different types of speech. (The importance of these barriers was investigated by Vygotsky). It is essential that in the process of producing essays children do a lot of planning and organizing needed also in constructing ordinary texts. At this moment children can come back to the discussion started before the event and reflect on it. Children with the help of a teacher or a parent can find the pictures or other pieces of information in the Web to answer their questions raised during the event or essay writing.
- **Presenting**. Presenting the result is a very important part of the project. A child shows her/his essay to others and says something, for example: "I did this", or tells a story which is much longer than a video clip. The teacher and other students can comment on the presentation, ask questions and extend the topic, at the end of every presentation they applaud. Comments added to the clip at the production stage help the teacher recollect the story, but also can be partly read by a student, to help him present the story, including the forgotten details. Reflection takes place, new questions occur and new impressions are discussed and recorded. From time to time, the teacher can write keywords or title some fragments and children can see the words on the screen. At a moment all children can concentrate on one statement as: "I saw…", "I know now…", "Next time I want to…".
- **Internet**. All the stories are placed in the information space and are available to parents, who are advised to ask their child to show the presentation at home. There is also an option for podcasting – sending some of the created essays to the Internet subscribers.
- **Beyond the event**. A child may also create a story or a fairy tale based on the impressions and knowledge s/he got during the excursion. For example, a story about hares in winter or a princess in the castle the child visited. It also can be recorded by a child using a microphone and a voice editor or it can be in the text editor.
- **Becoming the history.** A part of the work is final titling of the files and placing the results into common and individual information spaces. It can be used in personal diaries and portfolio revisited later.

Quick Time and Movie Maker can be used for films, Power Point – for presentations, Garage Band – for podcasts.

The going-out metaphor can work in other cases such as **making** something: puppets for the theatre or toys for the Christmas Tree. In this case, children can make their own photos or videos about different stages of the process and use these materials for telling how it happened.

In the same way children record and comment a video instruction "How to make fried eggs", or "How to sew a dress for Dolly". Recorded instructions such as "How to brush teeth", "How to serve the table", or "How to introduce yourself" can be used by younger children. Also, they can do helpful presentations for their friends

Figure 4.3.15 Group outing

Figure 4.3.16 In the Zoo

Figure 4.3.17 New experience

Figure 4.3.18
Recording scenes and events

with special needs, who can execute and learn the instructions presented as videos or still-frame sequences. These can be "Shopping" or "Travelling by metro" and even "Going to bed" helping to know all the details before the event not to be afraid during it.

ICT and gender issues

It is generally recognized and well recorded that in schools (from primary stage upwards) there are differences **between boys and girls** in *'information behaviour'* and using ICT. How do these differences arise, and where are their roots? Can the difference be eliminated, or at least, restrained or exploited for the sake of children's learning?

Some researchers assume that children upon entering their early childhood education centre may already have initial **stereotypes** about the equipment appropriate for boys and girls (Siraj-Blatchford and Whitebread, 2003).

> *Studying children in primary school, Selwyn and Bullon (2000) found no significant differences between boys and girls in terms of the applications used on the computer. Other researchers point out that there is no gender difference in the time spent engaged with a computer in the playroom among the younger children (4–5-year-olds) but that girls become less involved with computer activities as they get older. Satisfying ICT activities in preschool may offer opportunities to* ***establish boys and girls as confident users of computers as a tool for learning and communication***[38]*.*
>
> *ICT in Pre-school (2002: 16)*

[38] Highlighted by the authors of this survey.

In our study we wished to check whether teachers of the centres noticed any differences between girls and boys in the context of using ICT. Below are some of their comments:

- ... *clearly no! We expected that boys' interest would be deeper, but now we see no difference between boys and girls engagement* (C5),
- ... *we see no differences – neither at the beginning of the school year, nor at its end when children get one year older* (C17),
- ... *we haven't noticed any differences* (C15, C16),
- ... *analysis of sessions with children revealed some differences in usage of ICT by boys and girls. Most boys prefer games with logical bias, whereas girls prefer creative games* (C10),
- ... *boys are more enthusiastic about using computers, they do it more often than girls* (C6),
- ... *we do not see considerable differences in what boys and girls choose to work with, but girls are most enthusiastic when it comes to sound recording* (C7).

Based on these observations, literature and our own experiences from the kindergartens we believe that[39]:

- Many researchers in the area of **ICT and gender** issue work on an inaccurate assumption that if ICTs are integrated into early childhood education, then these are exclusively computers and prevailing type of activities are playing computer games.
- Differences between girls and boys in our context occur more in those ECE centres where computers are the only or mostly exploited category of ICT.
- Thorough and complex integration of ICT (of various categories, in various scenarios and across curriculum) into early childhood education will establish boys and girls as confident users of ICT as a **tool for learning, self-expressing and communicating**. Such approach may postpone, restrain or moderate the stereotypes, which, otherwise, boys and girls create and carry to higher stages of education and for their lives.

Figure 4.3.18 Girls are recording sounds to their story (C5)

[39] Although more research is needed, which would specifically investigate this aspect of ICT use in early childhood education.

4.4 ICT and teachers' professional development

The importance of teachers' professional development in the area of ICT competencies is publicly acknowledged and supported in most countries. Among others, it is also confirmed by the UNESCO project ICT Competency Standards for Teachers (UNESCO ICT-CST, 2008a, 2008b, 2008c). One of the ICT-CST project objectives is to extend teachers' professional development and to advance their skills in pedagogy, collaboration, leadership and innovative school development using ICT:

> *New technologies require new teacher's roles, new pedagogies, and new approaches to teachers' training. The successful integration of ICT into the classroom will depend on the ability of teachers to structure the learning environment in non-traditional ways, to* ***merge new technology with new pedagogy***[40]*, to develop socially active classrooms, encouraging cooperative interaction, collaborative learning, and group work. This requires a different set of classroom management skills to be developed. The key skills of the future will include the ability to develop innovative ways of using technology to enhance the learning environment, and to encourage technology literacy, knowledge deepening and knowledge creation.*
>
> *(UNESCO ICT-CST 2008a: 9).*

If we again focus our interest on the area of ECE, we should remind the International conference *Early Learning in the Knowledge Society*[41] held in Brussels in 2003, entirely devoted to the development of ICT competencies of ECE teachers (Siraj-Blatchford, I. and Siraj-Blatchford, J., 2006: 69). The conference elaborated four significant policy recommendations, which are highly topical and worth mentioning:

- to include Early Learning in national ICT strategies for education,
- to provide initial training and ongoing professional development for all practitioners,
- to optimise ICT policies by supporting parental involvement,
- to support knowledge building and cooperation at all levels for practitioners, policy-makers and parents.

Has the situation in ECE teachers ICT professional development changed over the past seven years? Teachers mostly understand that professional development is essential for them, and so is their motivation – such development cannot be successful without a great deal of intrinsic enthusiasm. Fortunately, this exactly coincides with the experiences we have from national project in Slovakia[42] and with what literature says on this topic: *The Early Years workforce is not lacking the enthusiasm to develop children's learning through ICT. Rather, it is a workforce faced with challenges, which affect competence levels and, therefore, confidence levels of staff. Some settings have a clear vision and development plan for providing a broad-based and exciting approach to learning through ICT. Other settings can consist of staff who feel a sense of uncertainty about the potential of ICT, how to start, where to access training and support to ensure quality is at the heart of their provision* (S. Dennis cited from Price, 2009: 119).

[40] Highlighted by the authors of this survey.

[41] The conference was organized by IBM as an opportunity to present results of the DATEC research project, including early evaluations of the progress being made in the KidSmart programme in Europe, www.ibm.com/ibm/ibmgives/downloads/early_learning.pdf.

[42] Within the project we plan to provide the ICT competencies development program for 4.500 ECE teachers.

When we analize the reports from the ECE centres, we clearly observe that they recognize the importance of complex professional development, including ICT competencies:

> *The biggest challenge is to get enough **time to develop personnel expertise**. It is important to be able to do that.*
>
> *C7, ECE Centre in Oslo, Norway*

> *The biggest problem for us is the lack of special knowledge, deep and complex ICT competencies. And also missing funds! Both my staff and I have serious problems with using ICT in a professional way. Although we already have basic skills, when something does not work, we need somebody who can help us. Fortunately, we are getting help from an IT teacher.*
>
> *However, as a leading kindergarten, since this September we will start organizing **exhibitions and open classes** for those who are interested.*
>
> *C5, ECE Centre in Budapest, Hungary*

> *Out of fourteen teachers in our centre, 13 use computers every day, sending e-mails, surfing on the Net. Some of our activities we **develop** on computer by ourselves.*
>
> *C6, ECE Centre in Budapest, Hungary*

> *Eight out of ten teachers have basic computer skills; they use computers naturally and regularly. They use PC to develop cognitive processes of the children, as well as to make their own preparation. They search for **courses and seminars** consistent with professional development programme for a teacher. They look for information about their future trips, exhibitions they want to visit, theatre programme, etc.*
>
> *C3, ECE Centre in Prague, Czech Republic*

> *Chile has already got a tradition of using ICT in schools and most teachers have been trained in using it for administrative and pedagogical activities. Teachers have been trained by the local university, and all of them own a personal computer. Around 50% of the teachers use a screen projector and a laptop in her class every week, at least once. All teachers have e-mail address and know how to use the Internet and have access to educational content.*
>
> *C2, ECE Centre in Cunco Chico, Chile*

However, there is an evidence of the lack of ICT professional development programmes specialized for ECE teachers or the lack of programmes going beyond the basic ICT competencies, although there is enormous interest in such programmes[43] from the side of the ECE workforce.

Rarely we observe the presence of complex and extensive expertise in this field outside the ECE centres, none of our reports mentions any support coming from any form of pre-service teacher-training centres or universities. The most common framework for professional development is taking part in an initial external programme (often focused on basic computer skills), then proceeding in an internal 'trial and error' procedure, sometimes individually but usually in small groups within the centre – in a kind of *unstructured and spontaneous* **peer coaching**[44] – with the goal to increase ability to implement new pedagogy effectively

[43] This is the reason why we decided to include rather extensive Appendix 1, which proposes a framework for complex initial and advanced ICT competency development programs specially designed for ECE teachers.

[44] For 'peer coaching' definition see Glossary.

or to enhance positive school and class climate[45]. Many centres organize their own courses and workshops, sometimes also for neighbouring or collaborating centres. In some cases, more systematic programmes are organized by local, regional or national education authorities. Some teachers are actively involved in professional (virtual) networks. Some centres help support the dissemination of their experience (by taking part in) organizing regional or national conferences for ECE teachers.

ICT competency of teachers is formed in different ways: at training courses of MIOE, at special sessions held by the administration of our centre; because of experience gained in the process of practical work.

C13, ECE Centre in Moscow, Russian Federation

Neither have they joined any virtual network nor do they communicate with their colleagues via PC. They do not create any educational tools using a computer. They have not attended any course, except for courses providing basic computer skills.

C3, ECE Centre in Prague, Czech Republic

Our teachers are involved in a virtual network, namely the groups 'young teachers', 'speech therapists', 'psychologists', etc. Teachers also use Internet library (www.educom.ru), educational resources from 'September 1' (www.1september.ru), etc.

C10, ECE Centre in Moscow, Russian Federation

We would like to focus on dissemination of our experience among other ECE centres in Slovakia. I think experiences of the ECE teachers in our city allow us to do so. Prievidza has been the venue of the national conference on integrating ICT into early childhood education twice already. In 2009 and 2010, we presented what kind of ICT we use in ECE, how the city authorities support us, and how successful we are in joining the national project. We also presented our cooperation with the experts from Comenius University in Bratislava.

Every year we make a DVD with all teaching/learning materials, projects and activities, which we managed to create in a year time… We provide it to every kindergarten in Slovakia that shows its interest… This kind of material sharing we consider sensible and useful…

C15, ECE Centre in Prievidza, Slovakia

Figure 4.4.1 Slovak National Conference on Integrating ICT into Early Childhood Education, February 2010, Prievidza

[45] An exception is in-service training of the teachers of the newly built kindergartens in Moscow (few dozens of ECE yearly), which receive advanced ICT equipment (of the type mentioned in this book). The training and support extend for the first year of operation of the kindergarten and are provided by the Moscow Institute of Open Education in cooperation with the Centre for Information Technologies and Learning Environments.


Figure 4.4.2 In-service training of kindergarten teachers at the Moscow Institute of Open Education and the Centre of Information Technologies and Learning Environments

ECE teachers as developers of their own resources

Many ECE teachers from the sample Centres have reported that they are developing their own teaching/learning resources, software activities, materials, simple manipulatives, etc. They do that because they want to implement (or re-implement), conduct and evaluate their own ideas and they feel the lack of such resources.

> *Teachers of our centre have designed multimedia materials for children for speech and thinking development, formation of elementary mathematical concepts, development of fine arts activities and skills of manual craft to work with parents in an interactive mode. These materials can be used at ECE centres by teachers as supplementary material in the **individual**, **subgroup** and **group** work, and by parents in the frame of home education, training and development. These materials are available on our website for public.*
>
> *C12, ECE Centre in Moscow, Russian Federation*

> *Some teachers develop simple educational resources in the form of electronic textbooks for sessions with children. Several teachers are co-authors and the developers of software and methodological environments Dreamer's Magic Designs, Dreamer's Multicreativity, and Psychological bingo published by Novii Disc and distributed to educational institutions in Moscow, Russia and abroad. The specialists of our centre (teachers of computer art, psychologists, and speech therapists) are developing methods of using ICT in different kinds of preschool activities.*
>
> *C13, ECE Centre in Moscow, Russian Federation*

If an ECE centre is a part of a bigger school, we often observe close and intensive cooperation between the ECE teachers and higher stages' teachers (often ICT teachers) in conducting specialized courses, helping with hardware, solving any kind of technical or pedagogical problems.

> *90% teachers working with preschoolers are ICT-competent. Open information space of the school allows preschool teachers to share their experience with teachers of primary school. It also helps them conduct, develop and analyze the methods and forms of education and preserve the value of the preschool age.*
>
> *C11, ECE Centre in Moscow, Russian Federation*

> *Some teachers even create their own educational tools and materials for children (icons, tools for language and literacy using digital technologies, mats for robotic toys Bee-Bots).*
>
> *C16, ECE Centre in Bratislava, Slovakia*

> *Some teachers make their own mats for Bee-Bots…*
>
> *C15, ECE Centre in Prievidza, Slovakia*

4.5 Parents as partners in the process

All ECE teachers we have been working with are deeply interested in parents' attitudes to the process of integrating ICT into the early childhood education[46], trying to create a true partnership with parents and engage them into the educational programmes. They know that the process cannot succeed without explicit support and involvement of parents. The background of the parents concerning the level of their ICT competencies and their access to computers varies considerably in various countries and regions with the extremes where:

- most families have computers, use them in their everyday life and (at least, partially) understand that ICT can support cognitive and social development of their children,
- practically no families have any ICT, either any access to ICT and very often are computer illiterate – and sometimes illiterate even in the traditional sense:

> *Parents of children in our school (with integrated ECE centre) are mostly illiterate and do not have access to ICT at home. However, they appreciate that their children are acquiring ICT skills. They fully support us and let their children participate in after-school workshops with ICT.*
>
> *We expect that gradually more parents will purchase computers for their children. They know that their children will need to know how to use ICT, once they attend urban schools.*
>
> *C2, ECE Centre in Cunco Chico, Chile*

In some cases, parents have various misconceptions and myths, usually based on evidently negative reports about harmful effects on children playing inappropriate computer games. Such reports sometimes lead parents to concerns and anxieties that their children will be exposed to aggressive and violent computer games in the ECE centres, instead of appropriate learning and play activities, instead of communicating with the peers, etc. These concerns most probably coincide with the presence of the *generation digital gap*, which often cuts through the families. Thus, parents often rightfully fear they will not be able to help their children in the area of ICT; they will fail to protect them from potential threats and will not understand why and how their children are using ICT in the ECE centres.

