Digital Skills Working Group

Review of National Curricula and Assessing Digital Competence for Students and Teachers: Findings from 7 Countries

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December 2010
# TABLE OF CONTENTS

**INTRODUCTION** ........................................................................................................................................... 1

**DEFINITION OF DIGITAL COMPETENCE** ................................................................................................. 3

  *Digital Competence Domains* .................................................................................................................. 4

**PART A) STUDENTS’ CURRICULA** .................................................................................................................. 7

  *Responsible Actors* ................................................................................................................................. 7
  *Digital Competence for Students (Primary)* ............................................................................................ 7
  *Digital Competence for Students (Secondary)* ....................................................................................... 13
  *Primary vs. Secondary Curricula* ........................................................................................................... 15

**PART B) ASSESSMENT OF STUDENTS’ COMPETENCE** ............................................................................... 21

  *Responsible Actors* ............................................................................................................................... 21
  *Assessment of Digital Competence (Primary)* ....................................................................................... 21
  *Assessment of Digital Competence (Secondary)* .................................................................................. 21
  *Primary vs Secondary Level Assessment* ............................................................................................ 22

**PART C) CURRICULA FOR INITIAL TEACHER TRAINING** ........................................................................... 23

  *General Characteristics* ....................................................................................................................... 23
  *Digital Competence for Teachers (Primary)* ......................................................................................... 23
  *Digital Competence for Teachers (Secondary)* .................................................................................... 26

**PART D) ASSESSMENT FOR INITIAL TEACHER TRAINING** ....................................................................... 28

  *Responsible Actors* ............................................................................................................................... 28
  *Assessment of Digital Competence (Primary)* ..................................................................................... 28
  *Assessment of Digital Competence (Secondary)* ................................................................................. 29

**PART E) TEACHERS’ IN SERVICE TRAINING** ............................................................................................. 30

  *General Characteristics* ....................................................................................................................... 30
  *Digital Competence for In Service Teachers (Primary and Secondary)* ................................................ 30

**PART F) TEACHERS’ IN SERVICE TRAINING ASSESSMENT** ..................................................................... 34

  *General Characteristics (Primary and Secondary)* ............................................................................. 34

**SUMMARY AND CONCLUSIONS** ............................................................................................................. 35

**ANNEX 1 FINDINGS PER COUNTRY** .......................................................................................................... 41

  *Czech Republic* ...................................................................................................................................... 41
  *Finland* .................................................................................................................................................... 44
  *Lithuania* ................................................................................................................................................ 46
  *Norway* .................................................................................................................................................. 50
  *Portugal* .................................................................................................................................................. 52
  *Slovakia* .................................................................................................................................................. 54
  *Switzerland* ............................................................................................................................................. 59

**ANNEX 2 KNOWLEDGE BUILDING EXAMPLES** ......................................................................................... 63
CZECH REPUBLIC: THE EDUCATION PORTAL TO SUPPORT THE CZECH FRAMEWORK EDUCATION PROGRAMME .................................................................63
NORWAY: HANDHELD TECHNOLOGY IN BORDERLESS AND INTERACTIVE SCIENCE TEACHING ..................65

ANNEX 3 CASE STUDIES ................................................................................................................................................................71

ITALY: ICT AND IN-SERVICE TEACHER TRAINING - BLENDED ELEARNING PROVIDED BY PUNTOEDU........71
NORWAY: ASSESSING DIGITAL COMPETENCE IN PRIMARY SCHOOLS .................................................................82
SLOVAKIA: IN-SERVICE TEACHER TRAINING PROJECT FOR INFORMATICS TEACHERS IN PRIMARY AND SECONDARY SCHOOLS ...........................................................................................................90
SLOVAKIA: ICT IN INITIAL TEACHER TRAINING WITHIN THE FACULTY OF MATHEMATICS, PHYSICS AND INFORMATICS, COMENIUS UNIVERSITY, BRATISLAVA .................................................................98
SWITZERLAND: ANALYSING RESEARCH ON THE ROLE OF ICT IN TEACHER TRAINING ..........................108
INTRODUCTION

The topic of digital literacy is of major importance in the framework of EUN’s work programme and is specifically dealt with within the Digital Skills Working Group (DSWG). The working group was set up in 2009 and meets around 3 times per year to establish a work programme on the topic of digital competence that is in line with the priorities and needs of the Ministries supporting this group. It serves as a forum for the exchange of ideas, experiences and visions resulting in concrete outputs such as studies and reviews on the topic. The working group is composed by representatives of Ministries of Education, national or regional ICT in education authorities and national content experts.

In the framework of the remit of the group, European Schoolnet in collaboration with the Swiss Education Server carried out “A review of national curricula and ways of assessing digital competence for students and teachers” between December 2009 and May 2010.

A questionnaire was addressed to the 13 Ministries of Education which are members of the Digital Skills Working Group. Altogether 7 countries provided input to the questionnaire: Czech Republic, Finland, Lithuania, Norway, Portugal, Slovakia, and Switzerland. The aim was to identify how digital competence for students and teachers is addressed and assessed in national curricula. An overall analysis of the review is presented in the main report. Additionally, results by country are presented in Annex 1.

Moreover, the questionnaire asked to submit successful knowledge building activities describing new -as opposed to traditional approaches- to learning and constructing knowledge in a specific area. Examples from Norway, City of Tromsø, where handheld technology is used in different contexts as a way to improve learning and to increase motivation among the students, and the Czech Republic (“The Methodical Portal of the Czech Framework Education Programme”), are described in Annex 2.

The curricula and assessment review is complemented by 5 case studies (see Annex 3 of the report) as decided by the group in its working group meeting on 27 May 2010. The case studies aim to illustrate one aspect of digital competence development as addressed in a specific national context. The case studies focus on the following aspects:

- Italy: Blended in service teacher training- Digiscuola and interactive whiteboard training for teachers.
- Norway: Assessing digital competence in primary schools.

1 Currently 13 countries are members of the group: Belgium (Flanders), Czech Republic, Cyprus, Finland, Italy, Lithuania, Norway, Poland, Portugal, Spain, Slovakia, Switzerland, United Kingdom.

- Slovakia: ICT in initial teacher training within the faculty of Mathematics, Physics and Informatics, Comenius University, Bratislava.

- Switzerland: Analysing research on the role of ICT in Teacher Training
DEFINITION OF DIGITAL COMPETENCE

Digital Competence involves the confident and critical use of Information Society Technology (IST) for work, leisure and communication. It is underpinned by basic skills in ICT, i.e. the use of computers to retrieve, store, produce, present and exchange information, and to communicate and participate in collaborative networks via the Internet.² A competence is not limited to cognitive elements (knowledge and understanding of content, theories, concepts, tacit knowledge); it also encompasses functional aspects (involving technical skills) as well as interpersonal attributes (social and organizational skills) as well as ethical values. For the purpose of the questionnaire the following definition of the term Digital Competence was used:

DIGITAL COMPETENCE IS THE APPLICATION OF ACQUIRED KNOWLEDGE, SKILLS AND ATTITUDES WHEN USING ICT IN ORDER TO PERFORM A TASK ADEQUATELY IN A SPECIFIC CONTEXT, SUCH AS EDUCATION, WORK, AND PERSONAL OR PROFESSIONAL DEVELOPMENT.

In the following table you can find descriptions of specific knowledge, skills or attitudes considered to be crucial in order for somebody to be digitally competent. This list is not comprehensive but illustrates some key characteristics within each of the three aspects (1-3) of digital competence.

<table>
<thead>
<tr>
<th>Competence Domain</th>
<th>COMPETENCES</th>
<th>COMPETENCES</th>
<th>COMPETENCES</th>
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<tbody>
<tr>
<td></td>
<td>Knowledge (1)</td>
<td>Skills (2)</td>
<td>Attitudes (3)</td>
</tr>
<tr>
<td></td>
<td>Cognition and understanding</td>
<td>Cognition, organizational skills, analytical skills, higher order thinking skills</td>
<td>Critical thinking, reflective attitude, ethical issues</td>
</tr>
<tr>
<td>Digital Competence</td>
<td>Knowledge and understanding needed to master the use of different ICT applications (= functional ICT)</td>
<td>Skills needed to master the use and management of different ICT applications (= Application of knowledge)</td>
<td>Attitudes needed to master the use and management of different ICT applications</td>
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<tr>
<td></td>
<td>• Knowledge about the use of the main computer applications, including word processors, spreadsheets, databases, information storage and management.</td>
<td>• Ability to use appropriate software in order to present, understand and produce complex clusters of information, e.g. by way of tables, graphics, graphs, charts, maps, slides.</td>
<td>• Propensity to use ICT when working both autonomously and in teams.</td>
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<td></td>
<td>• Knowledge about internet applications and communication via electronic media.</td>
<td>• Ability to search, collect and process (organise, distinguish relevant from irrelevant...) electronic information, data and concepts and to use them in a systematic way.</td>
<td>• Critical and reflective attitude in assessing any kind of available information.</td>
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<tr>
<td></td>
<td>• Knowledge about internet safety and data protection issues.</td>
<td></td>
<td>• Sensitivity to issues of internet safety, including privacy issues, ethical issues and cultural differences.</td>
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<td></td>
<td></td>
<td></td>
<td>• Interest in ICT as a means to broaden horizons for cultural, social and professional purposes.</td>
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</tbody>
</table>

The table presented here is based on the document Key Competences for Lifelong learning, A European Reference Framework, European Commission, November 2004. [http://ec.europa.eu/education/policies/2010/doc/basicframe.pdf]. It has been adapted for the purpose of this questionnaire.
THE ANALYTICAL FRAMEWORK

The aforementioned definition of digital competence is reflected in the questionnaire’s 4 main sections (Parts A to D).

<table>
<thead>
<tr>
<th>Section</th>
<th>Students</th>
<th>Teachers</th>
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<tbody>
<tr>
<td>Curricula</td>
<td>Part A)</td>
<td>Part C)</td>
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<td>o Knowledge</td>
<td>o Knowledge</td>
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<tr>
<td></td>
<td>o Skills</td>
<td>o Skills</td>
</tr>
<tr>
<td></td>
<td>o Attitudes</td>
<td>o Attitudes</td>
</tr>
<tr>
<td>Assessment</td>
<td>Part B)</td>
<td>Part D)</td>
</tr>
<tr>
<td></td>
<td>o Knowledge</td>
<td>o Knowledge</td>
</tr>
<tr>
<td></td>
<td>o Skills</td>
<td>o Skills</td>
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<td></td>
<td>o Attitudes</td>
<td>o Attitudes</td>
</tr>
</tbody>
</table>

Curricula and Assessment were analysed based on the answers to the questionnaire according to target audience, teachers and students, and for a specific level of education, primary education and secondary education. In addition, the questionnaire sought to identify in service teacher training courses and the type of digital competence targets they state for teachers professional development with ICT and how they are assessed.

This results in the following areas of analysis:

Part A: Students’ curricula (primary and secondary education)
Part B: Students’ assessment (primary and secondary education)
Part C: Teachers’ initial training curricula (primary and secondary education)
Part D: Teachers’ initial training assessment (primary and secondary education)
Part E: Teachers' in service training courses curricula (primary and secondary education)

Part F: Teachers' in service training courses assessment (primary and secondary education)

The aim is to identify the main areas of digital competence which are stated in national curricula for students and teachers with regard to knowledge, skills and attitude targets. Even though we cannot generalise findings on the basis of curricula reviews in 7 countries, an overall mapping of the competence domains according to the analytical framework nevertheless allows us to see which competence domains are emerging in student and teacher curricula in primary and secondary education. The second aim, while following the same method of analysis, was to gauge how digital competences are assessed.

Eventually in a final analysis, we contrast some findings, e.g. primary vs. secondary curricula, or student vs. teachers’ curricula, and look at specific indicators across categories, e.g. the degree of integration of digital competence in student (primary and secondary) and teacher (primary and secondary) curricula to raise points for further discussion and investigation.
PART A) STUDENTS’ CURRICULA

RESPONSIBLE ACTORS

In most of the countries the same actors are responsible for defining both primary and secondary school curricula.

In each country in focus curricula for primary and secondary education are defined in unison and in most cases both at the national (and – e.g. in Switzerland - regional level) and at the local level of the school. This indicates that schools in the countries in focus enjoy some freedom in how to integrate digital literacy into the curriculum (e.g. on a voluntary or on a compulsory basis).

In all countries the Ministry of Education (national or regional) is responsible for primary and secondary curricula. In the Czech Republic, Finland, Lithuania and Norway and Slovakia, there is also a specific curriculum agency/council or board. In Switzerland and Portugal such a specific curriculum agency does not exist.

In all countries (except Norway, but subject to change) there are separate curricula for primary and secondary education.

DIGITAL COMPETENCE FOR STUDENTS (PRIMARY)

DIGITAL COMPETENCE IS A KEY COMPETENCE, WHICH IS INTEGRATED INTO THE CURRICULUM

In Slovakia, Norway and Switzerland digital competence is officially stated a key competence (with regard to knowledge and skills) in primary education. Digital competence could also be regarded as a key competence in Finland, because it is integrated across the curriculum in all subjects.

In all countries (except Portugal) it is also part of the primary curriculum. Knowledge and skills are integrated mainly in a transversal and interdisciplinary way, except for Slovakia and the Czech Republic, where ICT is mainly taught as a separate subject in primary education.

In Norway, Lithuania, Switzerland and the Czech Republic attitudes towards digital competence are explicitly mentioned in the curriculum. In other countries, such as Finland, knowledge, skills and attitude targets are not specifically described.

KNOWLEDGE TARGETS

Only three countries, i.e. Slovakia, Switzerland, and Norway specifically describe knowledge targets for primary education. In Finland no distinction between knowledge and skills targets is made. Knowledge targets can be broadly grouped into:
Functional knowledge:

- knowledge about the basic ICT concepts
- knowledge on how to use ICT

Knowledge on issues of information handling:

- knowledge on internet safety aspects

Media literacy:

- knowledge on the different media

Knowledge on how to use ICT adequately for learning

- to complement skills
- for creative and productive use
- for problem solving

**SKILLS TARGETS**

All countries specify skills targets. These are usually more varied and numerous than the knowledge targets, and the descriptions are more detailed. They can be roughly divided into:

Basic user skills:

- protecting one's personal data
- making good use of various programmes and software (e.g. educational software and games)
- gather information, evaluate sources

Responsible user skills:

- using ICT safely while observing ethical standards

Knowledge on how to use ICT adequately for learning

- for information handling
- for communication
- for production and the creation of knowledge
• for problem solving

Thus, some of the skills targets already comprise attitudinal targets, mainly as regards Internet safety issues.