As pointed out by Siraj-Blatchford and Whitebread (2003: 26), when children enter their ECE setting or school environment they bring very different ICT experiences that are somehow related to their gender and to their parents' ability to use ICT. It is important, therefore, that as early years' educators we **attempt to involve parents** in their young children's ICT education.

Nearly two decades ago, Staker (1993) knowledgeably proposed the following strategies to promote collaboration among parents, children and schools in young children's ICT education:

- Workshops for parents in small groups, where they could talk about children's work with ICT.
- Allowing parents observe children at work.
- Displaying children's ICT-related work in the school entrance hall to inform parents and stimulate their interest.

[46] See, for example, 'Parents as important partners in modern education' in Chapter 3.

- Parents being invited to work with groups of children in the classroom.
- Children being able to borrow ICT equipment from school[47].
- Parents being offered advice on the software, which could be specifically purchased for use at home.

Let us examine – after a considerable lapse of time from that visionary writings – how the relationship with parents is evolving from the perspective of the ECE centres, we have been working with.

> *Working with parents towards the use of ICT is of great importance. Increased **parental competence** in this area is one of the important tasks of the teaching staff. Working with parents helps teachers to form correct attitude to computer, and parents become our allies in structuring ICT usage by their children at home. Most parents support the strategy of the institution, transfer the experience of using ICT from our preschool institution to home environment. Products of children's activities with the use of ICT in the form of printouts, crafts, exhibitions of computer work stimulate interest of parents to ICT. Many families use the same software at home (e.g., Dreamer's Magic Designer). Parents are encouraged and pleased by children's stories and the weekly results of their work at the computer session. This approach is supported by experts in education, because it creates a unified child's developmental environment. In order to reduce the risks associated with the use of ICT at home, various methodological recommendations are being presented.*
>
> *C13, ECE Centre in Moscow*

> *Parents should be confident that the time their children spend at the computer in the ECE Centre is appropriate and well-balanced with physical exercises, that their children experience only quality software and games, which parents themselves have already examined and got acquainted with. It is highly attractive for them to look at the software applications we use in our ECE centre, because for some of them this is their first encounter with the computer. If children already know how to use these software applications, they become 'teachers' and teach their parents how to use them. This strongly supports their self-confidence and conviction.*
>
> *C3, ECE Centre in Prague*

Why do innovative and responsible teachers from ECE centres want to have an impact on parents? The main reason is their intention to:

- influence and further develop parents' relations with ICT,
- get their approval and acceptance of *sensible rules of safe and appropriate ICT behaviour*,
- help parents' select suitable software applications for use at home by their children.

If we want to engage parents in the processes of ICT integration, we should know what their children do with computers at home. We should also endeavour to **exploit productively children's home experiences with ICT** when trying to achieve our educational goals. There are several ways of obtaining this information:

- we discuss these issues with children,
- we survey parents so that to learn what their kids are doing with ICT at home – and **whether parents know** what the kids are doing at home,

[47] In 1993, Staker had the following technologies in mind: calculator games, technical Lego or computer software.

- we strive to exploit all experiences with ICT they gain at home,
- we want them to adopt our rules and approach use ICT at home in the way, similar to that wish it to be employed in the ECE centre in the ECE centre.

> *Most of our families have computers, looking for information on the net and for everyday use. Kids are also using them at home, usually they play games. However, they keep no rules. In our groups at the ECE centre, they have a chance to learn how to use it in a project, in teamwork. We think that good habits and rules about using ICT must be respected. Our goal is to explain to parents that they should learn how to use ICT to support their children's physical and cognitive development.*
>
> *C6, ECE Centre in Budapest*

> *As a result of joint efforts of parents and teachers in different aspects of care, education and development of preschool children, a unified approach and requirements of these processes are used; unified developmental environment is presented; continuity between two important social institutions of family and kindergarten is implemented; issues of adaptation and socialization in early childhood through the implementation of individuality principle are effectively solved. This helps to* ***reduce the parents' anxiety****.*
>
> *Distant communication helps to overcome the spatial and temporal barriers as well, especially in the case of long absence of a child from the kindergarten; it makes the relationship between parents and teaching staff smooth and convenient.*
>
> *C12, ECE Centre in Moscow*

To meet these goals, ECE centres employ the following forms and instruments:

- we encourage parents to enter (both metaphorically and in real) the centre, to bring along their younger children, to get involved in our activities,
- we arrange open classes for them (and teachers from other settings) to demonstrate our approach and activities engaging ICT (... *they may familiarize themselves with our software applications and experience real contact with our IBM KidSmart unit*, C3),
- we organize special workshops for parents, where we argue for the appropriateness of our 'rules of action', which they should follow at home as well,
- ... *we have extended our educational objectives by a new goal* ***Open up our centre to parents*** *– within it we plan to make our efforts more visible, we want to attract the community of parents, clarify to them the importance of early childhood education and the potential role of ICT in it, systematically cooperate with families and thus extend our joint endeavour* (C17),
- *... we organize presentations of educational activities of a class followed by a functional analysis and recommendations for parents and teachers, we use videos and photo documentation from family environment for educational purposes, we create our ECE centre's magazine using ICT, etc.* (C16),
- at the meetings with parents, we explain our policy of ICT integration, we clarify key educational goals, forms and activities we employ. We use ICT to show video records of the projects and activities with children[48],
- we organize displays of our children's products created with ICT,
- we communicate with parents through ICT,

[48] Sometimes even recorded by children themselves.

- we extensively use our web site to publish the details about our centre; we want to ... *visualize the educational content of our kindergarten* (C7). We publish a lot of photographs and videos,
- during a school year we create and collect electronic portfolios of children's products, then dictribute them to parents on CD or DVD.

Parents have free access to all school premises (with integrated ECE centre). They frequently bring their younger children and observe our activities. Library and computers are located in an open room where everyone who visits school is able to see children working on computers.

We have a formal meeting with all parents every two months, where teachers talk about what´s going on in class, present plans for future and what has been achieved by the class. Parents are also invited to some important events at school, where kids' products are displayed and many ***workshops are held with children and their parents****. Each semester parents receive a CD or DVD with films and pictures of the main projects and regular activities developed by kids. It also includes children's drawings, texts, virtual books, animations or games made with computers. Sometimes we print and hand out books or card games made by children using computers.*

… we have highly positive feedbacks from parents about their children's interest. Kids love ICT activities, and many of them also use computers at home.

C1, school with ECE centre, Rio de Janeiro

What roles do parents in this *centre–parents partnership* play? As we have noticed, parents sometimes:

- initiate or motivate their ECE centre to start or further extend the process of integrating ICT,
- help equip the centre with certain hardware and/or software,
- supply consumables (printer cartridges, paper, batteries for electronic toys, etc.),
- help with hardware and software administration,
- approve educational programmes, goals and forms,
- approve or comment the choice of software,
- cooperate and learn from the experience and know-how of the centre in favour of their child's development,
- adopt rules and procedures for safe and productive use of ICT at home,
- observe and critically assess the process.

Here are some additional observations from the early childhood education settings:

- *.. some parents bought the same software and programmable toys to their children* (C16);
- *... we have noticed positive influence of what is happening in the class on our parents; their interest in our work has increased, they regularly communicate with us and visit our website, they help us with administration of ICT and often bring in some consumables. We feel they respect our work* (C16);
- *.. we are getting more support and trust from parents than from academic professional educators* (C6);

Figure 4.5.1 Parents and teachers from other centres or local education authorities come from time to time and watch our activities (C16)

- *... when we manage to convince parents of necessity to respect certain rules at home as well, in some cases an older brother is the one who takes care of the younger one, probably because of the low level of the parents' ICT competencies* (C5);
- *... close collaboration with parents allows us to construct the educational process respecting individual abilities and interests of children* (C10).

This evidences that innovative kindergartens invest much efforts in developing a close and productive partnership with the parents of the children. They realize that their endeavour to integrate ICT in support of the modern education goals must be accompanied by cooperation with parents, their support and understanding of the process.

4.6 Stay safe and healthy in the digital world

In section 2.2, we briefly analyzed how the ECE literature interprets different safety concerns. In this section, we study what ECE teachers think about these issues. Using their reports and literature, we comment on individual areas of concerns (Fig. 2.2.1) about children's safety and health. We must deal with these concerns thoughtfully. We remind that most authors who recommend to refrain from using ICT in ECE and warn about risks and dangers, often have *playing computer games* in mind and lack information about the modern trends in ICT use in many innovative ECE centres. The negative and positive experience contrast as follows:

> *The model of the passive child in front of the computer screen only holds until one has actually experienced young children interacting with any form of technology, whether it is a programmable robot, a digital camera or a computer. Immediately, one witnesses the engagement, the social interactivity and collaboration, the creativity that is stimulated and the potential of ICT for young children's learning becomes very clear.*
>
> *Adams and Brindley[49] in (Hayes and Whitebread, 2006)*

Probably the most significant and representative literature source at present in this area is the so-called Byron Review *Safer Children in a Digital World*. The author states: *I believe that crucial and central to this issue is a strong commitment to changing behaviour through a* ***sustained information and education strategy****. This should focus on raising the knowledge, skills and understanding around e-safety of children, parents and other responsible adults* (Byron 2008: 7). According to her

[49] The editors of the series *Learning & Teaching with Information & Communication Technology.*

children's first **knowledge and skills necessary for living, learning and playing safe in the digital world**.

Teachers from our ECE centres are aware of this necessity:

> *If we are sure that games are provided to children under the supervision of their teacher, we do not need to worry about this. Insecure situation may appear at home, where children play without any supervision or together with their older siblings.*
>
> *C3, ECE Centre in Prague, Czech Republic*

> *My experience of using a computer by preschool children is not negative at all. A child never uses a computer on his/her own. If a child wishes to use a computer, somebody else will always join in. Children love to talk about certain programs, they evaluate their "answers" and share their experience of using it. I often ask more experienced children to explain the other children how to play a game or how to use a program. Children become 'teachers' which raises their self-confidence. If you have Kidsmart, you will have lot of fun together with your children.*
>
> *C3, ECE Centre in Prague, Czech Republic*

> *We have not come across any sanitary or safety obstacles as we integrated ICT in the classroom according to a valid sanitary and safety code for pre-primary education of children in kindergartens and according to the needs of preschool children. Many risks are eliminated by complex integration – ICT is only one of the work places...*
>
> *C16, ECE Centre in Bratislava, Slovak Republic*

In this context, a frequently discussed question is how to restrict the time, which children spend using any desktop computer application. According to DATEC (Siraj-Blatchford and Whitebread, 2003:11), this time should be comparatively short, normally not exceeding 10 to 20 minutes at a time in the case of 3-year-olds. DATEC suggests that this might be extended to a maximum of 40 minutes by the age of eight.

C3 adopted time limits fairly consistent with what DATEC suggests: up to 15 minutes for 4.5-year-olds, 20 minutes for 5-year-olds and 25 to 30 minutes for children between 5 and 6.

The following rules are respected in C15:

- *children in the age of 3 come to a classroom with a computer and IWB at least once a month depending on the project; each child spends maximum 10 minutes at the computer,*
- *children aged 4–5 come to a classroom with a computer corner at least twice a month, usually we do whole class activities, each child spends at the computer max. 15–20 minutes per day,*
- *for children aged 5–6: there is an ICT corner in every classroom, we use computers for many activities during the day (depending on the program), each child can spend max. 30 minutes at the computer.*

Our ECE centres are aware of other risks as well. In C3, they pay our attention to the following issues:

- Watch out *for low-quality programs! If a game or a program does not work properly, children lose interest in it.*
- *If we have only a limited variety of programs and we use one program all the time, it can support schematic thinking (the right solution is the one, which the* computer provides us).

- Same reason *can lead to a schematic behaviour and limited solution when a child does not develop (children know where to click to succeed – they choose their answer automatically).*
- *This can cause an inflexible thinking and task-solving (children already know the right answer, so when they play the game again they are not thinking about it, if they do not know the right answer they prefer the method of trial and error).*

Several centres also point out the issue of the *'old hardware'*, sometimes donated by parents, institutions or entrepreneurs, who may easily fail to meet radiation or other health precautions.

Concerns about harmful physical effects

These concerns mostly relate to the hazards of postural effects, repetitive strain injury, carpal tunnel damage, effects on sight, encouragement of sedentary behaviour and obesity, and possible risks of radiation exposure from monitors (Siraj-Blatchford and Whitebread, 2003). By limiting the time children spend at computer we can help to avoid some of these dangers. Siraj-Blatchford and Siraj-Blatchford (2003: 21) emphasize that ...*general health awareness relating to ICT and computer use should form part of children's learning about ICT, and should certainly form part of any setting's health and safety policy.*

Another important concern is appropriate furniture, suitable lighting, safe arrangement of the computer corner and principles of ergonomics. Siraj-Blatchford and Whitebread (2003: 118) formulate four basic principles of ergonomics (however, different countries may have different regulations):

- The child should sit upright and feet flat on the floor.
- The child's forearms should be horizontal at 90 degrees relative to the upper arm, with elbows and palms at the level of the tabletop (keyboard/mouse).
- The monitor should be on a table at least 75 cm deep with the screen positioned for viewing 10–20 degrees below eye level.

The child should be using an appropriate size mouse or a trackball.

We emphasize that many other possible risks are not addressed in the literature, and little research has been conducted to identify them for children at this stage of physical development. Rare exception can be found in (Siraj-Blatchford and Siraj-Blatchford 2006: 47–48), where the authors draw attention to possible risks when using the projectors associated with front lit IWBs. All projectors, if misused, have the potential to cause eye injury; so some guidelines should be followed:

- Make clear to all users that no one should stare directly into the beam of the projector.
- When entering the beam, users should not look towards the audience.
- Encourage users to keep their backs to the projector beam.
- Children should be supervised every time when a projector is being used.

The major manufacturers of projectors provide now options of short-throw projectors that can be mounted directly above the IWB and close to it (on an arm mount). This construction reduces radically the probability for a child to look at the projector beam (to stand close to the whiteboard, facing others, and looking upward).

Another important issue relates to the installation of IWBs. It should not be installed too high up for children to operate it independently.

Concerns about children's learning, cognitive, social, and emotional development

As noted in New Zealand Council for Educational Research (2004:22), some ECE researchers expressed concerns about possible detrimental effects of computer use for children's learning, cognitive, social, or emotional development. For example, solitary game play could lead to children's isolation from social interaction in learning and play. Other authors, however, suggest that it is teachers' responsibility to appraise critically computer games used by children in order to identify whether these might include or promote violence.

On the contrary, our analysis of the ECE centres' reports and several examples cited in this study make us believe that if ICT usage is planned and integrated into other activities in a productive way it presents new opportunities for all forms of social interaction.

Concerns about exposure to harmful contents

New digital technologies are both increasing children's learning opportunities and bringing **new potential risks and new worries for parents and teachers** that children may be damaged or harmed. Early years are the stage when children's **skills around e-safety** should be developed. *This is the time when children are still very much focused on the family and home. Key to children's development at this time is forming relationships with key adults – developing a strong attachment bond which will go on to lay the foundation for the child's relationships throughout life. A key frontal cortex cognitive skill that is underdeveloped at this age and stage, but develops with age*[50]*, is the ability to differentiate between reality and fantasy and as such these children are more vulnerable to content, e.g. violent, frightening, sexual or highly emotional.*

Given the lack of critical evaluation, self-regulation and impulse control in children of this age, it is imperative that their access to the online world and video games is robustly monitored and supervised. Their 'technological diet' needs to be restricted, in terms of what they should access, watch, play, when, and for how long (Byron 2008: 35).

As Byron concluded, everyone has a role to play in empowering children to stay safe while they enjoy living, play and learning with new technologies, just as it is everyone's responsibility to keep children safe in the non-digital world (Byron, 2008: 13).

Concerns about ICT displacing other important learning and play activities

Although there are voices against children's use of computers, most authors are sure that computers can play an important role in young children's education experiences alongside with other kinds of activities – ICT should not be seen as a way of displacing them. To the contrary, as we have seen so many times in this study, ICT has a surprising potential to support children in their learning and play – if we know how to safeguard their health and development. *ICT can contribute to*

[50] Harris et al. (1991).

children's creative play and expression not only through the selective and supported use of particular software applications, but also through using a range of different forms of ICT (for example, digital cameras, programmable toys, or walkie-talkies) both indoors and outdoors, for a range of different learning and play activities (New Zealand Council for Educational Research, 2004:23).

As our ECE teachers have mentioned repeatedly, **attentive, thorough and knowledgeable integration of ICT across curriculum is the best answer** to most of the concerns.

4.7 ICT and children with special educational needs[51]

The term *Children with special educational needs* (SEN) is used to refer to young persons who – for a variety of reasons (intellectual, physical, social, psychological) – experience learning difficulties, which are more significant than those experienced by the majority of learners of the same age. Difficulties in learning can be permanent, recently acquired, fluctuating or circumstantial. Such children need special educational help and assistance.[52]

The current trends in international education and social policies are turning towards **integration** of those who are at risk of exclusion from the society, providing them with the access to high-quality basic education. The primary reason for promoting the attendance of mainstream schools and ECE centres by children with special needs is to **increase their learning opportunities through interaction with peers** and to encourage their participation in the life of community. Overcoming of barriers and providing inclusive education for children with a wide range of special needs should be facilitated to enable them to play appropriate roles in the modern society.

ICT offer a great potential to support lifelong learning for all groups of people, including those who have special educational needs. The application of ICT enhances independence, integration, and equal opportunities for such people, and in this way facilitates their inclusion in society as valued, respected and contributing members. For some of them, a technological solution is the only way to ensure that they can make their needs, opinions and views known. For them, access to ICT-based solutions is a lifeline to inclusion.

ICT can help and support the involvement of children with special needs in the learning and play process by overcoming some of the effects of their impairment, as well as possible barriers that traditional ways of educational technology may create. Though specific applications of ICT are extremely diverse and varied, the key ways, in which ICT can support educational process for children with special needs, are as follows:

- Identifying the preliminary level of personal development (experiences and skills), that is to say, the starting point of a child;
- Assisting in personal development by shaping new skills or updating existing ones;
- Improving the access to information;
- Enabling tasks to be tailored to suit individual skills and abilities.

[51] Contributed by Natalia Tokareva.

[52] In this publication we focus on the group of children with special educational needs, i.e. physical, sensory, communication and mental disabilities.

- Enabling greater learner autonomy;
- Unlocking hidden potential for those with communication difficulties;
- Improving motivation of children with special needs for learning and communication, etc.

Taking into account the above-mentioned trends of ICT usage in education of persons with special needs, it is important to emphasize a special field of its application as tools, which promote access to information and serve for compensation issues. Any device, system or service that enables persons with disabilities employ in their daily lives, education, work, or leisure can be referred to as **assistive technology** (AT). In education, the technology supporting and helping children with special needs increasingly implies computer-related applications.

Rapidly grown processing power has let manufacturers offer sophisticated hardware and software to get the access and meet the learning needs. Over the last few years, a computer has turned into a valuable resource for teaching children with an ample range of learning difficulties. ICTs have expanded the AT field to new dimensions, opening new doors, broadening horizons and enabling autonomy for many individuals with special needs.

From the developmental point of view, the early manipulation of objects and use of tools are of particular importance. Thus, an assistive device provided to the motor actions of a child may enable his or her development.[53]

At a very early age (under 2) AT is useful to let a child use objects as tools to achieve a desired result (Brinker and Lewis 1982, Cook et al. 1990). Later on (2–6 years) AT systems are designed and used so that children can deal with objects more symbolically. Older children (7–11 years) use AT more variably, since they are able to apply logical operations to specific problems. Finally, the design of AT devices for the adolescent can be based on problem solving and decision-making but actual operations should be allowed too. The important role of AT to support play and cognitive development of children with motor impairment has been studied as well (Besio, 2002, 2004).[54]

Motivation is very important to support an effective use of AT. For this reason, the goals of a potential user should be carefully defined, so that the device application can become meaningful and motivating to the person.

Using high-tech AT devices in educational activities allows children with special needs to be indispensable in the group of their peers, to participate in the learning or game process.

AT gives the opportunities to access the curriculum, including ECE at the adequate level, providing facilities as well as incentives for learning. Using the right AT device, suitable software and appropriate educational methodology, children who cannot hold a pencil can, nevertheless, draw and write, for example. Similarly, children unable to speak can use the computer as a communication tool. Box 4.7.1 briefly describes main trends of AT application concerning various types of impairments.

However, the ICT implemented is no panacea to all troubles of special education. Through profoundly improving the access to information and supporting communication, they can become a powerful key – didactic and communication

[53] The work of the famous psychologist Jean Piaget (1954) is particularly useful to interpret the child's development in AT respect because of its emphasis on object manipulation in the early years.

[54] The international scientific review *Technology and Disability* devoted a special issue to this topic in 2004. See the introduction by Besio and Salminen.

means – which, in turn, would lay the basis for major progress in personal development allowing the participation of people with special educational needs in community life.

As examples of ICT application for ECE children with special needs, we can mention C12 and C13 centres where various types of technologies are used to support boys and girls to overcome speech and language difficulties. For this purposes specialized software is carefully chosen and applied. Among others, we can mention such products as “Games for Tigra” and “Speech development. Learning to speak correctly”, which is aimed at correction of the general immaturity of speech skills for children from 5 years. The software programs allow to develop and correct prosodic, pronunciation, phonemic, lexical, grammar and text forming skills.

Box 4.7.1

Main trends of AT application in regard to various types of impairments*

- The primary purpose of AT for persons with physical impairments is to let them write and communicate (in written and/or oral forms). It is achieved with a wide range of input devices, pointing devices and software to support writing, reading, drawing, and studying.
- To respond to the needs of children with visual impairments non-visual forms of communication are applied, using the auditory or tactile senses. At the same time we should take into account the specifics of visual perception for persons with low vision: visual acuity (target size), visual range (field size), visual tracking (following a target), and visual scanning (finding a specific visual target in the field of several targets).
- There are several AT approaches to assist persons with hearing impairments in oral communication. One approach is to provide a feedback either visually or tactually, that represents and relates the person's speech patterns to typical speech. Another approach is to provide alternatives to oral communication, such as visual displays, being read by the listener.
- Various AT solutions are created to meet the educational needs of students with language and speech impairments. A methodology of augmentative and alternative communication (AAC) is based on a communication rather than verbal code: alphabetic devices support the user's communication through the alphabet letters; symbolic devices are based on a symbolic or graphical code. Software products also exist, which help create one's own communication board on the computer screen by means of a symbolic or alphabetic code.
- The computer can be a good starting point to motivate children with cognitive impairments to learn; it can support the learning process, acquisition of basic abilities, increased motivation and self-esteem. Various AT solutions can be found to overcome slowness and inaccuracy of the eye-hand coordination, difficulties in stimuli elaboration, memory and/or motion. Alternative access devices or access options can be adopted.
- Specialized software is developed for early childhood education to support attention, thinking, and memory skills aimed at preventing learning disabilities in reading, writing, calculating, etc. These children need assistance not only in learning but also in organizing their material and computer desktop.

* Based on the UNESCO IITE specialized training course (2006).

Figure 4.7.1 Special educational needs equipment

4.8 ICT curriculum for ECE

All ECE centres we have been working with are aware of how important it is to reflect upon goals and strategies of the ICT integration in a broad context:

> *It is important to highlight pedagogy and didactics, focus on what we want kids to learn from this, and why and how.*
>
> *C7, ECE in Oslo, Norway*

All centres are innovative institutions and – as it often happens – they have to 'pay' for their exceptionality: they usually run at the forefront of national strategies for ICT in ECE. They often pioneer and help shape processes, which in the near future will influence or become official education policy of their countries concerning the integration of ICT into early childhood education.

> *Concerning preschool, legislation is quite unspecific about what and how should be done with children. Except for a final expectation (more "traditional" or "cultural" than legal), kids should enter regular primary school being able to read and write short texts and make some basic calculation, we are free to choose. This freedom gives us the opportunity to build a preschool where we want to let children manipulate objects, build and test hypothesis, without pointing out every mistake. The school program is based upon research on cognitive development, focused on mathematics, written and verbal language and scientific thinking. Literature is present in everyday routine. Kids listen to stories, they are encouraged to write, read and draw and are exposed to cultural patrimony, which, in our vision, includes lots of fairy tales, traditional and modern stories, typical Brazilian games and songs, watching paintings and sculptures, creating their own pieces of art work and making small scientific experiments.*
>
> *Working with **multiple representations** is one of the most important targets for preschool. Children need to manipulate concrete materials and to live real physical situations. After these experiences, we suggest children to represent situations and objects in many different languages, using symbolic games, make-believe playing, drawings and other graphic representations, developing oral language and introducing written language. Computer should be a tool for them to do that, while maintaining a well-balanced relation between ICT activities and the real ones using concrete materials. Beside 'literary books' projects we also talk about and work with daily news, such as rain and flood in Rio, Fifa Soccer World Cup, or anything that affects kids' lives or can be interesting for them.*
>
> *C1, ECE in Rio de Janeiro, Brazil*

What do these innovative ECE centres do? As we have just read, they ponder about educational goals, contents and forms, about skills and knowledge that children at different ages can be expected to achieve, they are building the **ICT policy** of their early childhood centre – in fact, they are creating their own **ICT curricula**.

According to the UNESCO Policy Brief on Early Childhood (2004), such curriculum framework should include:

- A statement of the **principles and values** that should guide ECE centres.
- A summary of **programme standards** that parents may expect in the early childhood centre.
- An orientation concerning **content and outputs**, that is, an outline in relation to the broad goals that centres will pursue, and attitudes, dispositions, skills and knowledge that children at different ages can be expected to attain across different developmental areas.


Figure 4.8.1 Working with multiple representations (C1 – left, C14 – right)

- Pedagogical guidelines outlining the processes through which children achieve the outcomes proposed, e.g., through experiential learning.

When specifying the goals, contents and process, the ECE centres (or education authorities) should proceed carefully and avoid indicating target skills and competencies of their children in too much detail. In this aspect, we lean to the approach, which Siraj-Blatchford and Siraj-Blatchford (2006) call **emergent curriculum for ICT competencies**, as a parallel to *emergent literacy* or *emergent approach to numeracy*:

> *… we should not attempt to break ICT Education down in terms of the multitude of separate skills and competences that make it up. If we do this many will in any event soon be redundant. What we need to do is provide activities that encourage children to explore the technological affordances of a variety of ICT tools and to encourage them to apply them – playfully in the early years – for a range of different purposes.*
>
> *(Siraj-Blatchford and Siraj-Blatchford 2006: 2).*

Emergent curriculum arises naturally from adult–child interactions and situations that allow for *'teachable moments'*. It connects learning with experience and prior learning. In emergent curriculum, both adults and children have initiative and make decisions: it **includes all interests of children** and **responds** to their interests rather than focusing on narrow, individual, or calendar-driven topics. It is a **process** rather than a **product**. The curriculum is typically implemented after an idea or interest area emerges from the group of children. However, it is never built on children's interests alone; teachers and parents also have interests worth bringing into the curriculum. The curriculum is called emergent because it evolves, diverging along new paths as choices and connections are made, and it is always open to new possibilities that were not thought of during the initial planning process (see Jones and Reynolds, 1992).

We believe that the concept of emergent curriculum for ICT competencies for EEC adequately represents the approaches we have observed in most of our innovative ECE centres.

4.9 Where to go from here

The goal of this extensive chapter was to analyze different aspects of the process of integrating ICT into early childhood education, based on the reports of the sample centres. Before we entirely conclude it, however, let us focus on the **future of the process**. Working with the ECE centres, we have studied what their principals and teachers consider the most serious obstacles, how they try to cope with them, and

what plans and visions they have concerning the next development in the context of ICT.

What do the principals and teachers in our ECE centres consider the most serious problems in their work?

> *The biggest problem is to find **appropriate software**, and maintenance... But our team can handle small problems. We need new computers, printers and other tools; but we have financial limitations, we have no extra funds. We do not get any support from the Hungarian kindergarten association; **so far, they have not realized the importance of computers in children development at this age**.*
>
> *C6, ECE Centre in Budapest, Hungary*

> *What worries us, in general, is the unstable and weak Internet at school. We cannot **participate in collaborative projects** with other schools or use Internet-based software. We want preschool and primary teachers to **share their experience** about working with ICT with small children with other teachers.*
>
> *Other problem we have is shortage of the robots and lack of teachers' skill to organize and control the groups.*
>
> *Our plans now are to improve the ICT infrastructure and to connect teachers with peers for further professional development. We also expect students to learn with students from schools around the world, to express themselves using ICT and to communicate with their friends and their community and be ready to attend urban schools in the near future successfully.*
>
> *C2, ECE Centre in Cunco Chico, Chile*

> *We want to increase the **focus on pedagogy**, didactics and general computer knowledge. This gives staff the skills to explore digital tools together with children. Training can take place in everyday life and in the evening. It is important that everyone is familiar with all computer equipment, and that everyone knows how to use it with children. Several staff members are now active Internet users.*
>
> *C7, ECE Centre in Oslo, Norway*

> *Our challenge is to explore all possibilities ICT offer to preschool, and our main problems are (1) training teachers so that they become **autonomous enough to plan and develop their own ICT activities**, and (2) make sure that the quality of software and activities developed with the support of ICT **preserve the same values and goals** we look for in everyday pedagogic work.*
>
> *C1, ECE Centre in Rio de Janeiro, Brazil*

> *The biggest problems we are facing are: lack of computers in classrooms, absence of **quality educational programs** for preschool children, **low level of computer literacy** of our teachers and **deficiency of good methodology** about how to use ICT in ECE centres.*
>
> *C17, ECE Centre in Bratislava, Slovakia*

> *... lack of licensed software for work with children in **different domains**.*
>
> *C10, ECE Centre in Moscow, Russian Federation*

In particular, we want to underline two serious problems to which the reports draw our attention. The first concerns pre-service[55] education of the future teachers of ECE centres, especially the level of their *digital literacy* or *ICT competency*. The second one rightfully warns us of the fact that no matter how modern the early childhood

[55] We have already mentioned this problem in section 4.4.

education will be, everything depends on how the consecutive **primary education** will succeed in profiting from that and continue the development of children in a similarly transformed way.

> *It is surprising that we have been talking about a low level of digital literacy of young teachers, but there are still teachers who just graduated (from secondary schools or universities) and are digitally illiterate.*
>
> *C17, ECE Centre in Bratislava, Slovakia*

> *In future, we plan to include the latest digital technology in the educational process, which may contribute to the development of the younger generation. To keep this development sustainable it is important to observe the succession of preschool and school education. For this purpose, it is important to create information resources that support the basic principles of continuity of education for each of these stages.*
>
> *C13, ECE Centre in Moscow, Russian Federation*

> *It is a difficult starting point of a child's future life – leaving for a primary school where traditional methods of education are used.*
>
> *C16, ECE Centre in Bratislava, Slovakia*

> *The biggest problem, from my point of view, are the material conditions – lack of facilities providing the service, actualization of software all depend on finances. Internet is not available in every classroom. There is a certain lack of appropriate literature about ICT in the early childhood. We need more money to improve conditions not only for children but also for teachers. Each classroom should have a notebook for digital preparation of the teacher and for classroom documentation. Nowadays, our teachers use their private PC for doing that.*
>
> *C15, ECE Centre in Prievidza, Slovakia*

Let us now turn attention to how our ECE centres plan their further development and future progress in the context of efficient integration of ICT into the process of learning and play of their children. To our surprise, this topic was either nearly neglected in the reports or was reduced to ordinary 'everyday problems', such as planning to get more hardware, better educational software, more training... sometimes planning to get new kinds (categories) of ICT (which they do not possess at present or do not use for this or that reason). Briefly and rarely they mention some broader plans, intentions, or visions of further development:

- better exploit findings from the actual educational research in the area (or extend such research, if it is not adequately represented), so that they could better understand, how to intensify their process of ICT integration. They gladly accept cooperation with researchers from academia (C16, C17),
- get more high-quality literature for their professional development (if such literature exists and is available in their language), get more teaching/learning resources and didactic materials,
- improve future ECE teachers education so that young colleagues bring the latest know-how when they join us...