ATTITUDE TARGETS

Attitudes towards digital competence are only described in the curricula of 3 countries (Norway, Lithuania and Switzerland). They comprise judgemental attitudes related to Internet safety issues and source validation, and the ability to reflect on ICT and to relate it to the wider context of school, personal life and society.

THE RELATIONSHIP BETWEEN KNOWLEDGE, SKILLS AND ATTITUDE TARGETS

In primary education curricula the main focus is on skills development, as they comprise more than 50% of all targets sets. The rest is split between knowledge targets (27%) and attitude targets (24%), but it has to be noted that the distinction between knowledge, skills and attitude targets is not always clearly made. Overall emphasis is given to pedagogical targets (as opposed to functional targets) such as information management (from access, retrieval, analysing, evaluating to presenting and communicating of information), Internet safety issues, the use of ICT for various purposes and placing ICT in relation to society. Targets related to use ICT for collaboration are not mentioned.
A mapping of knowledge skills and attitude targets results in the following digital competence domains for primary curricula.

<table>
<thead>
<tr>
<th>Competence Domain</th>
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</tr>
<tr>
<td></td>
<td>Critical thinking, reflective attitude, ethical issues</td>
<td>Attitudes (3)</td>
<td>Critical thinking, reflective attitude, ethical issues</td>
</tr>
<tr>
<td>Digital Competence</td>
<td>Knowledge and understanding needed to master the use of different ICT applications (i.e. functional ICT)</td>
<td>Skills needed to master the use and management of different ICT applications (i.e. Application of knowledge)</td>
<td>Attitudes needed to master the use and management of different ICT applications</td>
</tr>
<tr>
<td>Czech Republic (CZ)</td>
<td>Basics of working with a computer: use the basic, standard functions of a computer and its most common peripherals; observe safety rules when working with hardware and software, and proceed in an informed manner in case they are faulty; protect data from damage, loss or abuse; Information searching and communication: utilise simple and suitable ways when searching for information on the Internet; search for information on web portals, in libraries and in databases; communicate by means of the Internet and other common communication devices: Information processing and application: work with text and pictures in text and graphics editors</td>
<td>Expected Outcomes – Cycles 1 and 2) Information searching and communication: verify the credibility of information and information sources</td>
<td></td>
</tr>
</tbody>
</table>
and assess their importance and interconnectedness

**Information processing and application:**
be able to work with text and graphics and table editors, and use suitable applications;
apply basic aesthetic and typographic rules for the work with text and pictures;
work with information in accordance with legislation on intellectual property rights;
use information from various information sources and evaluate simple relationships between data;
prepare and present information in text, graphic and multimedia forms at user level

<p>| Finland (FI) | Data security; To critically evaluate resources; Use of ICT and their diversified use; Internet ethics; |
| Lithuanian (LT) | The use of digital educational software and games; Main computer user skills | Safer Internet skills; Health care |
| Norway (NO) | <strong>Tool knowledge.</strong> both general tools and subject specific ones; <strong>Information knowledge,</strong> e.g. source evaluation, Internet safety and legal aspects; <strong>Media knowledge,</strong> e.g. competence in multimodal texts | User competence in the use of various programs and resources; Gather, evaluate and analyse information; Be creative and solve problems; Document, report, present, publish and communicate; User competence in the use of various programs and resources; Gather, evaluate and analyse information; Be creative and solve problems; Document, report, present, publish and communicate | Attitudes with regards to digital judgements in areas like: digital bullying, individual property rights, privacy and data protection, source validation |</p>
<table>
<thead>
<tr>
<th>Country</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portugal (Pt)</td>
<td>Ability to use digital resources online and offline. To search select and distinguish relevant from irrelevant information. Ability to communicate by means of the Internet (both and synchronous and asynchronous) with the supervision and support of the teacher. Ability to accomplish academic work, with the supervision of the teacher, and the use of digital tools to express knowledge, ideas and feelings.</td>
</tr>
<tr>
<td>Slovakia (SK)</td>
<td>Understanding of <strong>basic concepts and mechanisms for solving various problems using ICT</strong> Basics of algorithmic thinking and the ability to think about <strong>problem solving using ICT</strong>; Use of Internet tools for communication, for learning and solving school problems, in obtaining and communicating information</td>
</tr>
<tr>
<td>Switzerland (CH)</td>
<td><strong>Complement existing knowledge</strong> and skills by being media competent; Through <strong>discovery based learning</strong> raise the importance of ICT as a tool for learning and teaching; Establish a common <strong>knowledge of terminology</strong> in order to understand ICT; Get to know new media and its functions (e.g. What can I do with a specific ICT device) ICT is taught as a <strong>basic competence</strong> like reading and writing; Through the linking of knowledge and ICT, education reaches a new dimension: use of ICT as a tool for games, exercises and learning, a tool for the creation and construction of knowledge and as a means for information and communication. Students are able to use ICT purposefully in various ways for learning and have the necessary background knowledge, the <strong>creative and productive use of ICT</strong> is an important experience (as opposed to the mere consumption of games software).</td>
</tr>
</tbody>
</table>

Students deal with the importance, the opportunities, limits, chances and risks of ICT. They analyse and judge possible impacts of ICT on their personal life, working life, and culture and society at large.
DIGITAL COMPETENCE FOR STUDENTS (SECONDARY)

DIGITAL COMPETENCE IS A KEY COMPETENCE, WHICH IS INTEGRATED INTO THE CURRICULUM (SECONDARY)

In Slovakia, Norway, Portugal and Switzerland digital competence is explicitly declared a key competence, in Finland it can be implicitly considered a key competence (at least with regard to knowledge and skills) in secondary education. In ALL countries digital competence is also part of the secondary curriculum. Knowledge and skills are integrated mainly in a transversal and interdisciplinary way (in Norway, Switzerland and Finland), but also taught as a separate subject only, as it is the case for Slovakia, Portugal, or again both as a subject and transversally, in Lithuania and the Czech Republic.

In Slovakia, Norway, Lithuania, Switzerland and the Czech Republic attitudes towards digital competence are explicitly mentioned in the curriculum.

The following table maps the knowledge, skills and attitudes from all countries for secondary student curricula.

KNOWLEDGE TARGETS

All countries specifically describe knowledge targets. They can be broadly grouped into:

Functional knowledge

- understanding of the basic concepts and knowledge on how to use ICT and the computer

Knowledge related to presentations

- publishing, text arrangement and printing

Knowledge on issues of information handling

- gathering information
- evaluation of sources
- differentiation between different media

Knowledge on how to use ICT adequately for learning

- to complement skills
- for creative and productive use
- for problem solving
Know how to use ICT adequately for communication

- for adequate and effective communication of computer based communication tools
- and for communicating in virtual learning environments

In countries, where ICT is taught as a subject (Lithuania, Portugal, Slovakia, Czech Republic) basic functional knowledge is predominant.

**SKILLS TARGETS**

All countries specify skills targets. They are much more numerous than the knowledge targets and they describe more specifically how a particular task should be carried out by a digitally competent user (e.g. "effectively", "adequately", "critically", "and creatively"). There is also a progression in the level of description and the number of skills targets from primary to secondary. Skills targets can be divided into:

**Basic and advanced functional user skills:**
- handling of main application programmes
- handling of advanced functions of various programmes, software
- combining ICT tools

**Responsible user skills:**
- protecting data
- using ICT in a safe way
- using ICT in an ethical way
- considering legal aspects and proceeding in an informed manner

**Application of ICT as a learning tool**
- for information handling (considering topicality and relevance of information)
- for problem solving
- for the creation of knowledge
- for simulation and modelling
- for higher order skills (e.g. research skills, production, publishing, editing, creativity, skills in using various information sources such as education portals, databases, encyclopaedias.)
Use of ICT in real life

- use of ICT in different situations and educational settings
- use of ICT in various areas of social knowledge and practice

Use of ICT as a communication tool

- across a network, via various modes (sms, chats)
- ICT is used for cooperation (project and team work)

Use of ICT as a planning tool

- For one’s own work

ATTITUDE TARGETS

Attitudes towards digital competence are described in the secondary curricula in 5 countries Slovakia, Norway, Switzerland, Lithuania and Finland. They comprise to a large extend judgmental attitudes (and knowledge), are related to internet safety issues and critical source validation, creativity, and the ability to reflect on ICT and to relate it to the wider context of school, personal life and society. Thus, they are overlapping with skills already outlined in the skills table. Additionally, they also relate to communication and social interaction, health issues, and more to social and cultural aspects of ICT use.

PRIMARY VS. SECONDARY CURRICULA

Knowledge targets may be the same in primary and secondary curricula while there is often a progression in level from primary to secondary. Naturally, the aspect of progression is important in countries where ICT is taught as a separate subject.

In some countries additional knowledge targets are introduced at secondary level, as e.g. in the case of Switzerland, where there is a particular focus on the use of communication tools in secondary level curricula. Knowledge related to presentations: publishing, text arrangement and printing is bringing in a new area for competence development in secondary education.

Aspects of using ICT for research, for developing research skills, for planning and cooperation often appear as skills targets which are first introduced in secondary level curricula. Moreover, the notion of being creative and becoming and active producer of content becomes important only at secondary level. Another major emphasis at secondary level appearing in the description of skills as well as attitude targets is relating ICT to the world outside school and to many different situations e.g. to solve everyday problems in various social or virtual contexts.
A mapping of knowledge skills and attitude targets results in the following Digital Competence Domains for secondary curricula.

<table>
<thead>
<tr>
<th>Competence Domain</th>
<th>Knowledge (1)</th>
<th>Skills (2)</th>
<th>Attitudes (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Competence</td>
<td>Knowledge and understanding</td>
<td>Skills needed to master the use and management of different ICT applications (功能性 ICT)</td>
<td>Attitudes needed to master the use and management of different ICT applications</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>Basic computer literacy; Basic algorithm development; Safety and ethics</td>
<td>Digital literacy manage, combine and apply the ICT tools available; utilize his/her theoretical as well as practical knowledge of the functions of individual components of both hardware and software to solve problems creatively and effectively; organize data effectively and protect it from being destroyed or abused; be familiar with the possible uses of ICTs in various areas of social knowledge and practice Information resources and searching, communication utilize the services of information networks available to search for information, to communicate, as well as for self-learning and teamwork; make the best of the offer provided by information and educational portals, encyclopedias, libraries, databases and</td>
<td></td>
</tr>
<tr>
<td>Country</td>
<td>Educational Software</td>
<td>Data Security, to Critically Evaluate Resources, Use of ICT and Their Diversified Use Internet Ethics</td>
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<td>----------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Finland</td>
<td>In use of various programs and resources to: Gather information; Evaluate and analyse;</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Simulate and make models; Be creative and solve problems; Document, report, present, publish and communicate</td>
<td></td>
<td></td>
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<tr>
<td>Norway</td>
<td><strong>User competence</strong> in use of various programs and resources to: Gather information;</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Evaluate and analyse; Simulate and make models; Be creative and solve problems;</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Document, report, present, publish and communicate</td>
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<tr>
<td>Portugal</td>
<td><strong>General concepts:</strong> operating systems, use of the Internet, wordprocessor, spreadsheets, presentations, graphics/images, working on a project and database management</td>
<td><strong>Effective use of specific tools:</strong> spreadsheets, presentations, graphics/images, data bases software working on a project and additionally webpage design production</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Effective use of digital resources as a data source:</strong> use of digital resources on-line and off-line to search, select and analyse data with specific</td>
<td><strong>Safe use of digital resources:</strong> safe and respectful attitude online with respect to authorship and intellectual property</td>
<td></td>
</tr>
</tbody>
</table>

- **Educational Software**
  - assess topicality, relevance and reliability of information resources and information creatively;
  - use information and communication services in compliance with ethical, safety and legislative requirements
  - *Information processing and presentation*
    - process and present the outcomes of his/her work while using advanced functions of application software, multimedia technologies and the Internet;
    - apply an algorithmic approach to problem solving

- **Finland**
  - Data security, to critically evaluate resources, use of ICT and their diversified use internet ethics

- **Norway**
  - User competence in use of various programs and resources to: Gather information; Evaluate and analyse; Simulate and make models; Be creative and solve problems; Document, report, present, publish and communicate