  > *... we want to develop digital literacy of children as a part of pre-primary education (establish modern digital corners in every classroom of a kindergarten – computer, interactive board and other components of digital technologies)...*
  >
  > *C16, ECE Centre in Bratislava, Slovakia*

In future, we plan to create a digital portfolio for each child – that will help us monitor different domains of their development more efficiently. We are going to make a web page of our kindergarten (nowadays, we are part of the city web page) and later we plan to create a web page for every child.
C15, ECE Centre in Prievidza, Slovakia

We believe that general concepts and questions are discussed more in those centres where they have intensive cooperation with a research or academic institution, which studies the potential and forms of efficient integration of ICT into education. This partnership is beneficial to both sides. Yet, there are exceptions – ECE centres[56] with outstandingly knowledgeable and creative principals and/or teaching staff that are at the leading edge of understanding the process.

[56] We refer to some of our sample ECE centres, but also several other centres, which have exceptional reputation and are often mentioned in literature because of their 'pioneer' work.

5 Strategy for developing ICT capability in your ECE centre

Following the previous chapters, now we will give some recommendations for an ECE centre, which chooses to follow the road to integration of ICT in its program and activities. This advice can also help a centre, which decides to continue in this process – doing it more thoroughly and intensely as it has been done until now, maybe engaging new ideas, new partnerships or broadening its goals and ICT tools.

In this chapter, we address principals or teachers of ECE centres or some local or higher educational advisors, authorities or decision-makers.

Which ECE centre can start with this process? Every single one, where you understand the meaning and importance of ECE and where you care about better fulfilment of goals of quality education, about all-round development of their children. It would be wrong to assume that this process requires high budgets. It rather requires strong will and critical approach to teachers' own pedagogical experience, perception of modern knowledge about the role of ECE, courage and the need to innovate, reverence of children and their parents and – last but not least – curiosity and the itch to explore the potential of ICT to support this kind of transition. The story of the ECE centre from Cunco Chico in Chile is one of many proofs. It is located in a poor area with high proportion of aborigine students, which was – not more than 4 years ago – evaluated as one of the schools with the lowest achievements (see more details in previous chapters). Productive process of integration can be started by a strong-minded principal or teacher with one single programmable toy or one digital camera and an ordinary computer…

Our suggestions can be described in eight simple steps, shown in Fig. 5.1. It is only a scheme, which:

- should not necessarily be linear,
- the order of the steps may vary, although the proposed sequence has some internal logic,
- many of the steps can be run in parallel,
- the whole process is interactive, with episodes of different duration (e.g., if we take part in some interesting course we may decide to extend our ICT equipment with some new categories or types, etc.).

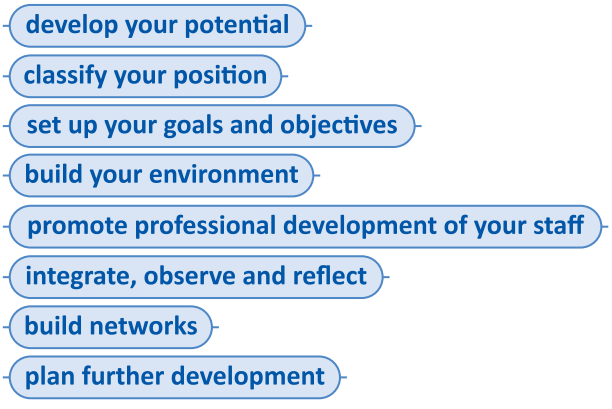


Figure 5.1 The scheme of recommendations structured into eight "steps"

5.1 Develop your potential

At present, we witness an unprecedented emphasis on the role and quality of preschool education in general – so much attention to high quality early childhood education has never been paid before. This also includes an exceptional interest in creative integration of ICT into ECE. More and more children encounter a computer before they go to school, before they go to preschool, possibly being exposed to both positive and negative impacts of ICT. Therefore, early childhood education cannot ignore this phenomenon. Productive procedures and strategies should be sought to engage ICT so that learning objectives are achieved in more effective, authentic and actual way, whenever there is a good reason for it.

If you decided to start or intensify the integration of ICT into the play and learning processes of children in your ECE centre, you will have to answer several questions. While searching for answers, try to extend your understanding of the context and develop your potential:

- Familiarize yourself with the government's ICT framework and policy documents – for all stages of education, especially for early childhood education. Many countries have recently developed or are in the process of developing an **ICT strategy for early childhood education**, many others are currently creating such frameworks.
- Develop your own ICT competency; you will need it in this process for several reasons. For example, you will have to plan and supervise ICT professional development of your staff. Also, be aware that developing one's ICT competency is a continuous lifelong process.
- Study high quality sources – academic books on ICT in ECE and sources that give practical ideas about how to proceed[57]. It is not easy, because so far there are not many of them. In this study, we gave references to several books published in English. Try to find more in your language. Use these sources to analyze the potential, which ICT is applicable to early childhood education.
- Search for examples of *good practice*; look for similar experiences at home and abroad. In this study, we devoted the whole Chapter 3 to the exciting snapshots of good practice. Then, in Chapter 4, we examined different aspects of the process of integrating ICT into early childhood education – based on the analysis of the reports from the 17 ECE centres.
- Look for more contacts – there could be more ECE institutions in your region, that are initiating the similar process.

All those challenging transformations will bring a lot of extra work to you and your peers, a lot of questions, problems and criticism, but also motivating, captivating and opening new ways into children's learning, learning both **about** and **through technology**[58] (Price, 2009).

If you believe in child-centred education and want to understand new opportunities mediated by ICT, if you are determined to discover appropriate ways of using technology in favour of children's play and learning, then obviously the process of transition in your centre has already started.

[57] There are several exceptionally experienced ECE centres with outstanding websites, which present the experience and recommendations in the field of ICT in ECE. One example is Hamerton Children's Centre and their site at *ictearlyyears.e2bn.org*.

[58] Highlighted by the authors of this study.

5.2 Classify your position

It is likely that you are an ECE centre, which has already taken some steps in order to integrate ICT into its activities. If you decided to make this process more effective and intense, it could be beneficial to pay closer attention to the analysis of your status, to consider where in this process you are. In Chapter 4, we analyzed the process of integration from different points of view. We used detailed stories of 17 centres from nine different countries, pointing out various backgrounds, conditions, strategies… and still experiencing very similar problems, failures and successes. Their attitudes and observations were confronted with the observations and opinions presented in the academic literature written by leading experts in the field. Close communication makes us believe, that our analysis can be helpful as a tool for projecting or supporting similar processes in other ECE centres as well.

The following aspects can be identified and studied in the process:

- **Motivation and initiation**: who is the initiator of this process and why – section 4.1 helps differentiate between extrinsic (represented by parents, local or higher education authority, researchers, etc.) and intrinsic (usually coming from the principal of the centre or some leading teacher(s) within the centre) motivation. We have presented examples of both types of motivation and their combination. We cannot say that one is better than another. However, we can say that without the intrinsic motivation the chance for success is fairly thin.
- What are your **goals**; which curriculum do you prefer – have you defined your goals clearly, in more detail than they are defined in the official educational curricular documents? Do you see some benefits in this process, benefits that would be impossible **without new technologies** (and new pedagogical approach)?
- Which categories of ICT do you use – do you use only one or two technologies (e.g. computer and digital camera, computer and educational software, floor turtle or so)? Do you realize that **ICT is a broad concept**, which gives us many different possibilities and opportunities for new experience for complex development of your children?
- How do you use these ICTs to support learning and play processes – do you use ICT as an additional and optional entertainment for children or do you **integrate** it in your planned process as a tool for achieving your goals?
- What kind of teachers do you have at your disposal, what level of ICT competency do they have, what is your level? How many of them and to what extent are they prepared and motivated to learn, discuss, discover, and innovate – are you able to create the **atmosphere of the learning community** in your centre?
- Who will support you – budgetary or parental assistance, support from education authorities, government ICT policy, etc.?
- What does your centre use the ICT technologies for (apart from administration) – mainly for and with children to support their learning processes or to support the children with special educational needs, to develop and plan activities, to analyze, to create e-portfolios of the children, to communicate with parents?
- How do you analyze, evaluate and further project this process – how much attention do you pay to the reflection of your situation, to the reflection of the development of your pupils in the context of using ICT, in the context of their

development in social, physical, intellectual, creative and emotional domains, which instruments (internal or external) do you use?

There are no wrong answers to these questions. We mentioned these issues because we want you to think about these aspects, to use them as a certain methodology to understand better your current situation in the process of ICT integration.

5.3 Set up your goals and objectives

The entire transition you are planning to promote should have clear orientation, and you should have rather obvious conception why you want to do it and how; what your goals and objectives are, what you would consider a successful course of the process... Note that this transition is an enormous investment, burden and personal involvement (of you and your staff). You have to understand clearly why you want to undertake it. Obviously, in such situation the goals, strategy and vision play important role.

However, do not look for the only and best strategy; there are many possible plans and many productive ways. Choose the one, which respects your tradition and your capacity. Look for *'good examples'* in your neighbourhood or far away – you will find many of them. In some aspects, they will be similar to each other, in others rather unique. Try to learn about their successes and failures.

- Keep your **goals and strategy** simple – you will have to explain it to different people with different ICT competency level, you will have to win their attention and support.
- Keep your goals and strategy flexible – the more you will learn and develop your insight, the better you will understand the potential of ICT for education, the better you will be able to formulate the goals and means to achieve them.
- When setting your goals, think about the **areas of learning, play and development**, which you consider cardinal for early childhood education and how to support their development with ICT[59].
- It is also important to clarify **what is beyond your goals and why**. Learning to operate computer and other ICT would be inappropriate goal. Certainly, children will develop such skills and knowledge, however, in the process of achieving other goals. At this age, it is no surprise that children will master ICT **through using it for other purposes**. Learning about ICT will come as one of the learning goals at some later stages.
- Undoubtedly, it is not apropriate to reward children with the access to ICT after they successfully completed some other tasks or if they behaved properly. On the contrary, we should look for strategies how to (a) implement

[59] However, this does not mean that the goals must necessarily be connected with particular subject areas in the ECE curriculum. For example, Te Whāriki, the New Zealand early childhood education curriculum does not align itself with traditional subject boundaries. Rather than specifying subject content areas, Te Whāriki emphasises five **integrated learning strands**: well-being; belonging; contribution; communication; and exploration. Assessment is holistic, viewing the child's learning as complex and contextual. The New Zealand Council for Educational Research (2004) states that ICT offers **new opportunities to strengthen many aspects of early childhood practice**. Potential offered by these technologies to the ECE sector, include in their view, (a) opportunities to support and enhance children's learning and play experiences; (b) opportunities to support and strengthen practitioners' professional learning and development; and (c) opportunities to support and strengthen relationships and communication between early childhood centres, parents, and other people connected to the early childhood education centre. *www.educate.ece.govt.nz/learning/curriculumAndLearning/TeWhariki.aspx* (accessed 12 July 2010).

ICT into many current activities so that we could achieve the goals in a more efficient, authentic and inspiring way and (b) specify new goals – previously unfeasible – which will create new opportunities to support children in their need to express themselves, communicate and collaborate in solving problems, etc.

5.4 Build your environment

- Familiarize yourself with all regulations, which concern any aspect of using ICT in the ECE centre, and respect them.
- No matter whether such regulations exist or not[60], how complex or brief they are, remember that your children's being safe is the highest priority – in all aspects studied in the previous chapters.
- Depending on your initial goals, select and get relevant ICT. Do not accept old hardware which somebody wants to donate you. Remember about possible harmful physical effects, especially, caused by older CRT monitors.
- When selecting software applications, have the DATEC criteria in mind (see Table 2.1).
- Build your *ICT space*. If you are not restricted by any regulation, choose your class (or all classes) as a place for that space and build here your **ICT** or **computer corner**. Remember the priorities: (a) safety; (b) functionality and practicality – so that you can easily integrate the equipment into different activities; (c) manageability – be modest, you do not need much to start; (d) arrangement: you should easily supervise everybody and everything going on in the corner; (e) flexibility – your needs will evolve, and the space should allow for future modifications.
- If possible, have the ICT corner connected to the Internet.
- If possible, have new furniture made for that place. It should be of appropriate height and should allow having all cords and plugs completely hidden from reach. As an alternative, you may choose a simple and temporary solution, then after several weeks or months of observing the functionality of the space set the 'permanent' arrangement. There are many 'good solutions', do not wait for the 'best one'.
- Pay special attention to proper lighting, which must be easily adjustable.
- In addition to the 'ICT technical requirements', the corner must meet all usual requirements for the ECE space.
- If you install an IWB, pay extra attention to its height so that children could easily operate it independently. Think thoroughly about the projector mounting and the direction of its light beam.
- Establish the **rules of usage** – for your colleagues but first of all for children (similarly as you probably do for other corners, equipment or situations). Make them clear, visible and understandable not only for children, but also for their parents.

Let us comment on some details of the ECE Centre C16 solutions (Fig. 5.4.1):

[60] Unfortunately, in some countries such regulations either do not exist, are mechanically adopted from primary education or are rather outdated and, therefore, do not address important and actual questions in this context.

- We designed our own small furniture for the computer corner. All wires are hidden inside the tables, including connections to the Internet and the video cable to the projector. All connectors come out through the holes in the top desks.
- The system of holes and connectors makes it possible to use one to three computers. In our centre, these are notebooks; therefore, we can easily move them elsewhere, rearrange, remove or carry them outside, etc. Most frequently, there are two of them on the tables. There is a colour printer in the corner.
- One notebook is connected to the ceiling-mounted projector, others can be connected as well but it would not be so easy to arrange.
- Data projector projects an image on the wall, inside a painted white 'cloud'. The image is fairly high on the wall, so it is impossible to stare into the beam.
- There are several cabinets with open shelves to the left, facing inside the corner. We use them to store small ICT things like programmable toys, digital camera, etc. so that they are safely put away, yet easily accessible by children (keeping the rules for their usage).
- In front of the corner, there is enough space for the whole group to sit on the floor. We use this space for discussions, for common projections or for someone to display his/her work to many children using the projector.
- Tables and chairs allow one to three children to sit in front of a computer. Three are still safe and possible but two are more convenient for children.
- One disadvantage of our solution is that there is no IWB and no space for it in the corner. However, we believe that we will get IWBs soon and we are sure that our creative principal will suggest a small change and solve this problem so that all merits of the corner will be preserved or increased.
- We want to conclude this section by stressing that our solution in C16 is nothing more than one of many possible solutions (see Fig. 5.4.3: computer displays are hidden under the glass tops of the tables). The most important is that the ICT space must be safe for children and well-planned and challenging for teachers and parents.

Figure 5.4.1 Computer corner in C16

Figure 5.4.2 Data projector is now hidden from one side by a helicopter. Creativity of our principal has no limits

Figure 5.4.3 One of the computer corners in C1

5.5 Promote professional development of your staff

- Do not expect that you or your teachers will attend several-days long professional development programme and will end up as ICT competent educators. Be aware of the fact that ICT professional development is a continuous lifelong process of personal growth.
- Estimate or evaluate the actual level of the ICT competency of your teachers and how much they are motivated to develop further. Think about efficient ways of increasing their motivation (if it is needed).
- Develop your personal strategy for planning, observing and evaluating the long-term process of the professional development of your staff.
- Struggle to create and support the atmosphere of the **learning community** within your centre, where people value expertise, where they learn from each other on daily basis, value expertise and support each other.

It could be of great help if your centre gets involved in a broader project: within such projects, it is rather common to conduct professional development programmes for all educators (in section 4.1 we discussed this point and some other advantages).

As indicated in New Zealand Council for Educational Research (2004), successful approaches to effective ICT professional development for teachers have the following features. They usually:

- involve teachers in setting the professional development and training agendas;
- take place in working classrooms;
- involve small-group collaborations between teachers;
- build on teachers‘ existing knowledge about curriculum and practice;
- are based on a specific project that teachers plan to implement in their own classroom;
- are linked to educational theory;
- provide time and opportunities to experiment and reflect on new experiences; and
- involve learning ICT skills on a ‘need-to-know’ basis.

In any ICT professional development framework, different orientations and levels of projected achievement can be distinguished. In the context of ECE, we may usually expect:

- initial computer skills programmes – usually devoted to basic computer skills, using basic applications for communication, writing, browsing the Web, etc.,
- study programmes aimed at broader ICT competencies, including the use of different tools for self-expression and communication,
- advanced development programmes, most often consisting of a selection of optional modules, sometimes coping with new pedagogies as well,
- advanced programmes for leading ECE innovators (although this level is at present more 'wishful thinking' than reality as far as the top expertise is hidden mostly inside the best ECE centres).

Note that the proposal of the initial training, presented in Appendix 2 (A2.1), does not fit easily into these ordinary categories. It struggles to (a) keep the principle of **adequacy** yet be rather broad in its topics; (b) respect the actual needs of the ECE teachers; (c) combine initial computer literacy with **new pedagogies of ICT for ECE**; (d) pay attention to developing those skills, which will prepare the ECE teachers to get involved in on-line courses or virtual professional networks; (e) provide participants with quality study materials so that the teachers could repeat each session afterwards by themselves – either at home or together with their peers.

Second level of the development programme – i.e., a more advanced level – will probably consist of several optional modules. Each participant will thus build the concrete contents with respect to their individual needs and expectations.

In any professional development framework, the most important is a proper **intrinsic motivation** and **extrinsic support**: each teacher must feel he/she is a part of the learning community thus never being alone with his/her professional problems. As it is pointed out in section 4.4, after completing different initial and more advanced courses, the most efficient way of further development is one or another form of **peer coaching**. It is a professional development strategy for teachers to consult with one another, to discuss and share teaching practices, to observe one another's classrooms, to promote collegiality and support, and to help ensure quality teaching for their children[61].

Most usual forms of training from the ECE centres' perspective are:

- face-to-face regular external course (beyond the ECE centre) – for several hours or one or several working days,
- regular and continuous face-to-face course organized once a week or a month, for a certain period,
- face-to-face regular internal course – organized by or for your centre,
- self-directed learning,
- peer couching within the centre,
- workshops and open activities organized by one centre to demonstrate or instruct certain activity, tool, technique, etc. to the peers from other neighbouring centres,
- getting actively involved in various professional virtual or physical networks.

[61] See more in the Glossary.

5.6 Integrate, observe and reflect

- Start with some simple activities (using, e.g., digital camera or drawing pictures with an easy drawing program or working with a simple programmable toy, etc.).
- After gaining some experience and after verifying the functionality of your ICT corner, focus on first attempts to integrate ICT into other activities within your curriculum. The level of integration will gradually increase, and you will exploit ICT more and more efficiently to support your primary goals within selected activities.
- Employ more and more different scenarios and ways to manage your group.
- Gradually concentrate on how to recognize and exploit new possibilities brought in by new technologies – how to develop new pedagogies and exploit them to achieve your goal better.
- Increase your skills in planning and conducting the activities. Develop the way, in which you document them – because of children and their parents, but also for a deeper analysis and assessment. Similar to all other steps, do this together with your peers.
- Integrate more categories and types of ICT, extend the palette of tools, possibilities, different scenarios and forms.
- Exploit ICT indoors and outdoors, as we discussed in more detail in section 4.3.
- Master further your skills in integrating ICT into activities for the whole group (often divided into teams).
- Learn to observe how children develop their skills to work with ICT. Observe also how they succeed in using ICT for their development in all other domains[62].
- Think about the achievements and improvements, observe the development of the whole group, of teams and individuals... – improve your **reflective practice**.
- Continuously create and collect high quality documentation, for example, in the form of e-portfolio[63] – for your peers and parents and for deep analysis and planning of further development.

We need further research to understand better the **role, appropriate formats, approaches** and **learning benefits** of integrating ICT into ECE curriculum. Although such educational research[64] will be mostly conducted by educational researchers, the ECE practitioners may significantly contribute by everyday observations and reflections, by their own research. One possible strategy of such framework in

[62] In this context we have been pleased to read from C14: *by being engaged in our development program, our children achieved not only the level of understanding, but most of them the level of analyzing, evaluating and creating (according to Bloom's taxonomy of achievements within the cognitive learning domain).*

[63] See Glossary.

[64] Several areas, in which further research would contribute to better understanding and enhancement of ICT use in the early childhood education sector, are identified in New Zealand Council for Educational Research (2004). Among other areas they include the following (in which, we believe, the **teachers' engagement and direct participation** would be essential): *In early childhood education settings where ICT is enriching the learning environment, how this impacts or enhances children's learning and development, including:* cognitive learning (e.g. language development, mathematical thinking, or information literacy); and learning, which reflects the principles, goals, and strands of the curriculum.

educational research is **action research**[65]. This can be illustrated by the experience of one ECE centre:

> *I started integrating ICT three years ago after participating in an in-service training programme aiming at promoting **action research in schools**. Part of the programme was to accomplish action research within our classrooms. My research question had to do with implementing open-ended, dynamic material in order to promote **problem solving strategy as a way of thinking**. The effectiveness of the approach was overwhelming so I decided to implement it within my regular teaching practice. Since then I have noticed interesting aspects of communication both between children as well as between a teacher and children...*
>
> *ICT plays an important role in helping the teacher more accurately evaluate child's progress. Evaluation is accomplished through observation, study of children's worksheets, group discussions and teacher–child dialogues. Parents also have interesting input helping the teacher gain a better picture of children's learning process.*
>
> *C4, ECE Centre in Maroni, Cyprus*

5.7 Build partnerships and networks

Do not stay alone in your innovative process. Build or engage yourself in *communities of practice*[66], networks of people with related goals, attitudes, and problems. Build various partnerships and networks:

- **inside your centre** (building, multiplying and sharing knowledge):

  Initiate and support cooperation among the teachers of your ECE centre. They should believe in this transition, they should identify themselves with it and support it. Usually it means more work, but it is a challenge and an exciting opportunity to grow as well.

  As we have quoted from UNESCO ICT-CST in section 4.4 ... *new technologies require new teacher roles, new pedagogies... The successful integration of ICT into the classroom will depend on the ability of teachers to structure the learning environment in non-traditional ways, to merge new technology with new pedagogy*.

  Endeavour to create (or co-author the creation of) a clear vision and development plan for providing exciting approach to learning through ICT,

- **with the parents of your children** (cooperating and combining efforts):

  Any change would be more or less impossible unless you won the approval and support of the parents. You have to explain your ideas and goals; you have to build active and productive partnership with them. You also have to learn what their children do with ICT at home and try to exploit it. Later you may also try to influence parents in some of their choices concerning *'ICT policy at home'*.

  Learn from the parents and 'teach' them as well. As we have seen in section 4.1, in some cases the process of integration of ICT into ECE is initiated by parents. However, after some time the centre usually develops its own expertise and takes over the initiative.

[65] See Glossary.
[66] Groups of people who share an interest, a craft, or a profession.

Think about different forms of cooperation with parents (we studied this issue in detail in section 4.5. This creative idea is illustrated by the following recommendation from C4: ... *organize a workshop with children and their parents...*

- **with other educators** (sharing, multiplying and disseminating knowledge):

  Support communication and cooperation with **other centres**. Learn from them and 'teach' them. If possible, share your experiences, all teaching/learning resources developed by your staff, and your portable ICT (as C16 and C17, or all twelve centres in Prievidza, the town where C15 is located, do).

  Increase cooperation with your **local education authorities** – sometimes the initiative comes from their side; in other cases you have to win their approval and support.

  Try to build cooperation with a **research institution**, which is active in the field of ICT in ECE. Such cooperation may yield interesting relations and help get involved in a project, find an ICT in education advisor...

  Cooperate with **primary schools**, which children will attend after graduating from your centre. Such teamwork may be mutually beneficial.

5.8 Plan further development

You, as a leader of such a highly important transition, must look ahead, beyond the problems of today (when not busy with solving them) and ponder about general course of the process.

- Carefully observe how the integration of ICT is changing the climate in groups, how the relations and ways of communication between you and teachers are evolving, how they cooperate among themselves in this context, continuously observe the whole process, reflect on all its aspects, evaluate them and plan the next steps.
- Study the actual trends in early childhood education, especially, in ICT in ECE: **(a)** read special literature on this topic[67]; **(b)** be active in communication with other innovative teachers and centres. As often observed in the reports of the ECE centres, in many countries the leading expertise in this topic is not concentrated at universities or ECE teacher training institutions, but in the innovative ECE centres. Then the most appropriate way to disseminate it, is to organize open sessions, visit open sessions in other centres, etc.; **(c)** write about your experiences. If you want to read about others' experiences in this context, you must write about yours, share and spread your expertise. Let us remind that some of our sample centres engage in organizing regional or national conferences on ICT in early childhood education and take active part in the events.
- In section 4.2, we presented different categories of ICT, however, we also noted that some of our sample ECE centres are using only few of them. This may be due to different reasons. Considering how modest (in this aspect and according to the reports) their plans for future development are, we assume that they may not be familiar with some categories or types of ICT. Think about the types

[67] We frequently referred to several top writings, but they are mostly in English and unaccessible for most of ECE teachers. Most of these outstanding publications are oriented to academic community and often employ academic research jargon. Such books as Price (2009), entirely oriented to practitioners, are rare. Teachers of ECE centres often complained about the lack of high-quality literature in their languages addressing their needs.

of ICT, which are being exploited in your centre and which are not. Will your children gain if you extend the spectrum?

- Ask yourself: Which new forms of integrating ICT could be adopted, which new forms of class management (scenarios) could be employed? What are the major obstacles? How to avoid or reduce them? Do our partnerships and networks evolve well? Is our work visible to everybody who might be interested?
- Reconsider your physical *ICT space*, probably the ICT corner(s). Could its functionality be better, could you improve it so that it becomes safer, more challenging, and more productive in achieving your educational goals?
- Observe new important issues, which should be reflected in the ECE curriculum to a certain extent. Could ICT[68] be employed in any way to support such an intention?

[68] Good example of a new topic could be **sustainable development and renewable resources of energy**. When a new robotic construction kit (Fig. 4.2.11) appears on the market, which allows children to build different working and moving objects powered by an attached **solar panel,** and has affordable price, should this toy be integrated into other activities in a ECE centre?

6 Conclusion

The main goal of this study was to better understand the phenomenon of ICT and its potential role in early childhood education. To achieve the goal, we established a network of 17 ECE centres around the world[69] and invited them to help us identify different aspects, which are relevant to the process of integrating ICT into play and learning activities of their children. We tried to recognize powers and risks of the transition and identify the trends for further development.

We managed to learn a lot from the sample ECE centres. Based on their *everyday life with digital technologies* we compiled Chapter 3, a collection of exciting pedagogical interventions into the territory of ICT in ECE. We analyzed the stories collected from the centres and used them in Chapter 4 to examine and document the process of transition from different perspectives. To achieve this, we extensively exploited a few academic and practitioners' writings published during the recent years. The outstanding literature review, which was commissioned by the Ministry of Education of New Zealand in 2004, helped a lot in deepening our understanding.

Combining the reports with the analysis of academic literature and our own experiences in Chapter 5 we formulated some preliminary principles and recommendations, which can help teachers, parents and school policy decision-makers to plan and foster further development in this field. We also identified considerable demand for extensive educational research in the field: research projects, which specifically investigate this phenomenon, are rare – actual expertise of the field is contained mostly in some innovative ECE centres[70]... It has been our honour and pleasure to learn from them, to learn from what they are reflecting upon:

> *In various real-life activities our children learn how to cooperate and collaborate with peers, they learn how to cope with unexpected and unknown situations. I see that educational activities exploiting ICT support the development of their critical perception and thinking, flexible decision-making, development of higher cognitive processes and effective collaboration.*
>
> *Exploiting ICT is also one of the ways of opening our centre to the community of parents. It enables them to participate in early childhood education.*
>
> *C16, ECE Centre in Bratislava, Slovakia*

It is very likely that ICT will continue to be a **significant presence in children's learning environments**[71] throughout their schooling and into their adult lives (New Zealand Council for Educational Research 2004: 7). In order to be full and capable participants in their environments, such authors as Siraj-Blatchford and Whitebread (2003: 1) believe it to be important for young children to start developing *technological literacy*. They define this as *... a new form of literacy, but it is one that is increasingly considered to represent an essential curriculum entitlement in any broad and balanced curriculum for the twenty-first century.*

The Next Generation Forum, an American-based research group, points out[72] that new technologies can be very powerful in supporting the creative potential of young

[69] See Appendix 4 for the methodology applied to conduct this study.
[70] Some of them were included in our sample, many others not.
[71] Highlighted by the authors of this study.
[72] See Siraj-Blatchford and Whitebread (2003: 23).

children. They argue that young children learn overwhelmingly by playing with toys and tools, and so we must present ICT to them as technological toys and creative tools. If we can do this, they argue, these technological toys and tools can change important aspects of children and their learning:

- they change the **learning relationships** between children and teachers;
- the technology empowers children by granting them a voice they have never had before;
- they open **novel ways of designing dynamic things** which put children in touch with ideas and concepts that used to be beyond their reach;
- they foster change in **learning strategies**;
- they open **new pathways to social interaction**.

This is an urgent challenge we simply cannot overlook.

Glossary

Action research – a reflective **process of progressive problem solving** led by individuals (for example, practitioners in the classroom) working with others in teams or as a part of a *community of practice* to improve the way they address issues and solve problems. Action research concerns actors – the people who carry out their professional actions from day to day. Its purpose is **to understand and to improve these actions**. It is about trying to understand professional action from inside. Action research in education is grounded in the working lives of teachers, as they experience them. Carr and Kemmis (1986) describe action research as being about: (a) improvement of practice; (b) improvement of the understanding of practice; (c) improvement of the situation in which the practice takes place.

Constructionism – a theory of learning pioneered by Seymour Papert and based on the work of Jean Piaget, John Dewey and Maria Montessori. It holds that children learn best when they play an active role of a designer and constructor. Nevertheless, the theory goes a step further. Constructionism, Papert says, adds *the idea that this happens especially felicitously in a context where the learner is consciously engaged in constructing a public entity, whether it is a sand castle on the beach or a theory of the Universe*. Constructionism is based on two different interpretations of **construction**. It is grounded in the idea that people learn by actively constructing new knowledge, rather than by having information *poured* into their heads. Moreover, constructionism asserts that people learn with particular effectiveness when they are engaged in *constructing* personally meaningful artefacts (such as computer programs, animations, or robots)[73].

The best way to become a good carpenter is by participating with a good carpenter in the act of carpentering. By analogy, the way to become a good learner is by participating with a good learner in an act of learning (S. Papert, 1999).

Constructivism – a theory about how people learn. It says that people **construct** their own understanding and knowledge of the world through experiencing things and reflecting on those experiences. This theory is generally attributed to Jean Piaget (1896–1980).