- **Portugal**
  - General concepts: operating systems, use of the Internet, wordprocessor, spreadsheets, presentations, graphics/images, working on a project and database management
  - Effective use of specific tools: spreadsheets, presentations, graphics/images, data bases software working on a project and additionally webpage design production
  - Effective use of digital resources as a data source: use of digital resources on-line and off-line to search, select and analyse data with specific
  - Safe use of digital resources: safe and respectful attitude online with respect to authorship and intellectual property
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<thead>
<tr>
<th>Country</th>
<th>Goals</th>
<th>Objectives</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slovakia</td>
<td>The understanding of <strong>basic concepts, practices and techniques</strong> when working with data and information flow in computer systems; Understanding the <strong>social, ethical and legal aspects of ICT</strong>: Information around us; Communication via ICT; Procedures, problem solving, algorithmic thinking; Principles how ICT works; Information society</td>
<td>Learn to work in an <strong>ordinary application program environment</strong>; Learn how to <strong>efficiently search for information</strong> stored as digital media or on the network, and <strong>learn how to communicate across the network</strong>; Learn to solve problems with the use of algorithms, learn to write programs with the use of programming language, search bugs and debug programs; <strong>Develop cooperation and communication skills with ICT</strong>; Develop <strong>research skills</strong> with ICT</td>
<td>To develop <strong>ones personality, creativity, logical thinking, responsibility, moral qualities, critical self-awareness and self-improvement</strong>; Learn to respect <strong>intellectual property rights</strong> and ownership of ICT products.</td>
</tr>
<tr>
<td>Switzerland</td>
<td>To know important <strong>ICT devices and tools</strong> such as the computer, mouse, scanner, digital cameras. To know the basics of operating systems and the main functions of standard programmes. To know how to store documents. To know how to communicate in a virtual learning environment and in the Internet. Know how to correctly use <strong>computer based communication tools</strong> (email, chat, sms) as well as the basic features of synchronous and asynchronous communication. To know the rules and behaviour when using ICT and computer based communication tools, to know the <strong>linguistic and creative rules of messages</strong> when using different means of communication such as email, chat, forum or sms.</td>
<td>To apply and use <strong>ICT in different situations</strong> in educational settings. To be able to judge which means are suitable for information, communication or presentation, to <strong>solve everyday problems</strong>, to <strong>collect, select and produce information</strong> to answer questions, to question information sources and evaluate information. To use the computer for every day routine work, to <strong>apply generally known problem solving techniques</strong> to solve tasks. This concerns the work with learning software, information searches from outlined websites, the work with digitised dictionaries and to use other media based support tools. To plan and realise with support one’s own work such as <strong>presentations or publications on the internet</strong>. To use <strong>learning environments</strong> and the internet to exchange ideas, to draft, send and receive messages (via emails, sms, chats). To judge the value of information on the internet based on the sources and criteria. To judge the danger of virus, worms, hacking and be able to protect.</td>
<td>To reflect upon the <strong>advantages and disadvantages</strong> of computer and the Internet in every day life, to reflect upon the own use of the computer and the Internet, to reflect upon the impact of ICT on every day life and on the local and social environment. To observe changes through ICT on every day and working life and deal with the consequences of it, to know about the impact of ICT on its own life and to take it into account when making decision. To continuously reflect upon its own use of ICT. To take ICT into consideration when making future professional choices. To reflect upon <strong>ethical and legal questions</strong> when using ICT, to know what is allowed on the Internet and what is not, to know how to behave when encountering problematic contacts or content. To know how to safeguard one’s own personality and that of others as well as the <strong>protection of data</strong>.</td>
</tr>
<tr>
<td>Country</td>
<td>Knowledge and skills targets comprise: (compulsory)</td>
<td>Considering health care issues, while using the computer;</td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>-------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Lithuania</td>
<td>Computer information arrangement;</td>
<td>Positive attitude towards own abilities;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Drawing;</td>
<td>Motivated daily use of computer;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Text arrangement and printing;</td>
<td>Use the computer as sources of access to other cultures and languages;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Internet and services;</td>
<td>Safer internet use;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Computer design (e.g. using Logo);</td>
<td>Organising learning activities/Presentation of learning results;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Data processing (e.g. excel);</td>
<td>Inquiry of computer design perspective;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Presentations;</td>
<td>Software and data protection, copyright issues;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Programming, computer and website creation basics (voluntarily)</td>
<td>Consequent and structured critical thinking;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Self expression and self presentation;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Creative use of publishing tools;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Creative and critical processing of published information</td>
<td></td>
</tr>
</tbody>
</table>

**Consequent and structured critical thinking; Self expression and self presentation; Creative use of publishing tools; Creative and critical processing of published information**
PART B) ASSESSMENT OF STUDENTS’ COMPETENCE

RESPONSIBLE ACTORS

In most of the countries the same actors are responsible for assessing primary and secondary schools. In all countries (except Portugal) there is a specific assessment agency. The ministry is not involved in assessment in Lithuania, Switzerland and Finland.

ASSESSMENT OF DIGITAL COMPETENCE (PRIMARY)

In Slovakia, Lithuania and Switzerland knowledge and skills are assessed, whereas in Norway\(^4\), Portugal, Finland and the Czech Republic they are not. Attitudes towards digital competence are in general not assessed, with the exception of Lithuania.

In countries where knowledge is assessed, Lithuania, Slovakia and Switzerland, there is an equal balance between ICT based and paper based assessment for a specific type of assessment (meaning that both ICT based and paper based methods are used e.g. for assessing a single student project). It is interesting to note that the most traditional methods of assessing (written examinations, oral examinations) are generally little used to assess knowledge about digital technology and if so, then only in the case where ICT is a separate subject (e.g. in Slovakia). ICT based assessment is used to evaluate single or collaborative group projects, during multiple choice tests and with problem sheets in Lithuania and for self assessment using portfolios in Switzerland. The latter two are likewise used for paper based assessments.

Only in Lithuania are attitudes towards digital competence assessed using both ICT and paper based methods via collaborative group projects and problem sheets, direct observations (paper based) and ICT based presentations.

ASSESSMENT OF DIGITAL COMPETENCE (SECONDARY)

In the majority of countries (Slovakia, Portugal, Lithuania and Switzerland and the Czech Republic) knowledge and skills are assessed, whereas in Norway and Finland they are not. Attitudes towards digital competence are assessed in 3 countries only (Portugal, Lithuania and Czech Republic).

Knowledge (and skills) are assessed with various methods by the countries in question with a strong tendency to ICT based assessment (with the exception of Lithuania).

\(^4\) In Norway a few tools are used in some exams, e.g. spreadsheets and word processor. Knowledge about ICT is probably assessed by teachers, but there are no official standards for this. At national level there are some pilot projects on measuring students’ digital competence.
The most frequently used type of assessment for assessing knowledge are ICT based multiple choice tests. Other ICT based assessments are carried out during project work (single student or collaborative). Again more traditional ways of assessing knowledge such as written or oral examinations are rarely mentioned. ICT based assessment with problem sheets, via oral questioning after the submission of a research project, direct observations, presentations, simulations and self assessment are mentioned by at least two countries.

ICT based project work (student and collaborative) and presentations are the most frequently mentioned types of assessment for assessing skills in 4 countries. Other types of ICT based assessment mentioned by at least two countries are: direct observations, problem sheets, simulations, self assessment, portfolios and quizzes.

There are only two countries, Switzerland and Portugal, which apply more student centred assessment methods involving the learner directly in the process of assessment as in self assessment and the creation of portfolios for the assessment of skills.

Attitudes are assessed to a lesser extent than skills and knowledge. ICT based collaborative group projects are mentioned by all those countries, which assess attitudes, i.e. Lithuania, Czech Republic and Portugal.

**PRIMARY VS SECONDARY LEVEL ASSESSMENT**

Methods for assessing vary considerably with a slight tendency towards ICT based assessment in the countries in focus. Digital Competence in general is hardly assessed in primary education, but more so in secondary education with regard to knowledge and skills. Attitudes towards digital competence are hardly assessed in primary education. Attitudes are assessed to a lesser extent than skills and knowledge, but more so in secondary education than in primary education.
PART C) CURRICULA FOR INITIAL TEACHER TRAINING

GENERAL CHARACTERISTICS

Both, curricula for primary and secondary level teaching, are defined at the same levels by the same actors in each country in focus. In all countries universities define the curricula for primary and secondary level teacher curricula. In the Czech Republic, Switzerland and Finland secondary curricula are defined by the teacher training institution alone, whereas in Norway, Portugal, Lithuania and Slovakia the ministry has a role (either with regard to definition, approval, recommendations, standards, or accreditation) of initial teacher training curricula.

As regards the content of the curricula for initial teacher training there are separate curricula for primary and secondary level teaching in most countries. Exceptions are Lithuania and Norway. In Norway, there will be two main programmes for primary level education, one for grade 1-7, and one aimed at grades 5-10. In addition, there will be various programmes for secondary education, which to some degree fall under the same umbrella.

DIGITAL COMPETENCE FOR TEACHERS (PRIMARY)

DIGITAL COMPETENCE IS A KEY COMPETENCE WHICH IS INTEGRATED INTO THE CURRICULUM (PRIMARY)

Only in Norway (with regard to skills) and in Lithuania digital competence is considered a key competence for primary teachers.

Overall, knowledge and skills for digital literacy are rarely integrated in the curricula, this is the case only in Norway, Lithuania, Finland and the Czech Republic. As the responsibilities for the content and methods lie with the universities themselves, we can not generalise the way of integration. In Norway and in Finland ICT is integrated in an interdisciplinary manner. In Lithuania and the Czech Republic ICT is also taught as a separate subject in some universities.

In the case of Portugal no information could be provided as responsibilities (for primary and secondary) solely lie with the universities. Each university defines its own curriculum and assessment procedures, but the ministry of Science, Technology and Higher Education approves it.

KNOWLEDGE, SKILLS AND ATTITUDE TARGETS

Three countries (Czech Republic, Norway and Slovakia) describe knowledge and skills targets in a very general manner only. No distinction is made between knowledge and skills targets. Specific targets are either not well described, not well researched, or not available at all in these countries due to the autonomy of the university / or teacher training institutions. Actual integration could be very heterogeneous. The described targets focus on the ability:
➢ to use ICT for various purposes in teaching and learning

➢ to evaluate how to use ICT in specific subjects

➢ to apply working approaches that develop skills development with ICT, e.g. problem solving skills
A mapping of knowledge skills and attitude targets results in the following Digital Competence Domains for primary teaching curricula.

<table>
<thead>
<tr>
<th>Competence Domain</th>
<th>COMPETENCES</th>
<th>COMPETENCES</th>
<th>COMPETENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Knowledge (1)</td>
<td>Skills (2)</td>
<td>Attitudes (3)</td>
</tr>
<tr>
<td></td>
<td>Cognition and understanding</td>
<td>Cognition, organizational skills, analytical skills, higher order thinking skills</td>
<td>Critical thinking, reflective attitude, ethical issues</td>
</tr>
<tr>
<td>Digital Competence</td>
<td>Knowledge and understanding needed to master the use of different ICT applications (= functional ICT)</td>
<td>Skills needed to master the use and management of different ICT applications (= Application of knowledge)</td>
<td>Attitudes needed to master the use and management of different ICT applications</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>Students can chose two subject specialization, one can include ICT, e.g. technical education and ICT” and pedagogy of ICT” for lower secondary schools.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slovakia</td>
<td>Principles of how ICT works; Communication via ICT; Programming (is offered in two faculties)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norway</td>
<td>Knowledge and skills targets are very generally defined for different subjects, e.g. for Arts and Craft: “be able to use and evaluate ICT as tools and measures in creative work”. In some subjects they are described even more generally</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DIGITAL COMPETENCE FOR TEACHERS (SECONDARY)

DIGITAL COMPETENCE IS A KEY COMPETENCE INTEGRATED INTO THE CURRICULUM (SECONDARY)

In Lithuania and Slovakia digital competence is regarded as a key competence, in Switzerland and Norway the skills development aspect of digital competence only is regarded as a key competence. Overall, knowledge and skills for digital literacy are integrated in the curricula (and to a higher degree than is the case for primary teacher education) in all the countries in focus, except for Portugal where no information was available. As the responsibilities of the content and methods lie with the universities themselves, it is difficult to gauge the degree of integration. In Slovakia, Norway, Finland and Lithuania ICT is integrated in an interdisciplinary manner. In Slovakia, Lithuania, the Czech Republic and Switzerland ICT is also taught as a separate subject. In the Czech Republic future teachers can choose a subject specialisation, e.g. Technical Education and ICT (pedagogy at lower secondary schools) and Pedagogy of ICT (for lower secondary schools). Future teachers often choose two subjects of which one can be ICT related. Similarly, in Slovakia future teachers for secondary schools choose 2 subject specialisations, one of them may be informatics (= ICT plus a simplified version of computer science).

KNOWLEDGE, SKILLS AND ATTITUDE TARGETS

4 countries (Czech Republic, Norway, Slovakia and Switzerland) describe knowledge and skills targets on a very general level only. Except for Slovakia there is no distinction made between knowledge and skills targets. Moreover, targets can not be generalised within those countries because of the autonomy of the university/or teacher training institutions. Further in depth investigation of specific universities and teacher training departments would be needed to obtain deeper insights. Actual integration could be much more heterogeneous. The described targets focus on the ability:

- Pedagogical knowledge to use ICT: e.g. to use ICT in different subjects or teaching (in a competent and evaluative manner), to know ICT related cognitive theories
- Media knowledge and Information literacy
- Technical ICT knowledge and knowledge on basic ICT concepts
- Using ICT for lifelong learning
- Knowledge on the social aspects of ICT
EMERGING DIGITAL COMPETENCE DOMAINS FOR TEACHERS` CURRICULA (SECONDARY)

A mapping of knowledge skills and attitude targets results in the following Digital Competence Domains for secondary teaching curricula.

<table>
<thead>
<tr>
<th>Competence Domain</th>
<th>COMPETENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge (1)</td>
<td>Cognition and understanding</td>
</tr>
<tr>
<td>Skills (2)</td>
<td>Cognition, organizational skills, analytical skills, higher order thinking skills</td>
</tr>
<tr>
<td>Attitudes (3)</td>
<td>Critical thinking, reflective attitude, ethical issues</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Digital Competence</th>
<th>Knowledge and understanding needed to master the use of different ICT applications (= functional ICT)</th>
<th>Skills needed to master the use and management of different ICT applications (= Application of knowledge)</th>
<th>Attitudes needed to master the use and management of different ICT applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Czech Republic</td>
<td>Universities follow their own curriculum, mainly teaching ICT as a separate subject. Students can chose two subject specialization, one can include ICT, e.g. “technical education and ICT” and “pedagogy of ICT” for lower secondary schools.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norway</td>
<td>Knowledge and skills targets are very generally defined for different subjects, e.g. for Arts and Craft: “be able to use and evaluate ICT as tools and measures in creative work”. In some subjects they are described even more generally.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slovakia</td>
<td>To know basic ICT concepts; To know the current theoretical models of cognitive socialisation and education in relation to ICT; To develop information literacy</td>
<td>To use ICT in the acquisition, processing and presentation of information; To learn independently how to acquire knowledge in the subject of ICT, in pedagogy and to use ICT to develop and integrate ICT into teaching.</td>
<td>To know the social aspects of IT and the Information society; To use ICT for continuing education</td>
</tr>
<tr>
<td>Switzerland</td>
<td>The target set for knowledge and skills is competent use of media and ICT in the classroom.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PART D) ASSESSMENT FOR INITIAL TEACHER TRAINING

RESPONSIBLE ACTORS

In general, there are hardly any differences concerning the level of definition and responsible organisations for initial teacher curricula and assessment between primary and secondary level initial teacher training.

In Slovakia, Norway, Lithuania and Finland the responsibility is shared between the university, ministry and a specific assessment agency. In Switzerland and Portugal the responsibility for assessment lies with the universities, which have full autonomy in this respect. In the Czech Republic the sole responsibility for assessment lies with a specific assessment agency.