In the classroom, the constructivist view of learning can point toward a number of different **teaching practices**. It usually means encouraging students to use active techniques (experiments, real-world problem solving) to create more knowledge and then to reflect on and talk about what they are doing and how their understanding is changing. The teacher makes sure he or she understands the pupils' pre-existing conceptions, and guides the activity to address them and then build on them[74].

Piaget's theory provides a solid framework for understanding children's ways of doing and thinking at different levels of their development. It gives us a precious window into what children are generally interested in and capable of at different ages. To Piaget, what's more, children not only have own views of the world (which differ from those of adults), but these views are extremely coherent and robust (Ackermann, 2001).

Digital divide – a gap between those individuals and communities that have, and do not have, access to the information and communication technologies. It includes the imbalance both in *physical access* to technology and the resources, and *skills*

[73] See the web site on **Constructivism and Constructionism** at *userwww.sfsu.edu/~foreman/itec800/finalprojects/annmariethurmond/home.html.*

[74] *www.thirteen.org/edonline/concept2class/constructivism/index.html.*

needed to effectively participate as a *'digital citizen'*. Digital gap has many material and social implications and influences the lives of all of us.

Digital literacy – comprises knowledge, skills and understanding necessary for **appropriate**, **safe** and **productive** usage of digital technologies for **learning and discovering** – in our profession and in everyday private life. It is a collection of competencies to:

- meaningfully engage various digital tools for our own needs and personal development,
- effectively solve tasks and problems in the digital environment,
- choose and apply appropriate technology for finding information, processing it, applying, sharing or creating,
- critically evaluate and analyse information obtained from the digital sources,
- understand social implications (including safety, privacy protection and ethics), which emerge in the digital world.

E-portfolio or **digital portfolio** – a collection of electronic evidence gathered and organized by a teacher, usually on the Web or otherwise. Such electronic evidence may (in the context of ECE) include input images, photographs, sound recordings, various scanned products, etc. It can serve as a type of **learning record** that provides actual **evidence of achievement**. E-portfolio can advance learning and development by providing children and teachers with a method to organize, archive and display pieces of work – over a longer period. E-portfolios are becoming more and more popular because they offer practitioners and researchers the opportunity to review, communicate and assess the results of children's work.

Emergent curriculum – describes a curriculum that develops when exploring what is *'socially relevant, intellectually engaging, and personally meaningful to children.'* In emergent curriculum, both adults and children have initiative and make decisions. This power to impact curriculum decisions and directions means that sometimes curriculum is also negotiated between **what interests children** and **what adults know is necessary for children's education and development**. Ideas for curriculum emerge from responding to the interests, questions, and concerns generated within a particular environment, by a particular group of people, at a particular time (Cassady, 1993). Emergent curriculum is never built on children's interests alone; teachers and parents also have interests worth bringing into the curriculum. The curriculum is called emergent because it evolves, diverging along new paths as choices and connections are made, and it is always open to new possibilities that were not thought of during the initial planning process (Jones and Reynolds, 1992)[75].

Interactive whiteboard (IWB) – a large interactive display connected to a computer and projector. The image from the computer display is projected onto the board surface, on which the users can operate with a pen, a finger or another device. The board is typically mounted at the wall or floor stand.

ICT (in education) – implementing various digital tools, techniques and equipment to support teaching, learning and other cognitive activities.

ICT competencies – see *digital literacy.*

IWB – see **Interactive whiteboard.**

Logo – a programming language created in 1967 **for educational use** by Daniel G. Bobrow, Wally Feurzeig, Seymour Papert and Cynthia Solomon. The name is

[75] See also *www.niu.edu/ccc/curriculum/curriculum.shtml* and *www.childrensmuseums.org/programs/playingforkeeps.htm.*

derived from the Greek *logos* meaning *word*, emphasising its contrast with other existing programming languages that processed numbers. Technically a dialect of Lisp, Logo was designed as a **tool for learning by *exploring big ideas***. Its features – interactivity, modularity, extensibility, and flexibility of data types – follow from this goal.

Mostly due to Papert's writings, Logo became a platform for the new theory of learning – *constructionism* – a new culture in teaching and learning. It is worth reading what Papert highlighted as features of the **Logo culture** (S. Papert, 1999: xv–xvi):

- The Logo programming language is far from all there is to and in principle we could imagine using a different language, but programming itself is a key element of this culture.
- So is the assumption that children can program at very young ages.
- And the assumption that children can program means much more than that: in this culture we believe (correction: we know) that children of all ages and from all social backgrounds can do much more than they are believed capable of doing. Just give them the tools and the opportunity.
- Opportunity means more than just "access" to computers. It means an intellectual culture in which individual projects are encouraged, and contact with powerful ideas is facilitated.
- Doing this means teachers have a harder job. But we believe that it is a far more interesting and creative job and we have confidence that most teachers will prefer "creativity" to "easy."
- However, for teachers to do this job they need the opportunity to learn. This requires time and intellectual support.
- Just as we have confidence that children can do more than people expect from them we have equal confidence in teachers.
- We believe in a constructivist approach to learning.
- Yet more than that, we have an elaborated constructionist approach not only to learning but to life.
- We believe that there is such a thing as becoming a good learner, therefore, that teachers should do a lot of learning in the presence of the children and in collaboration with them.
- We believe in making learning worthwhile for use now and not only for banking to use later.
- This requires a lot of hard work to develop a rich collection of projects in which the interests of an individual child can meet the powerful ideas needed to prepare for a life in the 21st century.

Microworld – thoroughly designed, domain-specific, open and highly interactive software application (interface) for learning (Edwards, 1995). Such interfaces give children and students opportunities to build their own knowledge of fundamental concepts. When working with microworlds, children are encouraged to encounter concepts and relations through **active engagement and exploratory learning**. Although there are many software applications aiming at the learning process, microworlds are distinguished by their focus on immersive learning and their sensitive tuning to person's cognitive and motivational states (Rieber, 2004). A microworld consists of the following components:

- A set of computational objects that model the mathematical or physical properties of the microworld's domain.

- Links to multiple representations of the underlying properties of the model.
- An ability to combine objects or operations in complex ways, similar to the idea of combining words and sentences in a language.
- A set of activities or challenges that are inherent or pre-programmed in the microworld; the student is **challenged to solve problems**, reach goals, etc.

Netiquette – a blend of two words: network and etiquette, a set of rules or social conventions that facilitate interaction in computer networks.

Peer coaching – a professional development strategy for teachers to consult with one another, to discuss and share teaching practices, to see one another's classroom, to promote collegiality and support, and to help ensure quality teaching for their children.

Peer coaches are teachers who are recognized by their staff as strong teachers. Many of them have had (in the context of this study) some success in integrating technology into their emergent curriculum. All coaches are willing to help other teachers in reaching this same goal. Coaches assist other colleagues to implement new approaches with ICT into classroom activities by discussing and sharing teaching practices, and supporting efforts to enrich children learning through the uses of technology. Research has identified many benefits of peer coaching for teachers, **reduced sense of isolation** among them, an ability to implement new strategies effectively, a positive school climate, and revitalized abilities[76].

[76] For more on peer coaching, see Gottesman (2000), *www.mentors.net*, *www.pimarsc.org*.

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Appendix 1:
Social Interactions and ICT-Based Education[77]
(following Vygotsky's cultural-historical school traditions)

The Vygotsky's early works discussing the thesis that social interactions play a decisive role in the development of thinking in the course of learning and serve an impetus to elaboration of ICT use in the processes of teaching-learning in Russia. A social situation is assumed to be a source of development. According to Vygotsky, *any function in a child's cultural development appears twice, in two aspects – in the first instance in the social aspect as an interpsychic category among people, later in the psychological aspect as an intrapsychic category inside a child* (Vygotsky, 1983: 145). Social relations come to the fore as genetically social, provided that in its original form every function is shared among the participants. Hence, the principle and method of ICT integration in education is as follows: ICT is a means to organize paired interactions in the problem solving process as well as a means of cooperative educational activities in the classroom (*teacher – student – group of students*).

Thus, for example, the ICT-controlled social interactions initially served as tools to implement thinking processes and communications, later they started to perform the function of cognitive self-regulation and intellectual presentation of various pieces of information. These interactions activate yet undeveloped cognitive functions, enabling a student to act at a higher level of cognition. The difference between what a student may do on his/her own (the actual level of development) and what a student may do under proper guidance is defined as 'a zone of immediate development'. In this case, according to Vygotsky, learning is successful only if it outpaces development, if it arouses and brings into being the functions that are yet maturing or lie in the zone of immediate development. It is exactly how, as Vygotsky's believes, education plays an exceptionally important role in the development.

Investigations of Russian and foreign psychologists, accomplished following the guidelines of Vygotsky's school, indicate that children, who take part in cooperative work based on the use of ICT, carry out the process of genuine exploration (quasi-exploration), demonstrate interest and emotions that inspire their effective development. Meanwhile, though it is difficult to instruct children how to communicate properly in the ICT environment, to organize situations of collective learning in teams (these activities promote the development of interaction and collaboration schemes of a learning type), but it is necessary for students' development. Psychology has attained considerable achievements in investigation of ICT-based collaborative activities, yet many issues remain unclear, while proper organization of collaborative activities of an adult and children, as well as among children, depends on them, i.e., how group and individual forms of education correlate in the ICT environment, how teams (groups) of children should be composed, how individual characteristics of students should be accounted, etc. Nevertheless, the accumulated experimental data on the role of social interactions in the process of ICT-based education discover new reserves for a child's intellectual development. Thus, these data lay the basis for the improvement of education content and techniques, as a matter of fact, the ground for a new ICT-based pedagogy to emerge in the immediate future. The main principle of a new pedagogy is collaboration

[77] Contributed by Vitaliy Rubtsov.

of children and adults, which breeds a precondition for ICT-mediated educational interactions to emerge, consequently, for an independent creative search of a child, which definitely eliminates an authoritarian supervision over child's thinking.

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Appendix 2:
Professional development for ECE educators

Complex and **continuous** professional development of ECE teachers is a key requirement of the productive integration of ICT into the learning processes of children. When designing a detailed format and contents of this professional development framework, each country and each initiative will take into account their own approach, forms and priorities. In spite of that, we believe that it is plausible to utilize previous experience and findings of research and try:

- to identify **general conditions**, which may contribute to efficient course of such professional development programmes (in section 5.5, we quoted a list of conditions resulting from a synthesis of research presented by the authors of New Zealand Council for Educational Research, 2004:51),
- to exploit recent outcomes of the UNESCO's project *ICT Competency Standards for Teachers* (2008a, 2008b, 2008c) and gradually recognize different levels of the **ICT competency standards for ECE teachers**,
- to develop and recommend a general structure for ECE teachers' continuous professional development and approximate contents appropriate for each level of these ICT competency standards.

In part A2.1 we propose a framework for the initial ICT competency professional evelopment programme for ECE teachers[78]. When presenting the initial ICT competency development programme we intentionally do not suggest any duration or time schedule because it depends on several additional factors[79] (available budget, human resources, space and equipment opportunities and other conditions).

A2.1 Initial ICT competency for ECE teachers

The format and contents of this educational programme is based on the structure of the professional development programme for ECE teachers, which we developed and implemented within a Slovak National project[80] in 2009 and 2010. Its content is structured into three **educational paths**, which we consider to constitute three components of the initial ICT competency for early childhood education teachers, which are combined in the table with general educational goals:

[78] Based on our experience from projecting and implementing several national professional development programs for teachers.

[79] In our recent implementation, we have used the structure of 8 hours per educational unit.

[80] This program was developed by Brecka, P., Hrusecky, R., Chalachanova, M., Javor, M., Kalas, I., Koprda, S., Kralikova, M., Maros, M., Moravcik, M., Mujkosova, E., Pekarova, J., Polak, J., Stryckova, G., Uhercikova, V., Vankus, P. and Zahorec, J.

Discovering ICT	Learning with ICT	Integrating ICT
Build and develop *basic computer competencies*, committed to "local" personal skills (i.e., bound to one's own computer, learning to utilize it offline, outside the virtual world)	Apply one's basic computer competencies to profit from the digital world, digital communities and communication within them. Learn to exploit ICT to communicate with other teachers and educators (within and outside the centre) in order to share successes and problems, discuss and exchange experience and learn more	Utilize one's emergent digital literacy to integrate *new technologies* and *new pedagogies* into everyday life of the ECE centre, into the learning processes of children in the most **efficient**, **attractive**, **safe** and **productive** way

Each of these educational paths comprises several **educational units**, which in detail define its contents. The following table shows the whole structure. Note that one-half of all 12 units belongs to the *Integrating ICT* path. This distribution correctly represents the priorities of the programme.

Discovering ICT	Learning with ICT	Integrating ICT
painting and drawing	Internet	digital camera
working with text	social networking	digital toy
multimedia		edu software for children
		pedagogy of ICT
		integrating ICT info ECE
		safe and healthy with ICT

The order of the units is important, so that first go the units that will support the participant's own *learning with ICT*. We use different colours of the units to represent the educational path the units belong to.

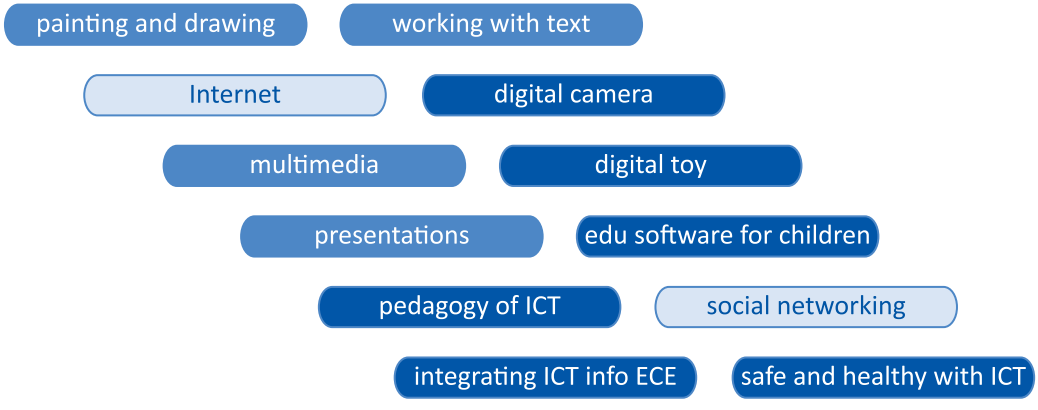

Figure A2.1 This is the recommended order of the educational units (from left to right, then from top down: that means Painting and drawing, Working with text, Internet, etc.)

The units are expanded in the same order in the tables below. The following four aspects are specified for each unit: **General objectives**, **Contents**, **Methods and management** and **Recommendations**. When organizing a concrete implementation of this programme, several additional aspects should be determined according to the actual and relevant conditions, including its **Duration**, **Resources** (human, technical, etc.), **Teaching/Learning materials,** etc.

One *integrated topic* will pass through all units as far as it should not be implemented as a stand-alone unit. It is about working with files and folders, interacting with computer and its system, using supporting applications, using USB flash drive and other simple details, which are often technical and boring, but in the context of basic computer skills and techniques they are highly important – but often neglected.

Painting and drawing	
General objectives	Teachers should be able to: • apply basic tools of a graphics editor to create their own drawings and paintings; • use **mouse** and **tablet** to draw simple pictures; • customize the environment of the graphics editor to meet the needs of the users; • recognize most common formats of the graphics files; understand the differences and usual purposes. To meet these goals, proper bitmap graphics editor should be carefully selected considering several aspects and requirements.
Contents	• Basic tools, first attempts in a bitmap drawing software application; • Images and files, Open and Save; Save As; • More tools in step by step activities; • Selection; Copy and Paste; • Applying the Symmetry tool; Adding texts; • Working with stamps, Stamp Browser; • Customizing the environment (different interfaces); • Drawings, paintings, images and photographs. Different file formats.
Methods and management	• Hands-on experience, learning by doing; • Tablet as an alternative to mouse, drawing with tablet; • Using a series of worksheets; • Discussions on clarifying all new concepts, techniques, tools and most frequent problems; • Sufficient time for individual work.
Recommendations	• Do not lecture on painting and drawing with computer. • Exploit the fact that (nearly) all ECE teachers like drawing and can draw and paint. • Prepare and distribute complete study material, mostly composed of the worksheets, so that after each session teachers can practice on their own, see, for example, Fig. A2.2. Worksheets also allow for different speed of work and respect individualities and various levels of basic computer competencies. • Study material should build and develop tools and techniques, which are, more or less, identical in the most of bitmap graphics editors. • Using tablet is not a goal, but a tool. Many ECE teachers will see and use it for the first time. They should familiarize themselves with the tablet and may prefer it to a mouse for drawing and painting. • We recommend a short concluding discussion on what makes drawing on computer different from traditional drawing.