ASSESSMENT OF DIGITAL COMPETENCE (PRIMARY)

Except for the case of Lithuania and Slovakia there is no assessment of digital competence within primary teachers' initial training.

In Slovakia knowledge is assessed in an ICT based manner during single teacher projects, presentations and portfolios. Paper based assessment of knowledge takes place in written examinations (unseen), oral examinations (unseen), oral questioning after submission of a research and presentations. Skills are assessed in an ICT based manner during oral questioning after observation, direct observation, presentations and portfolios. Attitudes are not assessed.

In Lithuania\(^5\) knowledge and skills are assessed with ICT through the following methods: Single teacher project and collaborative teacher project, written examinations (seen and unseen), problem sheets, oral questioning after the submission of a research project, direct observations, presentations, simulations, self assessment and portfolios.

Attitudes in general are assessed with ICT through the following methods: Single teacher project and collaborative teacher project, written examinations (seen and unseen), oral questioning (seen and unseen), oral questioning after the submission of a research project, presentations, simulations, self assessment and portfolios.

\(^5\) The information is based on interviews with the representatives of the Vilnius college of HE and Teacher professional development centre.
In countries, where ICT is also taught as a specific subject, as in Slovakia, Lithuania and in Switzerland, digital competence is also assessed.

In Slovakia, the knowledge about digital technology is assessed via ICT and paper based written examinations, essays, oral examinations and via ICT based single and collaborative group projects, oral questioning after submission of a research and presentations. Skills are assessed with the help of ICT via single and collaborative teacher projects, written examinations, oral examinations, oral questioning after submission of a research project and presentations. Attitudes are assessed with the help of ICT and paper based essays, ICT based oral examinations, oral questioning after submission of a research project and presentations.

In Lithuania, knowledge in general is assessed using ICT through the following methods: Single teacher project, written examinations, multiple choice tests, problem sheets, oral examinations (unseen and open book), oral questioning after observation and the submission of a research project, presentations, quizzes. Skills and attitudes are also assessed with the help of ICT during written examinations (unseen and open book), multiple choice tests, oral examinations (seen and unseen), oral questioning after observation and the submission of a research project, presentations, portfolios and quizzes.

In Switzerland knowledge about digital technology is assessed with the help of paper based tests during single teacher projects and collaborative / group projects and during presentations. Skills are tested with the help of paper based multiple choice tests and self assessment. Attitudes are not assessed.

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6 The information is based on the curriculum of the faculty of Mathematics, Physics and Informatics, Comenius University, Bratislava.

7 The information is based on interviews with the representatives of the Vilnius pedagogical university and Teacher professional development centre.
PART E) TEACHERS’ IN SERVICE TRAINING

GENERAL CHARACTERISTICS

In general there is no differentiation with regard to course offers and in terms of requirements for primary and secondary teachers.

The review revealed that national teacher training initiatives currently exist (or existed in the past) only in some countries. This is the case for Finland, Slovakia or Lithuania. In the case of Lithuania reference is made to selected courses (e.g. ECDL) and national requirements and courses provided for in service teachers. In Finland reference is made to the training programme Ope.fi which systematically received national funding from 2000 to 2007. Only in 2011 the programme will be revised with regard to the curriculum and content. Slovakia mentions a number of accredited programmes and national projects.

In other countries no national in-service programmes exist and consequently there is only little, if any, information on that topic. In the Czech Republic many different courses mainly in the field of basic ICTs are offered. In Switzerland in-service training schemes for teachers are offered by individual teacher training colleges, each of which has a different curriculum. Likewise the situation in Norway, where there is no obligatory in service training for teachers and 28 different teacher training colleges give courses based on local curricula. In Portugal, a national teacher training and certification initiative for both primary and secondary school teachers is about to be implemented.

DIGITAL COMPETENCE FOR IN SERVICE TEACHERS (PRIMARY AND SECONDARY)

DIGITAL COMPETENCE IS A REQUIRED COMPETENCE AND INTEGRATED INTO TEACHER TRAINING PROGRAMMES (PRIMARY AND SECONDARY)

Digital competence, mainly referring to knowledge and skills, is a required competence for primary in service teachers in Finland, Lithuania, Switzerland and the Czech Republic. In these countries it is also part of the in-service training programmes for teachers, with the exception of Switzerland, where only skills development is part of the training - not knowledge. Even though it is not a required competence in Slovakia (but envisaged for the year 2011), Norway and Portugal, ICT is or can be part of the in service training of teachers. Attitudes towards digital competence are mentioned by Finland and Lithuania only.

KNOWLEDGE AND SKILLS TARGETS

There is no clear distinction made between knowledge and skills targets as outlined in various teachers’ in-service training courses. Knowledge and skills can be grouped into functional ICT targets and pedagogical ICT targets as offered in the training courses for teachers.

Functional ICT targets comprise:
The knowledge of basic ICT and computer functions including the ECDL modules (ICT concepts, managing files, word processing, web browsing and communication)

**Pedagogical ICT targets include:**

- To use ICT in the classroom and in teaching in a purposeful way for learning and teaching
- To use ICT in specific subjects and projects
- To know how to use different digital devices (e.g. Interactive whiteboards, beamers) and digital resources and services (wikis, blogs, social media) for teaching and learning
- Reference is also made in a very general way to ICT based teaching and learning methods

**ATTITUDE TARGETS**

Attitude targets mainly refer to the creative, competent, personalised and reflective use of ICT in teaching and learning.
EMERGING DIGITAL COMPETENCE DOMAINS FOR TEACHERS’ IN SERVICE TRAINING (PRIMARY AND SECONDARY)

A mapping of knowledge skills and attitude targets results in the following Digital Competence Domains for primary teaching curricula.

<table>
<thead>
<tr>
<th>Competence Domain</th>
<th>COMPETENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Knowledge (1)</td>
</tr>
<tr>
<td></td>
<td>Cognition and understanding</td>
</tr>
<tr>
<td>Digital Competence</td>
<td>Knowledge and understanding needed to master the use of different ICT applications (= functional ICT)</td>
</tr>
</tbody>
</table>

<p>| Czech Republic | Bachelor degree ICT in education; ICT coordinator course |
| Finland | To know the functions of the computer; Pedagogical use of ICT; Knowledge of social media (newly introduced) |
| Lithuania | Targets are mainly derived from the ECDL modules and the Distance learning course Teacher computer literacy. Knowledge and skills targets comprise: Module 1: basic ICT concepts |
|           | Technical skills in using computers (earlier Ope.fi II level), Pedagogical skills in using ICT in education (earlier Ope.fi II level); Skills using social media in education (new kind of training) |
|           | Skills to use ICT in all circumstances |
|           | Creative personalized ICT based teaching and learning; ICT based teaching and learning (methods, content, activities); |</p>
<table>
<thead>
<tr>
<th>Country</th>
<th>Module and Project</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norway</td>
<td>n.a.</td>
<td>Reflective use of ICT and evaluation</td>
</tr>
<tr>
<td>Portugal</td>
<td>To know how to include ICT in the classroom to develop good teaching strategies</td>
<td>Competent use of ICT and digital resources in each subject area</td>
</tr>
</tbody>
</table>
| Slovakia    | Targets are different in different projects: the informatics education and language projects focus on subject matter concepts and skills using ICT  
               The ICT in education project focus on different digital resources (both HW and SW – IWB, beamers, blogs, wikis, etc.) and the way how to use them in teaching/learning. | Competent use of ICT and know how to use ICT in education.                               |
| Switzerland | Competent use of ICT in the classroom                                              |                                                                                           |
PART F) TEACHERS’ IN SERVICE TRAINING ASSESSMENT

GENERAL CHARACTERISTICS (PRIMARY AND SECONDARY)

With the exception of Switzerland, where ICT based knowledge for primary teachers is not assessed, digital competence is similarly assessed during in service training courses for primary and secondary school teachers in the countries in focus.

In Portugal, Slovakia, Lithuania and the Czech Republic digital literacy, mainly referring to knowledge and skills, is assessed within in service training courses for primary and secondary school teachers. In the Czech Republic this type of assessment only takes place in specialised ICT oriented courses. Lithuania is the only country which assesses attitudes towards digital competence of teachers during in service training courses. Regarding the type of assessment it is noteworthy that in Lithuania, Portugal and Czech Republic only ICT based methods are used to assess digital competence (knowledge and skills).

ASSESSING KNOWLEDGE (PRIMARY AND SECONDARY)

ICT based testing to assess knowledge about ICT include single teacher projects (LT, PT), collaborative group projects (CZ), multiple choice tests (LT, CZ) presentation, simulations, portfolios (PT), portfolios and quizzes (LT).

In Slovakia ICT based oral examinations (presentation of a project) and paper based presentations are used to assess knowledge and skills in primary education, whilst for secondary school teachers’ paper based single teacher projects are used in some training programmes to assess knowledge.

Switzerland does not assess knowledge for either primary or secondary school teachers.

ASSESSING SKILLS (PRIMARY AND SECONDARY)

In in service training courses in Lithuania ICT based single teacher projects, multiple choice tests, presentations, portfolios and quizzes are used to assess skills. In Portugal ICT based single and collaborative teacher projects, presentations and simulations are used. ICT based problem sheets and observations are applied when assessing ICT skills in specialised ICT courses in the Czech Republic. Slovakia uses ICT based oral and paper based presentations.

Switzerland is the only country which assesses skills via paper based single and collaborative teacher projects, presentations, self assessment and portfolios for secondary teachers, but not for primary teachers.

ASSESSING ATTITUDES (PRIMARY AND SECONDARY)

Lithuania assesses attitudes towards digital competence of its primary and secondary school teachers via ICT based single teacher projects, multiple choice tests, presentations, portfolios and quizzes.
SUMMARY AND CONCLUSIONS

SCOPE OF THE REVIEW

The aim of the review is to identify how digital competence for students and teachers is addressed and assessed in national curricula. Altogether 7 countries provided input to the questionnaire, Czech Republic, Finland, Lithuania, Norway, Portugal, Slovakia, and Switzerland. The questionnaire was addressed to all 13 Ministries of Education being members of the Digital Skills Working Group. In the first section, the review analyses the overall findings for students’ and teachers’ curricula and assessment respectively for primary and secondary education. These findings are complemented by detailing findings on a country by country basis, two knowledge building examples and 5 cases studies. The knowledge building examples describe new approaches to learning and constructing knowledge as opposed to traditional approaches. The case studies illustrate how one particular aspect of digital competence or assessment was addressed in a nation or regional context.

DIGITAL COMPETENCE

Digital competence is an evolving subject with various definitions by different stakeholders. This review is based on a definition that reflects the concept of digital participation, which goes beyond purely functional ICT, where children are active learners, are involved in collaboration and communication with ICT, use technology that is appropriate to their needs and are evaluative and critical about the impact of new media.

"Digital Competence involves the confident and critical use of Information Society Technology (IST) for work, leisure and communication. It is underpinned by basic skills in ICT, i.e. the use of computers to retrieve, store, produce, present and exchange information, and to communicate and participate in collaborative networks via the Internet" (EC, 2007).

- The definition allows a structured approach towards the collection of data and analysis by distinguishing between knowledge, skills and attitudes, which all together form digital competence.

STUDENTS’ CURRICULA

The curriculum is an important binding document for teachers in every country according to which the learning and teaching process is organised to develop children's competences (knowledge, skills and attitudes) as required. Curricula can be more prescriptive or flexible, detailed or general as regards the description of content and methods. The review shows that schools in the country in focus enjoy certain flexibility on how to integrate ICT in the curriculum. Digital Competence is part of the curriculum in the majority of countries and also regarded as a key competence for students, but the way it is integrated differs.

Norway, Finland and Switzerland integrate ICT in a transversal way in different subjects or ICT related projects. Portugal and countries where ICT was a discrete subject in the past, such as in
the Czech Republic, Slovakia and Lithuania, still follow this approach but complemented by a transversal approach of starting to use ICT in other subjects or projects.

All countries have (or will have as in the case of Norway) distinct curricula for primary and secondary education. With regards to digital competence targets for students in primary and secondary education, the review shows that the main focus in primary education curricula is on skills development and pedagogical targets. They range from basics of working with a computer, information management targets, such as the capacity to access, retrieve, present and communicate information and to use ICT for various purposes. A minority of the national curricula in focus refer to Internet safety issues including a critical reflection on ICT. Collaboration activities with ICT do not appear in primary curricula.

- With learners accessing ICT at an increasingly younger age, primary curricula do not seem to correspond to the competence needs of young learners today. Areas such as critically engaging with ICT or using ICT as a tool for collaborative learning are not sufficiently addressed and specified in the primary curricula of the countries surveyed.

### STUDENTS’ ASSESSMENT

Students’ assessment of digital competence hardly takes place in primary education, but more so in secondary education with regard to knowledge and skills. In the countries surveyed for this analysis, methods for assessing vary considerably with a slight tendency towards ICT based assessment. Attitudes are assessed to a lesser extent than skills and knowledge, but more so in secondary education than in primary education.

### PRIMARY STUDENT CURRICULA VS. SECONDARY STUDENT CURRICULA

We can see a progression from primary to secondary curricula targets with the introduction of additional targets at secondary level in some countries. These new targets focus on the wider use of ICT as a communication tool, knowledge related to presentations, using ICT for research, planning and cooperation and relating ICT to the outside world. Moreover, the idea of an active, creative content producer becomes more important in secondary curricula in some countries.

### STUDENT TEACHERS CURRICULA

Digital competence is a key competence for primary student teachers in Norway and Lithuania and additionally in Switzerland for secondary student teachers. Universities enjoy full autonomy as regards if and how to integrate ICT in the curriculum. In some countries the Ministry of Education has a role with regards to the definition, standards, recommendations or approval of initial teacher curricula. Consequently, what we know in this area is limited, as various programmes exist at institutional and faculty level and digital competence targets can not be generalised for a country. Only Czech Republic, Norway and Slovakia for primary teacher curricula and additionally Switzerland for secondary teacher curricula, refer to knowledge and skills targets. Targets for future primary teachers are scarce. The few targets outlined for primary and secondary teachers broadly focus on technical ICT knowledge, pedagogical knowledge to
use ICT, media knowledge and information literacy, the use of ICT for lifelong learning and knowledge on the social aspects of ICT.