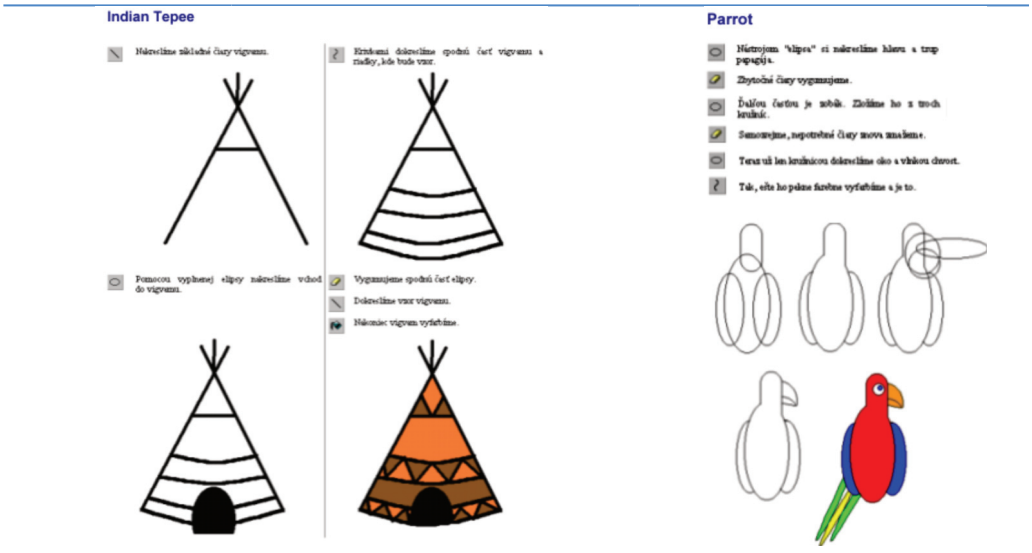

Figure A2.2 When learning to use a program for drawing, it is highly recommended to employ worksheets (similar to learning to use any new software environment)

Working with text	
General objectives	Teachers should be able to: • work with basic and the most common tools of the text editor; • create a document, format and edit it, save or save it as..., open, check and print; • know and accept some basic rules for creating text documents. To meet these goals, an appropriate text editor (word processor) should be selected considering several aspects and requirements.
Contents	• Opening a file with short text document; • Writing one's own text, elements of editing; • Inserting pictures; • Applying Save, Save As and Print the document tools; • Useful rules for working with text documents.
Methods and management	• Individual work (one-to-one mode) using worksheets, which help go step-by-step through the most basic tools and techniques at a speed suitable for each teacher. • Short discussions on clarifying all new concepts, techniques, tools and most frequent problems. • Short presentations of useful rules, common mistakes and problems.
Recommendations	• Do not lecture on the text editor, its tools and techniques. Rather help individual participants with solving tasks step-by-step. • Activities and tasks should be ordered and connected so that the participants create more complex documents step-by-step. • If several participants face the same problem, the solution or proper technique could be presented to the whole group on the screen. • Help participants with opening and regular saving their working documents. • All activities and tasks should fully respect common practice and needs of ECE teachers. • Repeatedly draw attention of all participants to most frequent and ordinary mistakes and problems.

Little postman Thomas the Clown rides across the Colour Kingdom

Poprosme Tomáša, aby zaniesol liečivé bylinky od draka prechladnutému kráľovi na hrad:

Najprv pôjdeš po  , potom po  , potom po  a ešte raz po  – a si tam!

Figure A2.3 In this unit we learn to insert (prepared) pictures into the text

Internet	
General objectives	Teachers should: • be familiar with basic Internet services (www, e-mail); • explore web pages and download texts and images; • browse the Web; search for information using simple keywords and phrases; • send and receive e-mails (simple and with an attachment); • know and accept rules of network etiquette; • be aware of the risks, which result from using the Internet. Within this educational unit, teachers will further develop their computer skills: working with files, interacting with computer and its system, using supporting applications, etc.
Contents	• Internet: what is it and what it offers; • Exploring web pages; • E-mail; • Searching with keywords and phrases; • Rules of netiquette[1)] (network etiquette).
Methods and management	• Individual work (one-to-one mode) using worksheets, which help go step-by-step through the most basic tools and techniques at a speed suitable for each teacher. • If necessary, the instructor may use short presentations with some hints on how to solve certain problems. • Short concluding discussion on the rules of netiquette.
Recommendations	• Do not lecture on the principles of Internet and its services. Rather concentrate on concrete activities and tasks useful for everyday life. • Worksheets should contain (a) guidelines for solving common tasks and problems, (b) useful icons, (c) screenshots with highlighted control or navigation elements, which are actually required, etc. • If several participants face the same problem, the solution or proper technique could be presented to the whole group on the screen. • Observe and help participants with exploring web pages, searching for information and downloading documents or images. • All activities and tasks should fully respect common practice and needs of the ECE teachers.

[1)] See Glossary.

Digital camera	
General objectives	Teachers should be able to: • take pictures with a digital camera; • know its basic functions (which are similar in most brands and types of non-professional cameras); • know and apply basic rules for taking pictures, be aware of the most frequent problems; • inspect the pictures in the camera display, delete pictures from the camera; • download pictures from the camera to the computer; • organize files and directories with pictures on the disk; • apply basic operations with pictures in a software for processing digital photographs; • use scanner at the beginners' level. Within this educational unit, teachers will further develop their computer skills: working with files, interacting with computer and its system, using supporting applications, etc.
Contents	• Practical activities in taking pictures with a digital camera; • Working with a camera display; • Downloading pictures into the computer, basic picture processing; • Useful rules for amateur photographers; • Ideas for using digital camera with children and by children; • Using scanner. Ideas for using scanner with children.
Methods and management	• Introductory activities with hands-on experience for each participant in taking pictures (in various modes), downloading them, selecting, processing, saving and printing. • Short discussions supplemented with concrete examples and demonstrations.
Recommendations	• Do not lecture on digital cameras and photography, various technical concepts and principles. Rather keep a well-balanced level and create opportunities for practical tasks and gaining experience for amateur photographers-beginners. • Topics on Basic rules for taking pictures and Ideas for using a digital camera with and by children should be organized either as discussions or practical demonstrations. • Ideas for using digital camera with and by children must be simple, creative, attractive and diverse. Example: a child takes a picture of the class, then takes away a toy from that scene. Other children use the picture to identify the missing object (Whittle and Jayne, 2007). • Each participant should accomplish the whole procedure of taking a picture, downloading it, processing, saving and/or printing...

Multimedia

General objectives	Teachers should be able to: • use basic tools for creating and processing different multimedia files – software application for recording and processing sound, video editing software and graphics editor for creating animations; • use headphones and microphone (or headset) for working with sound; • use digital camera to record a video; • download video files from camera or video camera to the computer; • understand legal issues of using multimedia resources.
Contents	• Working with sound, playing, recording and saving sounds; • Creating simple animations as sequences of bitmaps; • Using multimedia resources in a correct way; • Creating and processing video. Within this educational unit, teachers will further develop their computer skills: saving video, sounds and animations in files of different formats, downloading, copying and moving data from video camera, etc. 
Methods and management	• Individual work combined with working in small teams (up to 3 participants) using worksheets, which help proceed step-by-step through the basic concepts, tools, techniques and applications at a speed suitable for each participant or team. • All activities and tasks should fully respect common needs and experiences of the ECE teachers. • Topic Creating and processing video should be a teamwork. • Short discussions supplemented with concrete examples and demonstrations.
Recommendations	• Worksheets should contain all required material, including screenshots, icons, step-by-step instructions, properly arranged sequences of tasks, etc. • Do not lecture on technical details and principles of multimedia devices and applications. Rather keep balance and create opportunities for practical tasks and gaining experience for each participant. • If several participants face the same problem, the solution or proper technique could be presented to the whole group on a screem. • Carefully observe the advances of individual teachers and teams. Discuss common and frequent mistakes with the group. • It is recommended to customize the environment of the graphics tool (if the application supports such options) so that it corresponds to the needs and level of experience of the participants. • All activities presented in the worksheets should be motivating and enjoyable, instead of being technical. • All products of each participant or each team will be collected by the instructor for final whole-group presentation and discussion.

Digital toys

General objectives	Teachers should: • know various types of digital and programmable toys, which are appropriate for ECE; • know in detail one concrete toy, which could be used as a means to support the development of logical thinking and problem solving skills; • know examples of different activities that can be carried our with the toy and the areas of learning, which they develop; • be able to reflect on and discuss the potential and risks of applying that toy within the ECE curriculum; • be able to design similar activities with the goal to promote learning processes of children within the ECE centre. In this educational unit, teachers will further develop their computer skills: working with files, interacting with computer and its system, using supporting applications, etc.
Contents	• Controlling a programmable toy; • Activities with the toy supporting various learning goals; • General knowledge of other digital toys; • Discussing educational potential of the toys and the activities; • Analyzing and assessing the activities; • Designing one's own activity with the programmable toy.  *Figure A2.4* *Bee-Bot, see www.tts-group.co.uk/Bee-Bot*
Methods and management	• Analyzing the activity in small teams. • Short presentations on working with the selected toy based on literature review. • Discussion with the whole group on the potential of the toy, identifying its strong and weak points. • Overview of other digital toys, combining a presentation and self-study using selected and prepared web pages. • Individual work: designing and developing activity with the toy.
Recommendations	• Each teacher should accomplish the activities and then discuss possible problems, improvements and modifications, which may support other learning areas or goals. • If it is reasonable to use any additional props with the toy (e.g., a mat for the Bee-Bot) create them in small teams.

Presentations	
General objectives	Teachers should be able to: • operate a presentation application (for example, MS PowerPoint) and run the prepared presentation; • create a simple presentation; • create presentations including texts, pictures, animations, video and sounds; • use themes and colour patterns; • use animations and transitions; • print a presentation or its outline.
Contents	• Operating a presentation application and running the prepared presentation; • Creating a new presentation (slides, animated objects, transitions); • Using standard themes; • Inserting multimedia objects; • Good rules for creating presentations; • Printing a presentation and its outline.
Methods and management	• Individual work using worksheets, which help to go step-by-step through basic tools and techniques at a speed suitable for each participant. • If appropriate, the instructor may use short presentations with some hints on how to use certain tools. • Short discussions and presentations illustrating good practices, common mistakes and problems.
Recommendations	• Do not lecture on technical (advanced) features of the presentation environment. Rather concentrate on basic tools and techniques useful for simple presentations. • All presentations' topics and tasks should fully respect common practice and needs of ECE teachers. • Observe and help participants with opening and saving presentations and inserting files with additional objects (pictures, sounds, etc.). • Activities and tasks should be ordered and connected so that participants could create step-by-step more complex presentations. • If several participants face the same problem, the solution or proper technique could be presented to the whole group on the screen. • Worksheets should contain (a) guidelines for solving common tasks and problems, (b) useful icons, (c) screenshots with highlighted control or navigation elements which are actually required, etc.

Educational software for children	
General objectives	Teachers should be able to: • operate and productively use several educational software applications; applications for children, which offer a wide supply of inspiring activities and support the development of logic, math thinking, creativity, problem solving, children's personalities, etc.; • operate the IBM KidSmart computer unit (or another similar set); • evaluate the appropriateness of a software application for being engaged into learning processes of children; • understand that educational software is an object of intellectual property rights, thus its dissemination may be subject to certain conditions.
Contents	• Educational portals for children; • Familiarizing in detail with several selected educational software applications; • Short demonstrations of 2 or 3 additional educational software applications; • Familiarizing with the IBM KidSmart computer unit (or another similar set).
Methods and management	• Concentrate on key aspects of each application, its interface and navigation, educational goals and techniques used to meet them. • Instructor will demonstrate each application; participants will explore the same features and modules in parallel. However, after the demonstration, they should be given some time for individual examinations.
Recommendations	• It is recommended to examine in detail one or two high-quality portals with activities for ECE children. Briefly demonstrate some more, however, be careful and critical to choose the cases, which have true value for ECE learning areas and goals. • Carefully include some computer games. Be aware of the fact that they may exploit rather high degree of abstraction and contain elements that are more difficult for proper understanding. Teachers should be aware of the problems and prepare children to cope with them. One possible strategy is to integrate a computer game into a more complex activity, which may help children overcome these difficulties and benefit from other parts of the game. • The teacher will easily use certain software (and hardware) application with children only if s/he knows it well, and feels confident. • Show and discuss the shortcomings of the web portals, which offer edutainment[1)] activities for children. These are often drill and practice activities with rather low didactical value.

[1)] See Resnick (2004).

Pedagogy of ICT	
General objectives	Teachers should be able to: • understand and master didactics of integrating digital toys (most of those from the unit Digital toys) and educational software applications for children (most of those from the unit Educational software for children); • plan and monitor the development of children in using ICT to express themselves, for learning and play; • exploit ICT in support of most or all of teaching and developmental goals; • understand the role of ICT in modern early childhood education; know their potential for the personal development of ECE children and for the professional lifelong development of ECE teachers.
Contents	• Pedagogy of the programmable digital toys; • Pedagogy of the educational software applications; • Analysis and evaluation of the appropriateness of various ICTs for ECE; • Development of personality and competencies of an ECE child with the support of ICT; • How to project, implement, observe, assess and evaluate the progress of children in exploiting ICT for their learning and play.
Methods and management	• Instructor demonstrates some didactical methods to the whole group. • Some activities, procedures or technologies will be explored, designed and/or analyzed by smaller teams of 3 to 4 participants. Their solutions, recommendations or findings will then be presented to the whole group. • Some activities and tasks will be conducted individually (one-to-one mode). • Each broad topic should be concluded by a short whole-group discussion.
Recommendations	• It is recommended to concentrate on designing and/or analyzing concrete activities (for example, with digital camera, certain programmable digital toy or familiar educational software application). • Instructor should stress the potential of ICT for humanization of education, for personal development of children and their competencies, but also for the professional development of teachers. • Discuss with participants the way of proper engagement of tools, toys and software applications in the ECE. Try to materialize the outcomes of the discussion in the form of a list of general principles and criteria. • Give attention to: ♦ concrete proposals resulting from the of projects and activities to support all main topics of the actual educational programme; ♦ proper implementation and exploitation of educational software applications for ECE; ♦ identification of the benefits and risks of the process of integrating ICT into ECE, as a result of the common discussion.

Social networking	
General objectives	Teachers should be able to: • understand what a social network is and how it can support their further professional development; • exploit a social network for their professional development, communication and collaboration with other teachers (within and outside the centre); • actively involve in the online community of the ECE teachers; • actively and productively exploit one or more portals for modern teachers to search for and publish information on their work; • expand their communicative and collaborative competencies.
Contents	• What social networks are; • Pros and cons of using social networks; • Get familiar with Windows Live; • Instant communication; • Portal(s) for modern teachers, online communities of ECE teachers.
Methods and management	• Conduct an introductory discussion on the benefits of social networks and communities of practice. • Make use of worksheets with detailed step-by-step procedure for different activities: sending an e-mail within Windows Live, publishing photographs, sharing a document, etc. • Instructor demonstrates all steps on computer and displays them on the screen for the whole group.
Recommendations	• Carefully observe the advances of individual teachers and teams. Discuss common and frequent mistakes with the group. • Worksheets should contain (a) guidelines for solving common tasks and problems, (b) useful icons, (c) screenshots with highlighted control or navigation elements which are actually required, etc.