- The description of competence targets for student teachers remains in most cases on a general level. Moreover, the distinction between knowledge, skills and attitude targets is not always clearly made.
- Further in depth investigations via document analysis and case studies of specific universities and their teacher training faculties would be needed to obtain reliable insights on the current situation.

**STUDENT TEACHERS ASSESSMENT**

Except for the case of Lithuania and Slovakia there is no assessment of digital competence for primary student teachers. In countries, where ICT is taught as a specific subject for future secondary teachers, as in Slovakia, Lithuania and Switzerland, digital competence is also assessed.

**IN SERVICE TEACHERS’ CURRICULA**

In general there is no differentiation with regard to course offers and in terms of requirements for primary and secondary teachers. The review revealed that national teacher training initiatives currently exist (or existed in the past) only in some countries. This is the case for Finland, Slovakia and Lithuania. In Portugal, a national teacher training and certification initiative for both primary and secondary school teachers is about to be implemented. In other countries no national in-service programmes exist and consequently there is only little, if any, information on this topic as there are different providers and course offers.

As regards to competence targets more reference is made to pedagogical ICT targets as opposed to basic ICT functional knowledge. Targets are described in a very general way e.g. to apply ICT based teaching and learning methods and to use ICT in specific subjects and projects. Additionally, secondary teachers should know how to use different digital devices and resources (Interactive Whiteboards, wikis, blogs, social media) for teaching and learning. Attitudes, rarely outlined, refer to the creative, competent, personalized and reflective use of ICT in education.

- There is no differentiation of specific training offers for primary and secondary in service teachers, even though teachers have to meet specific requirements for both levels of education as set out in the curriculum.
- Further in depth investigations of teacher training offers at national, regional or local level would be needed to obtain reliable insights on the current situation.

**IN SERVICE TEACHER ASSESSMENT**
With the exception of Switzerland, where ICT based knowledge for primary teachers is not assessed, digital competence is similarly assessed during in service training courses for primary and secondary school teachers in the countries surveyed.

In Portugal, Slovakia, Lithuania and the Czech Republic, digital literacy, mainly referring to knowledge and skills, is assessed within in service training courses for primary and secondary school teachers. In the Czech Republic this type of assessment only takes place in specialised ICT oriented courses. Lithuania is the only country which assesses attitudes towards digital competence of teachers during in service training courses.

**STUDENT CURRICULA VS. TEACHER CURRICULA**

There seems to be a discrepancy between the demands set out in the curriculum for students as opposed to the required competences for teachers as described in initial teacher training curricula or in service training courses. On the basis of the information available the stated targets for initial and in service teacher training are only described on a very general level and do not correspond to the more specific requirements as set out in student curricula.

There is no distinction between requirements for primary and secondary ICT related in-service training. Whilst targets for students are concretely specified as regards the type of skills, knowledge and attitudes to be achieved, the targets for teachers such as “competent use of ICT” “pedagogical use of ICT”, “to use ICT in subject teaching and for skills development” do not match the specific requirements for students. The aspect of using ICT for assessment is not mentioned at all in the initial teaching curricula or in service training programmes described.

Some words of caution are needed, as a curricula review analyses documents which are also politically shaped. Overall, the review analyses the official documents and their wider interpretation and not the actual real integration of ICT in schools, which could be much more heterogeneous. The review reveals a knowledge gap in a couple of areas especially when it comes to teacher education or assessment. Therefore the members of the digital working group decided to complement the curricula review with a number of case studies and knowledge building initiatives.

**CASE STUDIES**

The case studies illustrate one aspect of students’ or teachers’ curricula and assessment from a national or regional perspective. Thus, we are able to gain deeper insights especially in those areas, where we only received limited information from the review, such as in assessment, in-service and initial teacher training. The idea behind the case study description is not to highlight a “best practice case” per se, but rather to illustrate how a specific problem or challenge has been addressed in a specific national context, outlining means of implementation, practical examples, the lessons learnt and critical reflections.

**The Norwegian case study** “Assessing digital competence in primary schools” describes the development of a web based test to assess digital competence for primary students in large
Norwegian municipality. In Norway, where ICT is a basic competence and embedded into subject teaching, the test aimed to demonstrate students’ digital competence as regards the description of the digital competence aims in the national curriculum. The case study highlights the fact that competence aims are not always sufficiently specified and can be interpreted differently from school heads and teachers. The aim of developing an evidence based knowledge base on assessment is seen as essential to progress in this area by providing feedback to students and teachers.

The Italian case study on “ICT and in service teacher training - blended eLearning provided by PuntoEdu”, gives in depth insights into how Italian teachers have used ICT training offers over the last ten years. Surveys, studies and observations reveal that Italian teachers are using the elearning environment more as a source of resources and content rather than as a collaborative learning environment. As regards the blended learning approach, combining face to face sessions and online learning, the perceived asset of ICT and eLearning is still controversial. Even though eLearning is considered easy and effective especially as regards time management and personalisation, many teachers still prefer traditional face to face sessions allowing for more interaction among peers and spontaneity. The main challenge remains to integrate the acquired knowledge and skills into daily teaching practices and the difficulty for teachers to link technology use to specific teaching purposes. The case study also shows that there is a need for both pedagogical training of ICT and technical training for specific ICT applications and devices.

The two Slovakian case studies emphasise a different approach towards ICT integration in schools. Historically ICT is taught as a separate subject “Informatics” since the late 1980s. The first case study “In service teacher training project for informatics teachers in primary and secondary schools” addresses the challenge of training a sufficient number of teachers for Informatics and the newly introduced subject Informatics education. The training’s emphasis is on digital literacy, modern teaching approaches, and specialised subject training in Informatics and Informatics education as well as didactics of the two subjects. The aim is to train 1500 teachers between 2009 and 2011. The second case study describes in detail “ICT in initial teacher training at the Mathematics, Physics and Informatics faculty of Comenius University, Bratislava”. The training course was developed after surveying the lifelong learning practices of in-service teachers and the ICT course offers of 20 faculties, which revealed that digital competence is only marginally tackled during university studies.

The Swiss case study also focuses on initial teacher training. It analyses “Research on the role of ICT in teacher training” and reflects on the methodology and findings of a recent study, which looked into the role of ICT in teacher training colleges in Switzerland. One of the main findings of the study is that only against the background of a uniform taxonomy to describe findings from both document analyses and case studies, was it possible to harvest insights from very heterogeneous documents and curricula. It was thus possible e.g. to detect a general shift in focus away from ICT user skills to didactical aspects in the larger framework of media studies.
KNOWLEDGE BUILDING EXAMPLES

The knowledge building initiatives describe new approaches to learning and constructing knowledge as opposed to traditional approaches. Characteristics of knowledge building activities may include:

- peer learning approaches between students and teachers (collective knowledge building);
- hands on approaches, where knowledge is built by experimenting, exploring and debating;
- activities where students are actively involved in the creation of knowledge and ideas as a source of learning (e.g. inquiry based learning, wiki based initiatives);
- where students do not only acquire facts but also meta skills such as cooperation, creativity, initiative taking and competencies such as learning to learn.

The Czech example “The education portal to support the Czech framework education Programme” illustrates how the set up the portal was a key element in the implementation of the Framework Education Programme, which aimed at reforming school education between 2005 and 2008. The portal mainly helped teachers, which received more freedom in the selection of teaching methods, with information, guidance and counselling, (carefully selected and reviewed articles on ICT pedagogy) to implement the changes announced by the reform in their own work.

The Norwegian example illustrates how handheld technology is used in borderless and interactive science teaching in the city of Tromsø, a large municipality. The evaluation of the project gives valuable insights into experiences of teachers and students, which emphasise the value of using handheld devices in primary education as a means to get more passive students actively involved in the learning process. Handheld technology is also suitable for use in science teaching as learning with these tools occurs through collaboration, trial, testing and games.

In the following Annex 1 details findings per country, Annex 2 Knowledge Building Examples, Annex 3 Case Studies.
## ANNEX 1 FINDINGS PER COUNTRY

### CZECH REPUBLIC

#### STUDENT CURRICULA

**Level of definition**

In the Czech Republic both primary and secondary curricula are defined at national level by the ministry of education in cooperation with the research institute of education in Prague (VUP, which is run directly by the Ministry of Education). There is also a more specific curriculum at the operative level of schools.

Assessment is dealt with by the Ministry of education in cooperation with the centre for assessments in education (CERMAT) directly run by the Ministry of education.

There are separate curricula for primary and secondary education.

<table>
<thead>
<tr>
<th>Primary curricula</th>
<th>Secondary curricula</th>
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</thead>
<tbody>
<tr>
<td>Digital Competence is not considered as a key competence and part of the curriculum, but is integrated in the curriculum as a separate subject called ICT.</td>
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</table>

**Skills targets** comprise:

**Stage 1 (age of pupils 6 – 10), Expected Outcomes – Cycles 1 and 2**

**Basics of working with a computer**

- use the basic, standard functions of a computer and its most common peripheries
- observe safety rules when working with hardware and software, and proceed in an informed manner in case they are faulty
- protect data from damage, loss or abuse

**Information searching and communication**

- utilise simple and suitable ways when searching for information on the Internet
- search for information on web portals, in libraries and in databases
- communicate by means of the Internet and other common communication devices

**Knowledge targets** comprise:

- **Basic computer literacy**
- **Basic algorithm development**
- **Safety and ethics**

**Skills targets** comprise

**Digital Technology**

- manage, combine and apply the ICT tools available
- utilize his/her theoretical as well as practical knowledge of the functions of individual components of both hardware and software to solve problems creatively and effectively
- organize data effectively and protect it from being destroyed or abused
- be familiar with the possible uses of ICTs in various areas of social knowledge and practice

**Information resources and searching**,
<table>
<thead>
<tr>
<th>Information processing and application</th>
<th>communication</th>
</tr>
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<tbody>
<tr>
<td>• work with text and pictures in text and graphics editors</td>
<td>• utilize the services of information networks available to search for information, to communicate, as well as for self-learning and teamwork</td>
</tr>
<tr>
<td>Stage 2 (age of pupils 11-15), Expected Outcomes – Cycles 1 and 2</td>
<td>• make the best of the offer provided by information and educational portals, encyclopedias, libraries, databases and educational software</td>
</tr>
<tr>
<td>Information searching and communication</td>
<td>• assess topicality, relevance and reliability of information resources and information creatively; use information and communication services in compliance with ethical, safety and legislative requirements</td>
</tr>
<tr>
<td>• verify the credibility of information and information sources and assess their importance and interconnectedness</td>
<td>Information processing and presentation</td>
</tr>
<tr>
<td>Information processing and application</td>
<td>• process and present the outcomes of his/her work while using advanced functions of application software, multimedia technologies and the Internet</td>
</tr>
<tr>
<td>• be able to work with text and graphics and table editors, and use suitable applications</td>
<td>• apply an algorithmic approach to problem solving</td>
</tr>
<tr>
<td>• apply basic aesthetic and typographic rules for the work with text and pictures</td>
<td>Attitudinal targets are part of the expected outcomes.</td>
</tr>
<tr>
<td>• work with information in accordance with legislation on intellectual property rights</td>
<td></td>
</tr>
<tr>
<td>• use information from various information sources and evaluate simple relationships between data</td>
<td></td>
</tr>
<tr>
<td>• prepare and present information in text, graphic and multimedia forms at user level</td>
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</table>

Attitudinal targets are part of the expected outcomes.

### STUDENT ASSESSMENT

Digital competence is not assessed in primary education.

Digital competence (knowledge, skills and attitudes) is assessed in secondary education as part of the ICT subject.

Knowledge is assessed (ICT based) during single students and collaborative projects, written examinations (unseen), multiple choice tests, problem sheets, oral examination (open book), oral questioning after the submission of a research project direct observations and presentations.

Skills are assessed (ICT based) during single students and collaborative projects, via problem sheets, direct observations presentations and simulations.

Attitudes are assessed ICT based during single student and collaborative projects, during direct observation,
### TEACHER CURRICULA (INITIAL TRAINING)

**Level of definition**
Teacher Training curricula - for primary and secondary education - are defined at the local level by the university or teacher training institution itself. There are separate curricula for primary and secondary education. There is a specific assessment agency, which is responsible for assessment, the accreditation commission of the Ministry of education.

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<tr>
<th>Primary curricula</th>
<th>Secondary curricula</th>
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Digital competence is not regarded as a key competence. Universities follow their own curriculum, mainly teaching ICT as a separate subject. Students can choose two subject specializations, one can include ICT, e.g. technical education and ICT” and “pedagogy of ICT” for lower secondary schools.

### TEACHER ASSESSMENT

Digital competence is not assessed within initial teacher training programmes for primary and secondary education.

### TEACHER COURSES (IN SERVICE TRAINING)

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<tr>
<th>Primary curricula</th>
<th>Secondary curricula</th>
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Digital competence is not a required competence for in-service teachers and can be part of in-service training (not always compulsory). There is no national ICT strategy, many different training courses are offered, but mostly providing basic ICT training.

There is a bachelor degree “ICT in education” and a study course “ICT coordinator” (3 semesters) in the programme of lifelong education for teachers in primary, secondary and vocational schools.

### TEACHER ASSESSMENT

Knowledge about ICT and skills in using ICT is assessed only in specialized ICT oriented courses.

Knowledge is assessed ICT based in written examinations (unseen) and in multiple choice tests. Skills are assessed ICT based with problem sheets and during direct observations. Attitudes are not assessed.
FINLAND

STUDENT CURRICULA

Level of definition
In Finland both primary and secondary curricula, are defined at national level by the national Board of Education and at the local level by the schools. The National Board of Education prepares the content of the curriculum, which the ministry of education confirms (in the future). Schools prepare a more specific curriculum at operative level.

The existing curriculum dates back to the year 2004. Currently, Finland is in the process of renewing the curriculum for primary and lower secondary education. The role of ICT will considerably be different in the next curriculum.

There is a special assessment centre for general assessment of the school system situated in Jyväskylä. The national board of education assesses achievements in certain subjects.

There are separate curricula for primary and secondary education.

Primary curricula= Secondary curricula

Digital competence is integrated in the curricula in a transversal manner. Digital competence could be regarded as a key competence because it is integrated across the curriculum in all subjects.

Targets as regards digital competence (no difference is made between knowledge, skills, and attitude targets) comprise:

- data security
- to critically evaluate resources
- use of ICT and their diversified use
- internet ethics

STUDENT ASSESSMENT

The curriculum only sets out guidelines for subjects. As ICT is not a subject in its own right, there are no specifications as regards the assessment of ICT.

TEACHER CURRICULA (INITIAL TRAINING)

Level of definition
In Finland both primary and secondary teaching curricula, are defined at the local level by the universities themselves, which prepare their own curricula. The role of ICT in teacher training studies therefore differs from university to university. No information is therefore available on digital competence targets and assessment within initial teacher training.

TEACHER COURSES (IN SERVICE TRAINING)
Digital competence is a required competence for in service teachers and is part of in service training of teachers. In 2000 a special national “curriculum” for ICT teacher in service training called Ope.fi (levels I, II and III) was launched. The Ope.fi training scheme was systematically funded until 2007. During the last years, in service training for teachers was more open and less training in using ICT has been offered. In 2011 the Ope.fi training will get a new curriculum with new content.

<table>
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<tr>
<th>Primary curricula</th>
<th>Secondary curricula</th>
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Knowledge targets comprise:

- *To know the functions of the computer*
- *Pedagogical use of ICT*
- *Knowledge of social media* (newly introduced).

Skills targets comprise:

- *Technical skills in using computers* (earlier Ope.fi II level),
- *Pedagogical skills in using ICT in education* (earlier Ope.fi II level)
- *Skills using social media in education* (new kind of training)

Attitudinal targets comprise:

- *Skills to use ICT in all circumstances*

**TEACHER ASSESSMENT**

There is no systematic assessment of teachers ICT skills.
**LITHUANIA**

**STUDENT CURRICULA**

**Level of definition**
In Lithuania primary and secondary curricula are defined at national level by the ministry of education, the Education development centre and at the level of the schools, which define a more specific curriculum in terms of content, software and teaching hours. The Education development centre also draws guidelines for assessment, which schools follow. There are separate curricula for primary and secondary education.

<table>
<thead>
<tr>
<th>Primary curricula</th>
<th>Secondary curricula</th>
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<tbody>
<tr>
<td>Digital Competence is not considered as a key competence. Schools can decide to include it into the curriculum (either as a separate subject or transversally) if they wish so. Skills can be integrated interdisciplinary as informal educational clusters.</td>
<td>Digital Competence (knowledge, skills and attitudes) is a key competence and part of the secondary curriculum. It is integrated as a separate subject called Information technology and in a transversal (interdisciplinary manner).</td>
</tr>
</tbody>
</table>

**Skills targets** comprise: **basic computer skills** and **the use of digital educational software and games**

**Attitudinal targets** comprise:
- *Computer user skills*
- *Safer Internet skills*
- *Health care*

**Knowledge and skills targets** comprise: (compulsory)
- *Computer information arrangement*
- *Drawing*
- *Text arrangement and printing*
- *Internet and services*
- *Computer design (e.g. using Logo)*
- *Data processing (e.g. excel)*
- *Presentations*

**Knowledge and skills targets** comprise: (voluntarily)
- *Programming basics*
- *Computer publishing basics*
- *Website creation basics*

**Attitude targets** comprise
- *Considering health care issues, while using the computer*
- *Positive attitude towards own abilities*
- *Motivated daily use of computer*
STUDENT ASSESSMENT

Knowledge about ICT skills are assessed in primary schools by giving descriptive feedback to students. The main methods to assess knowledge are via ICT and paper based single and collaborative student projects, multiple choice tests and problem sheets, paper based presentations and self assessment. Skills assessment takes place with the same methods, except that presentations are ICT based, not paper based as for assessing knowledge.

Attitudes are assessed via ICT and paper based collaborative projects, problem sheets, paper based direct observation, ICT based presentations or other (ICT based or paper based) methods depending on the school’s decision, e.g. observation of students practical work and behavior.

Assessment of students in secondary education is based on the guidelines developed by the Education development centre.

Knowledge and skills are assessed (ICT and paper based) during single students and collaborative projects, multiple choice tests, problem sheets direct observations and quizzes. Moreover via paper based oral questioning after observation and the submission of a research project and during ICT based presentations and simulations.

Attitudes are assessed ICT and paper based during collaborative projects, via problem sheets, oral questioning after submission of a research, self assessment and case studies. Presentations to assess attitudes are ICT based.

TEACHER CURRICULA (INITIAL TRAINING)

Level of definition

Teacher Training curricula- for primary and secondary education- are defined at national level by the Ministry of education which recommends educational requirements for teachers computer literacy programmes and at the local level by the university or teacher training institution itself. The Qualifications and vocational education and training development centre develops occupational and VET standards for primary school teachers. The Centre of Information Technologies of Education (CITE) recommends distance learning courses for the development of teachers.
pedagogical computer literacy on the National education portal [http://vma.emokykla.lt/moodle]. The Institute of information technologies is the ECDL representative in Lithuania.

There are 3 actors responsible for the assessment of future primary and secondary teachers. The ministry of education which recommends the requirements for teachers' computer literacy programmes, a specific assessment agency and the universities themselves, which decide on assessment as regards their regulations.

There are no separate curricula for primary and secondary education.

<table>
<thead>
<tr>
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<th>Secondary curricula</th>
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<tbody>
<tr>
<td>Digital competence is regarded as a key competence. Each university develops their own programmes (e.g. based on the ECDL application, informatics as a subject or the pedagogical part of the teacher computer course). The courses and modules are validated by the universities and faculties.</td>
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</tr>
<tr>
<td>ICT can be integrated a separate subject called Information Technology or transversally (e.g. ICT use in teaching and learning).</td>
<td>ICT can be integrated a separate subject called Information Technology or subject specific (e.g. ICT in arts teaching).</td>
</tr>
<tr>
<td>The specific targets for knowledge, skills and attitudes can not be generalised as they are defined by the universities.</td>
<td>The specific targets for knowledge, skills and attitudes can not be generalised as they are defined by the universities.</td>
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**TEACHER ASSESSMENT**

The following information based on interviews with the representatives of the Vilnius college of HE and Teacher professional development centre.

Knowledge and skills in general are assessed with ICT through the following methods: Single teacher project and collaborative teacher project, written examinations (seen and unseen), problem sheets, oral questioning after the submission of a research project, direct observations, presentations, simulations, self assessment and portfolios.

Attitudes in general are assessed with ICT through the following methods: Single teacher project and collaborative teacher project, written examinations (seen and unseen), oral questioning (seen and unseen), oral questioning after the submission of a research project, presentations, simulations, self assessment and portfolios.

The following information is based on interviews with the representatives of the Vilnius pedagogical university and Teacher professional development centre.

Knowledge in general is assessed with ICT through the following methods: Single teacher project, written examinations, multiple choice tests, problem sheets, oral examinations (unseen and open book), oral questioning after observation and the submission of a research project, presentations, quizzes.

Skills and attitudes are also assessed with ICT during written examinations (unseen and open book), multiple choice tests, oral examinations (seen and unseen), oral questioning after observation and the submission of a research project, presentations, portfolios and quizzes.

**TEACHER COURSES (IN SERVICE TRAINING)**
There are a number of face-to-face training seminars organised at national level as well as the distance learning course on teachers’ ICT educational use in schools. Various courses are also organised in teacher in-service training centre’s at municipal level. In order to approve teachers’ educational ICT competence, they are invited to prepare their own electronic portfolio (e-portfolio) where they should collect the documents confirming their ICT application experience. To train these competences, a special distance learning course was prepared for Lithuanian teachers by the researchers of the IMI in 2007 that was developed for the primary and special needs teachers. This course consists of three main components: content (themes); learning activities (teaching, learning and assessment methods); competences (goals).

Primary curricula = Secondary curricula

Digital competence is a required competence for in service teachers and part of in service training. Targets are mainly derived from the ECDL modules and the Distance learning course Teacher computer literacy.

Knowledge and skills targets comprise:

Module 1: **basic ICT concepts**

Module 2: **using the computer and managing files**

Module 3: **word processing**

Module 7: **web browsing and communication**

Attitude targets comprise:

- Creative personalized ICT based teaching and learning
- ICT based teaching and learning (methods, content, activities)
- Reflective use of ICT and evaluation

**TEACHER ASSESSMENT**

Knowledge is assessed ICT based during single teacher projects, multiple choice tests, portfolios and quizzes. Additionally skills and attitudes are assessed through ICT based presentations.
## Level of definition

In Norway both primary and secondary curricula are defined at national level by the Ministry of Education and the Norwegian Directorate for Education and Training. The Ministry of Education and the Norwegian Directorate for Education and Training are also responsible for assessment. There is no hierarchy of curricula, but most schools/organizations make more operative plans at local level. This is however not demanded.

There are no separate curricula for primary and secondary education. A few study programs are obviously more ICT-related, technology and design and media are two examples, but in general primary and secondary curricula are structured in the same way.

**Primary curricula = Secondary curricula**

Digital competence is defined as a key competence and is part of the curriculum. It is mainly integrated in the curriculum in a transversal (interdisciplinary) manner.

**Knowledge targets** comprise:

- Tool knowledge, both general tools and subject specific ones.
- Information knowledge, hereunder source evaluation, Internet safety and legal aspects
- Media knowledge, hereunder competence in multimodal texts

**Skills targets** comprise:

- User competence in use of various programs and resources to: gather information, evaluate and analyse, simulate and make models, be creative and solve problems, document, report, present, publish and communicate

**Attitude targets** comprise:

- Attitudes in regards of digital judgements in areas like
- Digital bullying
- Individual property rights
- Privacy and data protection
- Source validation
- Communication and social interactions in digital societies

## Student Assessment

Digital competences are not officially assessed. A few tools are used in some exams, e.g. spreadsheet and word processor. Probably knowledge about digital technology is assessed by the teachers, but there are no official
standards in this regard. Nationally there are some pilot projects on measuring students’ digital competence.

**TEACHER CURRICULA (INITIAL TRAINING)**

**Level of definition**

Teacher training curricula, both for primary and secondary education, are defined at the local and national level. National curricula are defined in more general terms by the Ministry of Education, while each University/Teacher training institution is responsible to make local educational programs based on the national curricula.

Even though there are different regulations for teacher training for primary and secondary level education, both curricula are equally general in regards of ICT and therefore primary and secondary curricula considerably match.

**Primary curricula = Secondary curricula**

Knowledge about digital competence is not considered as a key competence both for primary and secondary teacher education. Knowledge about digital technology is part of the curriculum. Skills about digital technology are considered a key competence and they are integrated into the curriculum in a transversal (interdisciplinary) manner.

Knowledge and skills targets are very generally defined for different subjects, e.g. for Arts and Craft: “be able to use and evaluate ICT as tools and measures in creative work”. In some subjects they are described even more generally.

Attitude towards digital literacy is hardly visible in the curriculum.

**TEACHER ASSESSMENT**

**Level of definition**

The Ministry of Education has the overall responsibility for teacher assessment. Each Institution is responsible for following given regulations. NOKUT, a national agency, supervises the Institutions thorough regular assessments.

From autumn 2010 there will be two main programs for primary level education, one for grade 1-7, and one for grades 5-10. In addition there will be various programs for secondary education; these programs are to some extent under the same umbrella.

**Primary curricula = Secondary curricula**

Digital competence is not assessed within teacher training programmes for primary and secondary education. However, knowledge about digital technology and skills can be in some cases assessed as part of other assessments.

**TEACHER COURSES (IN SERVICE TRAINING)**

There are no obligatory in service training for teachers, and therefore there is no official program for teachers. The 28 different teachers training colleges give courses based on local curriculums. ICT is one of several topics given as voluntary courses. Given the situation it is not possible draft a general pictures of the current situation.
**Portugal**

<table>
<thead>
<tr>
<th>STUDENT CURRICULA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level of definition</strong></td>
</tr>
<tr>
<td>In Portugal both primary and secondary curricula are defined at national level by the ministry of education. The ministry is also likewise responsible for assessment of primary education, whereas at secondary level this takes place at the level of the school only. There are separate curricula for primary and secondary education.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Primary curricula</th>
<th>Secondary curricula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Competence is not considered as a key competence, is not part of the curriculum, and is mainly integrated in the curriculum in a transversal (interdisciplinary manner). Consequently targets as regards as knowledge, skills and attitudes are neither defined nor assessed.</td>
<td>At secondary level digital competence is regarded as a key competence and is integrated as a separate subject. Knowledge targets comprise general concepts, operating systems, use of the Internet, wordprocessor, spreadsheets, presentations, graphics/images, working on a project and database management. Skills targets comprise existing knowledge targets such as effective use of word processor, spreadsheets, presentations, graphics/images, working on a project and additionally webpage design production.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STUDENT ASSESSMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital competence is not assessed in primary education.</td>
</tr>
</tbody>
</table>
## TEACHER CURRICULA (INITIAL TRAINING)

### Level of definition

In Portugal there is specific curriculum at the operative level of the universities or teacher training institutions for primary and secondary teacher students. University or teacher training institution defines the curricula with the approval of the Ministry of Science, Technology and Higher Education.

Universities or teacher training institutions are likewise responsible for the assessment of teachers (primary and secondary). There are separate curricula for primary and secondary education.

<table>
<thead>
<tr>
<th>Primary curricula</th>
<th>Secondary curricula</th>
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</thead>
<tbody>
<tr>
<td>As the curricula depend on the university no national answer can be given.</td>
<td></td>
</tr>
</tbody>
</table>

## TEACHER ASSESSMENT

As the assessment depends on the university no national answer can be given.

## TEACHER COURSES (IN SERVICE TRAINING)

For both primary and secondary school teachers there is currently no national level initiative. A national training initiative for teacher training and certification has just started to be put into practice and but no detailed information is available yet.