Integrating ICT into ECE	
General objectives	Teachers should be able to: • reflect on the process and problems of building a computer corner, or an ICT corner; • think about possible improvement of the environment of the ECE centre, so that it could better support modern education (by small changes, which are within our control); • discuss various scenarios of working with ICT and managing the group of children; • search for information on modern trends in the field provided by other centres within the country and abroad; • reflect on plans for future development concerning the ICT in the ECE centres; • choose new categories of ICT, which would be appropriate for further development, even if they exceed current financial and personnel capacities.
Contents	• How to arrange a computer corner within the class; • How to organize activities with children and ICT; • How to improve the environment of a ECE centre to better support modern education requirements; • Brief information on other categories of ICT. How to accommodate them in a ECE centre and manage them.
Methods and management	• Conduct mediated discussions. • Show case studies and conduct discussions on various aspects of engaging ICT in the class. • Present several cases from abroad, analyze and discuss them with participants. • Organize brainstorming in smaller teams on *How to improve the environment of our ECE centre to better support modern education requirements. Each team will present its conclusions.* • Briefly demonstrate how to engage other ICTs. • Discuss possible roles, contributions and risks of engaging ICT to meet educational goals and objectives. • Each participant should write down three ideas about *What can I do to improve my centre?*
Recommendations	• Keep the important didactical principle of appropriateness. • Do not lecture on different categories of ICT, their technicalities and principles. • Refer to specific experiences and situations. Respect real needs and expectations of the participants. • Give space to each participant to express his/her opinion. • Prioritize discussions on practical everyday problems of the teachers to be solved in the context of ICT in their classes. • Further develop teachers' view of ICT as a supportive tool for better experience of children, for gaining concrete experience, for learning by exploring...

Stay safe and healthy with ICT	
General objectives	Teachers should: • acquaint with all current safety and sanitary regulations with respect to ICT usage in the ECE environment; • discuss and reflect on children's well-being and staying safe and healthy in the digital world from the physical perspective (in the ICT corner; ergonomics; psycho hygiene, etc.) and intellectual perspective (coping with all risks of the Internet and virtual world); • gain a good summary of how children use ICT at home. Know how to analyze it and what kind of advice should be provided to parents; • know basic principles and rules for using software and other digital resources in a legally correct way. The study programme should be concluded to the full and evaluated. Discuss and reflect on further steps in the participants' professional development with special focus on continuous growth of their ICT competencies and extending their pedagogical competencies in ICT in early childhood education.
Contents	• Be safe in the ICT corner. • Ergonomics, psycho hygiene, well-being and safe usage of ICT. • Computer at home. • Being safe on the Internet. • Social and legal aspects of using ICT in ECE. Licensing.
Methods and management	• Conduct panel discussions, presentations, teamwork and workshops.
Recommendations	• Via discussions teachers should analyze and evaluate an overall contribution of the study programme to important topics: ♦Why did I participate in the programme and how do I value it (reflection)?♦How has the programme changed my attitude to digital technologies and integration of ICT in early childhood education and in my life?♦What are my plans for further professional development, what do I find necessary and important?

Appendix 3: From ECE to Primary Education: Emerging ICT competency standards for children

The Russian Federation has adopted the Federal Standard for Primary Education. The Standard encompasses the following requirements to:

- results of primary schooling;
- structure of primary school curriculum, including requirements to the volumes of curriculum parts, as well as proportion between the mandatory part and the part of the curriculum, which is shaped by the participants of educational process;
- conditions to implement primary school curriculum, including staff, finance, logistics and other resources.

The Standard sets a certain perspective for ECE in respect to ICT use. Below are some excerpts from the Standard.

II. Requirements to Results of a Primary School Curriculum

9. The Standard defines the requirements to the results of a primary school curriculum as follows:

Personal results are those that include students' willingness and ability for self-development, maturity of motivation to learning and gaining knowledge, students' values and notions reflecting their individual positions, social competencies, personal qualities, maturity of national identity;

Cross-curriculum results are those that include universal learning actions (cognitive, regulatory and communicative) acquired by students, which provide for the acquisition of key competencies, which comprise the basis for an ability to learn, as well as of interdisciplinary concepts;

Disciplinary results are those that include the experience in the activity specific for a particular subject, which aims at the acquisition of new knowledge, its transformation and application in the course of curriculum, as well as the system of fundamental elements of scientific knowledge that underlie modern scientific overview.

10. Personal results of the primary school curriculum must reflect:

5) Development of the ability to act on one's own and accept personal responsibility for the actions and deeds, including the ones in the information domain accomplished on the assumptions of the moral code, social justice and freedom;

11. Cross-curriculum results of the primary school curriculum must reflect:

1) Mastering the abilities to accept and preserve the goals and tasks of learning activity and to search for tools to implement this activity.
2) Mastering the ways to solve problems of creative and exploratory nature.
3) Shaping the ability to plan, control and assess the learning activities in accordance with an assigned task and terms of its accomplishment; to define the most efficient methods of achieving the result.

4) Shaping the ability to understand the causes of success/failure in the learning activity, as well as the ability to act constructively even under the circumstances of failure.

5) Mastering basic forms of cognitive and personal reflection.

6) Use of symbolic means of information presentation to create models of objects and processes under study, solution schemes for educational and practical problems.

7) Diligent application of language tools and instruments employed in information and communication technologies (hereinafter ICT) to solve communicative and cognitive tasks.

8) Use of various ways of data retrieval (from reference sources and in open educational information space of the Internet), of gathering, processing, analyzing, organizing, transmitting information, as well as its interpretation pursuant to communicative and cognitive tasks and technologies of a specific discipline, including a skill to use a keyboard, to record digital measurements and analyze images, to prepare presentations and deliver them with audio, video and graphic support in compliance with the standards of information selectivity, ethics and etiquette.

9) Mastering the skills of comprehension reading of the texts written in different styles and genres according to the tasks and goals; constructing a speech utterance pursuant to communication tasks in a conscious way and composing texts in orally and in writing.

10) Mastering the logical operations of comparison, analysis, synthesis, generalization and categorization by genus-species characteristics, definition of similarities and causal relationships, reasoning, as well as correlation with known concepts and notions.

11) Willingness to listen to an interlocutor and conduct a dialogue; readiness to acknowledge the existence of different opinions and everybody's right to have his/her own judgment; ability to express his/her point of view and to give reasons in its favor and for his/her assessment of events.

12) Identification of a common goal and ways of its achievement; an ability to negotiate an assignment of roles and functions in a collaborative activity; to implement mutual control in a collaborative activity, to evaluate adequately one's own behavior and that of associates.

13) Readiness to resolve conflicts in a constructive way taking into account the interests of parties and via cooperation.

14) Acquiring basic knowledge of essential and peculiar features of real objects, processes and phenomena (natural, social, cultural, technological, etc.) in accordance with the content of a particular curriculum.

15) Acquiring basic interdisciplinary concepts which reflect specific ties and relations of objects and processes.

16) Skill to work in physical and information environments of primary education (including the ability to operate educational models) in accordance with the content of a particular discipline.

12. Disciplinary results of primary curriculum must reflect the following consideration of the specifics of subject contents:

12.2. Mathematics and Informatics:

1. Use of basic knowledge in mathematics to describe and explain the surrounding objects, processes and phenomena, to evaluate their quantitative and spatial associations.
2. Acquiring basics of logical and algorithmic thinking, spatial imagination and mathematic terms, measurement, counting, estimation and evaluation, graphic presentation of data and processes, record and solution of algorithms.
3. Acquiring basic experience of applying mathematical knowledge to solve educational and practical tasks.
4. Ability to perform oral and written arithmetic operations with numbers and numerical expressions, to solve word problems, ability to act in accordance with an algorithm and to develop the simplest algorithms, to explore, identify and present geometrical forms and shapes, to work with tables, schemes, diagrams and graphs, finite sequences, aggregates, to present, analyze and interpret data.
5. Acquiring basic concepts of computer literacy.

Social and Natural Sciences

1) Mastering the available ways to explore nature and society (watching, recording, measuring, experiencing, comparing, classifying, etc.) via the retrieval of information from family archives, other persons, as well as in the open information space.
2) Development of the skills to identify and determine the cause-effect relationships in the surrounding world.

Arts

Visual arts

3) Acquiring elementary practical skills and abilities in various types of creative activity (drawing, painting, sculpture, design), as well as in specific forms of ITC-based artistic activities (digital photography, video filming, elements of animation, etc.).

Technology

4) Acquiring basic skills of productive cooperation, collaboration, mutual help, planning and organization.
5) Acquiring basic knowledge of rules and procedures to create physical and information environments, as well as the abilities to apply this knowledge in learning and accomplishing cognitive tasks, artistic projects and designs.

IV. Requirements to the conditions for primary school curriculum

25. Logistics of the primary school curriculum must facilitate the following:

- production and application of information (including image and sound recording and processing, presentations with audio, video and graphic support, communications via Internet);
- various ways of information retrieval (searching in the Internet, libraries, etc.);
- experiments including the ones based on the laboratory equipment, physical, virtual and visual models, collections of major mathematical and scientific objects and phenomena; digital (electronic) and conventional measurements;
- observation (including that of micro-objects) via GPS application, visual presentation, data analysis, use of digital plans, maps and satellite images;
- creation of physical objects including pieces of art;
- processing of materials and information with technological instruments;
- design and construction of models including the ones with digital control and feedback;
- performance, composition and arrangement of pieces of music with traditional instruments and digital technologies;
- physical development, participation in sport events and games;
- curriculum planning, recording its accomplishment as a whole and in separate steps (presentations, discussions, experiments);
- placing of materials and final results in the information environment of an educational institution;
- hosting mass events, meetings, presentations;
- organization of recreation activities and catering.

26. Information and education environment of an educational institution must include a set of technological tools (computers, data bases, channels of communication, software, etc.), cultural and organizational forms of information interaction, qualification of the participants in educational process, who accomplish learning, cognitive and professional tasks with ICT, as well as ICT support services.

Information and learning environment of an education institution must provide for a possibility to implement the following types of activity in electronic (digital) form:

- planning of education process;
- placement and storage of education process materials, including works of students and pedagogues, information resources used by the participants of education process;
- record of the progress and results of education process;
- interaction of the participants of education process, including remote interaction via the Internet, application of the data accumulated in the course of education process to solve the problems of learning management

- supervised access to the educational resources in the Internet for the participants of education process (restriction of an access to the information incompatible with the tasks of spiritual and moral development and instruction of students);
- interaction of an education institution with education authorities and other educational institutions and organizations.

Appendix 4: The study methodology

The study was conducted between May and August 2010. We obtained basic data from three sources: intense communication with the sample of 17 ECE centres from nine countries worldwide, literature research and our personal experiences resulting from the research projects in the field of ICT integration into ECE and the national project aimed at modern professional development of the ECE teachers in Slovakia.

The sample includes the most innovative participating ECE centres in the process of ICT integration and our choice was determined by the recommendations provided by national education and research authorities. The complete list of all early childhood institutions together with their detailed identification can be found in the Acknowledgements section. The communication with ECE centres was held through their headmasters, whose names are included in the introductory table. Each principal has agreed with the publication of this document and confirmed that all quotations and pictures collected from them and used throughout this document can be published with the consent of all persons envolved, including the parents of children. We present the names of our education advisors, experts or authorities in the same table.

The ECE institutions were provided with a semi-structured template to prepare detailed reports about different aspects of ICT integration into their learning processes and practice.

We personally visited several institutions and contributed to various (sometimes long-term) research projects (Moravcik, Pekarova, Kalas, 2009, for example). We analysed the data and documentation obtained using qualitative research methodology. The results of the analysis form a core of Chapter 4 and partly Chapter 5.

The template was in English, and in many cases our contact person or an expert of the UNESCO IITE institute had to localize it. In this case, the final report was translated back into English. The template was composed of parts A (A1–A7) and B:

A1 Identify your early childhood education centre

♦ Identify your education centre (its type, name and address) ♦ Describe educational vision of your centre, its main educational goals in general, values, priorities and mission (only if these goals and values are more specific than the goals stated by your educational authority and/or (local) government).

A2 ICT in your early childhood education centre in general

♦ When did you start integrating ICT in your centre (excluding basic administration and communication with your local or educational authorities)? ♦ Who or what was the stimulus for that decision? ♦ Are you obliged to do so because of the official educational policy? ♦ What are the benefits of the integration? ♦ What are the possible risks? ♦ What was – or still is – the biggest problem?

A3 Using ICT with and by children

♦ Which kinds of ICT (hardware and software) do you use with the children? ♦ Who and why recommended to use those kinds of technologies? ♦ What

activities do children undertake with support of ICT? ♦ Where in your centre are those technologies located? ♦ How are those activities organized? ♦ Do children work individually, in pairs, in small groups or with the whole class? ♦ How often do they use ICT? ♦ What difficulties do you encounter? What are the challenges? What are the biggest limitations or obstacles? ♦ What safe or hygienic regulations affect your everyday work in terms of using ICT with and by children? Which of these regulations you consider justified and which of them you consider improperly restrictive or obsolete?

[A3 topic will further evolve in A7 and B]

A4 Important triangle: children, parents and your early childhood education centre

♦ How do you cooperate and communicate with parents of your children – using or concerning ICT? ♦ Do they support the process of integrating ICT into the developmental and learning programme of your centre? ♦ Do you recognize any influence of that process upon parents? ♦ Are you familiar with how and why children use ICT outside your education centre? If yes, how do you learn? From children themselves? From parents? ♦ Can you profit (in the learning process) from this knowledge? ♦ Are children allowed and supported to use the same ICT (the same educational software or other resourses) at home? ♦ Do you recognize any gender differences in working with ICT?

A5 Using ICT for other purposes

♦ What are other purposes you use ICT for at your centre (excluding basic administration and communication with your local or educational authorities)? ♦ Which kinds of ICT do you use for those purposes? What are your plans for further extensions? ♦ What difficulties do you encounter? What challenges? What are the greatest limitations or obstacles?

A6 ICT competencies of your professional staff

(*By professional staff of your centre we mean all specialists directly engaged in the education process*) ♦ What is the level of ICT competencies of your professional staff? ♦ What percentage of them use ICT regularly and naturally – (a) in supporting the learning process of children, (b) in preparing for it, developing their competencies, etc.? ♦ Are they actively involved in any virtual social network outside their centre (i.e., do they communicate their experience and problems with other teachers from other centres via social networks)? How do they share their experience? ♦ How were their ICT competencies built? How are they being further developed? ♦ Have they attended any special programmes concerning new pedagogies with ICT (going beyond usual computer literacy)? ♦ Do teachers develop their own teaching/learning resources for children?

A7 Educational implications and further plans

♦ What are your and your staff educational goals when integrating ICT into the learning process of children? ♦ How were these goals set? Are they evolving (based on your growing experience)? ♦ Are you following certain vision? ♦ What role(s) of ICT in supporting the learning process do you

recognize? Which drawbacks do you recognize? ♦ Which competencies of children do you believe are supported and further developed? Please, explain. How do you track, observe or evaluate that? ♦ How do you assess appropriate use of ICT? ♦ What are your plans for further advance and development? ♦ Which digital technologies do you plan to involve in future? ♦ Which steps or transitions for primary education of your children do you recommend?

B Account (a snapshot) of the innovative process of ICT integration in your centre

Choose one particular instance of the process (one project, one activity, one aspect... – positive or negative) which you would like to share with other innovative early childhood educators around the world and give detailed and reflective account of it. We intend to include this page in a collection of innovative snapshots of the final study.