**Knowledge targets comprise:**
- To know how to integrate ICT in the classroom to develop good teaching strategies

**Skills targets comprise:**
- To be able to use ICT in the teaching of different subject areas

### TEACHER ASSESSMENT

Knowledge and skills about digital technology is assessed ICT based via single teacher and collaborative teacher projects, during presentations, simulations and portfolios. Attitudes are not assessed.
### Level of definition

In Slovakia both primary and secondary curricula are defined at national level by the Ministry of Education, Science, Research and Sports of the Slovak Republic and by a specific curriculum agency, as well as at the more operative level of the school. The National Institute for Education and State Institute for Vocational Education defines the curriculum with the help of external experts in subject curriculum boards which has an advisory function in this process. The Ministry of Education approves it. There is a more general curriculum at national level and a more specific curriculum at the operative level of the schools. There are separate curricula for primary and secondary education. As regards assessment, there are two assessment bodies, which are responsible for assessment next to the Ministry of Education, the National Institute for Certified Educational Measurements and the State School Inspection.

<table>
<thead>
<tr>
<th>Primary curricula</th>
<th>Secondary curricula</th>
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</thead>
</table>
| The following information is based on the national curriculum for primary education, June 30, 2008 (in Slovak). Digital Competence is a key competence and part of the curriculum, and is integrated as a separate subject called informatics education. **Knowledge targets** comprise the *understanding of basic concepts and mechanisms for solving various problems using digital technology (ICT)*. 5 topics  
• Information around us  
• Communication via ICT  
• Procedures, problem solving, algorithmic thinking  
• Principles how ICT works  
• Information society  
**Skills targets** comprise:  
• Basics of algorithmic thinking and the ability to think about problem solving using ICT.  
• Using ICT for obtaining information, communication, for learning,  
**Attitude targets** are not formulated as according to the educational standards definition attitudes can not be defined. | The following information is based on the national curriculum for Informatics (in Slovak). Digital Competence is a key competence and part of the curriculum, and is integrated in the curriculum in a transversal, interdisciplinary manner, e.g. in ICT based projects and presentations, or in subject curricula is included search for information on internet and as a separate subject called informatics. **Knowledge targets** comprise:  
• The understanding of basic concepts, practices and techniques when working with data and information flow in computer systems  
• Understanding the social, ethical and legal aspects of ICT  
5 topics  
• Information around us  
• Communication via ICT  
• Procedures, problem solving, algorithmic thinking  
• Principles how ICT works  
• Information society  
**Skills targets** comprise  
• Learn to work in an ordinary application program |
standardised.

Also in Math is developed digital competence by using ICT for searching, managing and presenting information. The appropriate SW should help students to avoid long calculations in order to focus on problem itself.

**Environment**

- Learn how to efficiently search for information stored as digital media or on the network, and learn how to communicate across the network
- Learn to solve problems with the use of algorithms, learn to write programs with the use of programming language, search bugs and debug programs.
- **Develop cooperation and communication skills** with ICT
- Develop **research skills** with ICT

**Attitude targets** comprise:

- To develop **ones personality, creativity, logical thinking, responsibility, moral qualities, critical self-awareness and self-improvement**.
- Learn to respect **intellectual property rights** and ownership of ICT products.

### STUDENT ASSESSMENT

Knowledge is assessed during paper based written examinations and ICT based oral examinations. Skills are assessed in primary education during paper based written examinations and ICT based via portfolios, presentations, direct observation, oral examination-unseen and via oral questioning after observation. Attitudes are not assessed.

The following information is based on the didactical guidelines for student assessment in Secondary Schools.

Knowledge is assessed ICT and paper based via collaborative group projects and written examinations (unseen) and only ICT based during oral examinations (unseen), oral questioning after the submission of a research project, direct observations, presentations, simulations, self assessment, portfolios

Skills are assessed ICT and paper based via collaborative group projects and only ICT based during single student projects, oral examinations (unseen), oral questioning after the submission of a research project, direct observations, presentations, simulations, self assessment, portfolios

Attitudes are not assessed.

### TEACHER CURRICULA (INITIAL TRAINING)

**Level of definition**

Teacher Training curricula- for primary and secondary education- are defined at the local level by the university or teacher training institution itself. They must be accredited by an accreditation committee at the Ministry of Education.
At both primary and secondary teacher education level the university is responsible for assessment.

There are separate curricula for primary and secondary teacher education.

<table>
<thead>
<tr>
<th>Primary curricula</th>
<th>Secondary curricula</th>
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</thead>
<tbody>
<tr>
<td>The following information is based on a survey carried out by the MoE in 2010.</td>
<td>The following information is based on the curriculum of the faculty of Mathematics, Physics and Informatics, Comenius university, Bratislava.</td>
</tr>
<tr>
<td>Digital competence is not regarded as a key competence in the accreditation guidelines for the educational programs. Nevertheless digital competence of diverse level is part of the curriculum of teacher education for future primary teachers in all faculties which have accredited educational programs for future primary teachers. ICT can be integrated as a separate subject (depending on the university: ICT in education, Informatics) or in a transversal way e.g. ICT in science. Recently MoE is providing steps to include digital competence into the accreditation guidelines. The situation at the national level was surveyed in May 2010 by the MoE.</td>
<td>Digital Competence (knowledge, skills and attitudes) is regarded as a key competence for secondary teacher education. Knowledge about ICT and skills in using ICT are integrated into the curriculum as a separate subject called ICT1-ICT6. Additionally skills are integrated in a transversal (interdisciplinary manner), where ICT is used to prepare homework, assignments and presentations.</td>
</tr>
<tr>
<td>Knowledge and skills targets comprise:</td>
<td>Knowledge targets comprise:</td>
</tr>
<tr>
<td>Two topics are defined in all curricula of all faculties:</td>
<td>• To know basic ICT concepts</td>
</tr>
<tr>
<td>• Principles of how ICT works</td>
<td>• To know the current theoretical models of cognitive socialisation and education in relation to ICT</td>
</tr>
<tr>
<td>• Communication via ICT</td>
<td>• To develop information literacy</td>
</tr>
<tr>
<td>Programming is offered in two faculties.</td>
<td>Skills targets comprise:</td>
</tr>
<tr>
<td>Pedagogical use of ICT in subjects is rarely offered.</td>
<td>• To use ICT in the acquisition, processing and presentation of information</td>
</tr>
<tr>
<td></td>
<td>• To learn independently how to acquire knowledge in the subject of ICT, in pedagogy and to use ICT to develop and integrate ICT into teaching.</td>
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<tr>
<td></td>
<td>Attitude targets comprise:</td>
</tr>
<tr>
<td></td>
<td>• To know the social aspects of IT and the Information society</td>
</tr>
<tr>
<td></td>
<td>• To use ICT for continuing education</td>
</tr>
</tbody>
</table>

**TEACHER ASSESSMENT**

Digital competence is assessed within teacher training programmes for primary education on very diverse levels.

Knowledge is assessed ICT based during single teacher projects, presentations and portfolios. Paper based assessment of knowledge takes place in written

The following information is based on the curriculum of the faculty of Mathematics, Physics and Informatics, Comenius university, Bratislava.

Knowledge about digital technology is assessed via ICT and paper based written examinations, essays, oral
<table>
<thead>
<tr>
<th>Examinations (unseen), oral examinations (unseen), oral questioning after submission of a research and presentations.</th>
<th>Examinations and via ICT based single and collaborative group projects, oral questioning after submission of a research and presentations.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skills are assessed ICT based during oral questioning after observation, direct observation, presentations and portfolios. Attitudes are not assessed.</td>
<td>Skills are assessed only ICT based via single and collaborative teacher projects, written examinations, oral examinations, oral questioning after submission of a research project and presentations.</td>
</tr>
<tr>
<td>Attitudes are assessed during ICT and paper based essays, ICT based oral examinations, oral questioning after submission of a research project and presentations.</td>
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</table>

**TEACHER COURSES (IN SERVICE TRAINING)**

Educational institutions (universities, methodological centers and the like) offer a variety of local courses, including ICT. These courses do not have even a single structure or goals and are not mandatory for teachers. Currently, there are several ongoing nationwide educational projects associated with the development of digital literacy of teachers. But these are pilot projects and the participation of teachers in them is optional.
Digital competence is currently not a required competence for in service teachers (but foreseen in 2011 as part of the Strategy of ICT in education for primary and secondary schools). There are currently a number of accredited programmes and national projects.

**Accredited programmes:**

- IWB in Education, IWB in English lessons
- ICT in Chemistry, ICT in English language
- Programming in Elementary school
- Developing multimedia resources
- Use of graphical SW in Art
- SW for Math

**National projects:**

- In service teacher training for primary and secondary teachers in informatics education (DVUI)
- In service teachers training for elementary school teachers in ICT in education (of 10 subjects) (elementary school includes primary and lower secondary level teachers)
- In service teachers training for primary teachers in foreign languages

**Knowledge targets:**

Targets are different in different projects: the informatics education and language projects focus on subject matter concepts and skills using ICT

The ICT in education project focus on different digital resources (both HW and SW – IWB, beamers, blogs, wikis, etc.) and the way how to use them in teaching/learning.

**Skills targets:**

There is no common target, but the general aim is that teachers are competent users of ICT and know how to use ICT in Education.

**TEACHER ASSESSMENT**

<table>
<thead>
<tr>
<th>Knowledge and Skills about ICT are assessed ICT based during oral examinations (presentation of the project, discussions) and as part of paper based presentation.</th>
<th>Knowledge and Skills about ICT are assessed ICT based during oral examinations (presentation of the project, discussions) and as part of paper based presentation. Additionally, for secondary school teachers paper based single teacher projects can be assessed depending on the type of the accredited programme.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitudes towards digital literacy are not assessed.</td>
<td>Attitudes towards digital literacy are not assessed.</td>
</tr>
</tbody>
</table>
Level of definition
In Switzerland both primary and secondary curricula are defined at regional level by the cantonal ministries of education. There is no national ministry of education. There is a more general curriculum at regional level and a more specific curriculum at the operative level of the schools. Individual schools assess their students’ knowledge and skills autonomously. There are separate curricula for primary and secondary education.

<table>
<thead>
<tr>
<th>Primary curricula</th>
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</thead>
<tbody>
<tr>
<td>Digital Competence is a key competence and part of the curriculum, and is mainly integrated in the curriculum in a transversal (interdisciplinary manner). Full obligatory integration of ICT, depending on the concept of the school, takes place from the 3rd grade onwards. Objectives are obligatory; with regard to content schools have some freedom of choice.</td>
<td></td>
</tr>
<tr>
<td>ICT in primary education is integrated in various subjects and it is considered to be particularly suitable for project oriented lessons. The main focus in primary education is on the introduction of the use of media, ICT tools and simple user applications. Work is geared towards the general objectives of knowledge about ICT and application of knowledge (basic skills).</td>
<td></td>
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<tr>
<td>Knowledge targets comprise:</td>
<td></td>
</tr>
<tr>
<td>• Complement existing knowledge and skills with media competence</td>
<td></td>
</tr>
<tr>
<td>• Through discovery based learning raise the importance of ICT as a tool for learning and teaching</td>
<td></td>
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<tr>
<td>• Establish a common terminology in order to understand ICT</td>
<td></td>
</tr>
<tr>
<td>• Get to know new media and how it functions (e.g. What can I do with a specific ICT device)</td>
<td></td>
</tr>
<tr>
<td>• Get to know the possibilities to use ICT for problem / task solving and the creation of products</td>
<td></td>
</tr>
<tr>
<td>• Understand how to use ICT as a tool for information gathering and learning</td>
<td></td>
</tr>
<tr>
<td>• To know how to create, format, save and print</td>
<td></td>
</tr>
<tr>
<td>Digital Competence is a key competence and part of the curriculum, and is mainly integrated in the curriculum in a transversal (interdisciplinary manner). ICT is generally integrated in various subjects with a view to content and objectives, e.g. in German (as a mother tongue), music, creative design, math, foreign languages and in transversal projects. Objectives are obligatory; with regard to content schools have some freedom of choice.</td>
<td></td>
</tr>
<tr>
<td>At lower secondary level (Sekundarstufe 1) the main focus is on skills and attitudes.</td>
<td></td>
</tr>
<tr>
<td>ICT can be integrated in various ways:</td>
<td></td>
</tr>
<tr>
<td>• As blocks of training sequences</td>
<td></td>
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<tr>
<td>• As ICT components in specific subjects</td>
<td></td>
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<tr>
<td>• As ICT applications and questions around ICT tackled in a subject related situation</td>
<td></td>
</tr>
<tr>
<td>ICT education and media education are strongly interwoven and classes have to be coordinated. Previous knowledge and experience of students must be considered when integrating ICT.</td>
<td></td>
</tr>
<tr>
<td>Knowledge targets comprise:</td>
<td></td>
</tr>
<tr>
<td>• To know important ICT devices and tools such as the computer, mouse, scanner, digital cameras. To know the basics of operating systems and the main functions of standard software. To know how to store documents.</td>
<td></td>
</tr>
<tr>
<td>• To know how to communicate in a virtual learning environment and in the Internet. Know how to correctly use computer based communication tools (email, chat, sms) as well as the basic features</td>
<td></td>
</tr>
</tbody>
</table>
Skills targets comprise:

- ICT is taught as a **basic competence** next to reading, writing.
- Through the linking of knowledge and ICT, education reaches a new dimension: use of **ICT as a tool for games, exercises and learning, a tool for creation and construction of knowledge and as a means for information and communication.**
- Students are able to use ICT purposefully in various ways for learning and they have the necessary background knowledge, **the creative and productive use of ICT** is an important experience (as opposed to the consumption of games software).

Attitude targets comprise:

- Students deal with the **importance, the opportunities, limits, chances and risks of ICT.** They analyse and judge possible **impacts of ICT** on their own life, working life and culture.

Skills targets comprise:

- To know the rules and behaviour when using ICT and computer based communication tools, to know **the linguistic and creative rules of messages** when using different means of communication such as email, chat, forum or sms.

- To apply and **use ICT in different situations** in educational settings. To be able to judge which means are suitable for information, communication or presentation, to **solve everyday problems, to collect, select and produce information to answer questions, to question information sources and evaluate information**

- To use the computer for every day routine work, to **apply generally known problem solving techniques** to solve tasks. This concerns the work with learning software, information searches from outlined websites, the work with digitised dictionaries and to use other media based support tools.

- To plan and realise with support one’s own work such as **presentations or publications on the internet**

- To use **learning environments** and the internet to exchange ideas, to draft, send and receive messages (via emails, sms, chats)

- To **judge the value of information** on the internet based on the sources and criteria,

- To judge the danger of virus, worms, hacking and be able to protect oneself against them.

Attitude targets comprise:

- To reflect upon the **advantages and disadvantages** of computer and the Internet in every day life, to reflect upon one’s own use of the computer and the Internet, to reflect upon the impact of ICT on every day life and on the local and social environment

- To **observe changes** through ICT on every day and working life and deal with the consequences of it, to know about the impact of ICT on one’s personal life and to take it into account when making decisions. To continuously reflect upon its own use of ICT. To take ICT into consideration when making future professional choices.
To reflect upon ethical and legal questions when using ICT, to know what is allowed on the Internet and what is not, to know how to behave when encountering problematic contacts or content. To know how to safeguard one’s own personality and that of others as well as the protection of data.

### STUDENT ASSESSMENT

| Knowledge and skills are assessed in primary education via self assessment and portfolios (ICT based and paper based). | Knowledge and skills are assessed in secondary education. Knowledge is assessed via ICT based multiple choice tests, simulations and self assessment. Skills are assessed via ICT based single student and collaborative group projects, presentations, self assessment and portfolios. |

### TEACHER CURRICULA (INITIAL TRAINING)

**Level of definition**
Teacher Training curricula for primary and secondary education are defined at the local level by the university or teacher training institution itself. There are separate curricula for primary and secondary education. The individual teacher training institution are likewise responsible for the assessment of their students.

<table>
<thead>
<tr>
<th>Primary curricula</th>
<th>Secondary curricula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital competence is not regarded as a key competence and is not part of the curriculum of teacher education for future primary teachers.</td>
<td>Knowledge about digital technology is not regarded as a key competence for secondary teacher education, but skills are. Knowledge about ICT and Skills in using digital technology is integrated as a separate subject into the curriculum called ICT, Media studies at advanced levels only. The target set for knowledge and skills is competent use of media and ICT in the classroom.</td>
</tr>
</tbody>
</table>

### TEACHER ASSESSMENT

| Digital competence is not assessed within teacher training programmes for primary education. | Knowledge about digital technology is assessed via paper based tests during single teacher projects and collaborative/group projects and during presentations. Skills are tested via paper based multiple choice tests and self assessment. Attitudes are not assessed. |

### TEACHER COURSES (IN SERVICE TRAINING)

| Primary curricula | Secondary curricula |
 Knowledge about and skills in using digital technology are a required competence for in service teachers. Whereas knowledge about digital technology is not part of in service training for teachers, skills are. The general target is the competent use of ICT in the classroom.

Knowledge and Skills about digital technology is regarded as a key competence and it is integrated into in service training for secondary teachers. The target set for knowledge and skills is competent use of media and ICT in the classroom.

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Digital competence is not assessed.</td>
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</tbody>
</table>
The review identified knowledge building initiatives, which foster in a new innovative way (with or without ICT tools) different or new approaches (as opposed to traditional) to learning and constructing knowledge in a specific area.

Characteristics of knowledge building activities may include:

- Peer learning approaches between students and teachers (collective knowledge building)
- Interactions among students who learn by teaching, being teachers themselves
- Hands on approaches, where knowledge is built by experimenting, exploring and debating
- Students actively involved in the creation of knowledge and ideas as a source of learning (e.g. inquiry based learning, wiki based initiatives)
- Students not only acquiring facts but also meta skills such as cooperation, creativity, initiative taking and competencies such as learning to learn
- Student centred approaches vs. teacher centred approaches (changing roles)

CZECH REPUBLIC: THE EDUCATION PORTAL TO SUPPORT THE CZECH FRAMEWORK EDUCATION PROGRAMME

Author: Bohuš Brdička, Charles University in Prague - Faculty of Education

A massive reform of the education system called Framework Education Programme was implemented in the Czech Republic between 2005-2008. The main idea behind the reform was to make schools more independent from the central administration. The main aim was to allow teachers own initiative to develop a richer variety of teaching approaches with the emphasis on constructivist methods. As a consequence the reform should also strive for bigger competitiveness of different schools and programmes. At the beginning the implementation of the reform was hindered by major problems. First of all teachers’ resistance to change was underestimated and the budget allocated for the reform was not appropriate. The lack of support, mainly a lack of communication explaining campaign, was the reason why many schools faced great difficulties when defining their own educational plan and introducing the plan into everyday praxis.

In the given situation there was an evident need to establish a service for teachers explaining and helping them with the implementation of the reform. The launch of a specialized portal accommodated with up to date tools and continuous secure services was seen as the best solution. The Methodical Portal (http://rvp.cz/) has been running already for 3 years under the supervision of The Research Institute of Education in Prague (VUP) and The National Institution
of Technical and Vocational Education (NUOV). The portal is financially supported by the European Social Fund.

The portal is a place where everyone interested in the Framework Education Programme can find all the necessary information, official documents and counselling. Counselling is done in the form of carefully selected pedagogical articles giving teachers the necessary knowledge how to implement changes announced by the reform in their own work. All visitors, including not registered ones, have free access to these articles and to an accompanied repository of digital learning materials (DUM). This repository contains about 3000 learning materials created by teachers mostly for their own use. Each of the resources is first reviewed and approved by an expert before it is published on the portal.

At present the portal has more than 5000 registered users (of about 150,000 Czech teachers) and it offers such services as personal blog (Blogy), portfolio (Digifolio), active participation in thematically organized forums (Diskuze) or jointly developed Wiki pages containing elementary pedagogic materials (e.g. lexicon, ideas, activities, ...). There is also one additional independent but very important component of the RVP.cz portal. The E-learning module offers teachers courses connected to the ongoing reform (e.g. development of the key competencies of pupils, designing and realisation individual learning plans etc.).

It would be exaggerated to say that RVP.cz portal saved the Czech education reform, but it definitely helps teachers to understand what they are supposed to do and to guide them in the implementation.
INTRODUCTION

Computers are starting to become widespread in primary and lower secondary schools, but the incidence of other technology is still relatively modest. Primary and lower secondary schools lack experience and knowledge in other, often newer, types of technology. This was precisely the research focus of the project “Hand held technology in borderless and interactive science teaching”.

1) How does hand held technology affect the learning situation in science subjects?

2) Do pupils’ interests in science change when using hand held technology?”

In addition to these two main questions, the evaluation report, on which the following information is drawn, looked at various aspects of the use of technology, and especially hand held units, in teaching and learning.

THE PROJECT

In the City of Tromsø, innovative handheld technology is used in different contexts as a way to improve learning and to increase motivation among students of primary and lower secondary school. The use of digital maps, GPS tracking and GPS based games, mobile telephones, data logs and hand held computers form the basis for the activities. In addition, digital cameras are used for documentation. Students are between the ages of 10 to 16, the subjects covered are mainly science, language and mathematics, but all subjects can potentially be drawn into the game. Motivation, activity and new knowledge are recurring themes when pupils and teachers talk about their experiences in the project.

The Skolenes IT-Senter (Schools IT Centre - referred to as SITS in the following) is a municipal IT centre that works exclusively with the schools in Tromsø. Educators and technicians work together to provide schools with complete and well-rounded IT services. SITS received funding to manage this project in autumn 2007. Six schools were chosen to participate:

- Mortensnes School, a primary school in the north of Tromsøya with just under 300 pupils
- Bjerkaker School, a primary school in the south of Tromsøya with just under 300 pupils
- Tromsdalen School, a primary school in Tromsdalen with just under 400 pupils
- Tromvik School, a combined school on the island of Kvaløya with just under 30 pupils
- Tromstun School, a lower secondary school in Tromsdalen with just over 300 pupils
- Læring Gjennom Arbeid (LGA), an alternative lower secondary school in the south of Tromsøya with about 30 pupils

Schools were selected according to a diversity of school types. Motivation in the implementation of the project was also a key point in the selection of schools. Each school received funding for project coordination, while SITS appointed a part-time project manager. SITS also provided expertise and administrative resources for the project. The University of Tromsø assisted with the evaluation of the project.

THE PROJECT’S OBJECTIVES

The primary objective of the project is to find out whether the use of digital teaching aids, hand held technology and other digital equipment used for academic purposes can bring anything new to teaching and increase expertise in science subjects of pupils and teachers working to achieve the academic goals of the Knowledge Promotion.

The primary objective was divided into the following sub objectives:

1. Using digital teaching aids, hand held technology and other digital equipment, as tools in the work of realising the goals for the science subjects in the Knowledge Promotion. In this work, adapted education in the subjects related to individual needs, gender, social and cultural differences is emphasised. At the same time the pupils will be able to experience and reflect on their own learning processes and learning strategies concerning the use of technology in relation to other learning methods.

2. Finding out whether hand held technology affects the pupils’ learning outcome and motivation for learning.

3. Finding out the opportunities and the limitations involved in the use of hand held technology in science teaching.

THE RELATION TO THE NATIONAL CURRICULUM

The hand held project has a clear connection with the national curriculum “Knowledge Promotion”. In all contexts in which the pupils have worked with the technology, the activities have had objectives defined by competence targets. The Knowledge Promotion has formulated many goals which are well suited to teaching programmes that make use of hand held technology. The curriculum says the following about matching science with digital competence:

“Being able to use digital tools in science is about being able to use such tools for exploration, measurement, visualisation, simulation, registration, documentation and publication in trials and in field work. Digital animation, simulation and games are good aids to stimulating creativity, bringing the subject alive and visualising science problems. Critical evaluation of network based
science information strengthens work on the subject. The digital communications systems provide opportunities to discuss science problems.”

In addition to these general formulations, the curriculum includes a number of actual competence goals for science that are well suited to working with hand held units. The connection between hand held technology and mathematics is equally clear:

“Being able to use digital tools in mathematics is about using such tools for games, exploration, visualisation and publication. It is also about knowing about, using and evaluating digital aids for problem solving, simulation and modelling. It is also important to find information, analyse, process and present data with appropriate aids and to be critical about sources, analyses and results.”

ABOUT MOBILE LEARNING

In Norwegian schools, the emphasis has mainly been on providing pupils with stationary computers, with the gradual addition of laptops. Smaller, hand held units have been used very little, at least in primary and lower secondary schools. Other countries have had more experience of using hand held technology in schools; in England for example, PDAs (Personal Digital Assistants) have been used. The evaluation report looks at some theories about the connection between handheld technology and learning.

“Mobile learning” can be understood in different ways; two common ways are mobile learning for the purpose of remote teaching and mobile learning in the sense that the person who is learning can be mobile. In the evaluation report the latter meaning was used, the possibility of using technology for learning regardless of location. Hand held technology is a prerequisite for being able to be mobile in this context.

Three concepts give a good description of what distinguishes hand held technology from other technology use:

**Universal presence:** The technology is available everywhere. You do not need to find special locations in order to access the technology, you can carry it with you.

**Penetrating:** The technology is widespread and connected. The element of collaboration is also part of this point; the technology is based on networks that allow many people to collaborate on tasks.

**Ambient:** The technology is “built into” the surroundings, a natural part of buildings and installations around us, almost in the way that sound and temperature is always natural elements of our surroundings. (Kukulska-Hulme, Traxler (2005), p. 2)

These properties of hand held technology allow for new uses in teaching and learning, while they are in themselves important objectives when establishing technical solutions based on portable units. In this project working with the “Ambient” perspective was a challenge. The technology that was used is innovative and largely untried in schools; it is therefore possible that
the goal of ambient technology is not easily achieved. Keeping in mind that the pupils in this project were only exposed to hand held technology for a total of 3 weeks and during the course of this time several different types of technology were used. On the other hand, the pupils might adopt new technologies faster than we expect and the technology may therefore be perceived as ambient by the pupils more quickly. It is reasonable to assume that the properties “universal presence” and “penetrating” can be more easily assessed in the project.

Another important concept when working on technology projects in schools is “learning technology”. By this we mean technology that has been designed and developed with a view to learning. Most of the technology is not of this type; it is often made to help individuals to find information, not for groups to learn together.

THE CONNECTION BETWEEN TECHNOLOGY AND LEARNING

When various types of technology are used in the classroom, the pedagogies will naturally also change to a greater or lesser extent. Hand held technology opens up many new and exciting possibilities for learning. These new possibilities come as a result of the technology’s potential for creating opportunities for information-rich learning contexts. In these contexts, pupils, groups, teachers and the natural surroundings are integrated with the technology, which can in turn challenge, establish a foundation for and expand the pupils’ learning (Chen et al, p. 107). This has been a clear focus in the project. The pupils have worked on various activities in the vicinity of their schools by means of various collaborative activities based on hand held technology. Kukulska-Hulme and John Traxler argue that the use of hand held technology in learning must be based on a desire or need for learning, otherwise the attempt will fail.

EVALUATION RESULTS

Data was collected from interviews with teachers participating in the project, pupils’ questionnaires and observations made by project management and persons involved in the evaluation work.

Teachers reported that more or less all the pupils are active, all are performing well. And they are largely doing this with others. When the teachers point out that otherwise passive pupils become active, it is implicit that this means in the context of the subject, that for example when pupils are working on measurements they become active when they can use technology. When pupils who are otherwise passive in the science subjects take control, this indicates that the technology has the potential to reach passive pupils in this subject. To explain why hand held technology is so suitable for use in science subjects, we can point to the fact that the tools are concrete and the learning occurs through collaboration, trials, testing and games.

One point of the evaluation was to analyse the extent to which hand held technology had a positive effect on pupils’ science learning. They were asked whether they have gained more interest in these subjects during the course of the project. If the pupils respond that they have gained more interest in the subject, this means there has been a connection between the activities in the project and the subject, and that the pupils have become more interested in the
subjects after working on various activities based on hand held technology. Increased interest in the subjects would normally be a good basis for increased learning.

In mathematics, a third of the girls and half the boys reported that they have not become more interested in the subject. 45% of the girls and 38% of the boys said that they have become a little more interested in the subject, while 21% of the girls and 11% of the boys said clearly that they have become more interested in mathematics during the course of the project. Even though a relatively large proportion of the pupils say that they have not become more interested in mathematics, the figures are quite encouraging. It was mathematics that had the least focus of the science subjects; in most of the exercises we were not able to work specifically on mathematics. This is the most probable explanation why we do not see a large effect on mathematics in the technology project. In several of the assignments the pupils worked on during the project mathematics was rather “hidden”. Pupils worked on many activities without really considering that they were actually working with mathematics.

Natural sciences had a clearer focus, especially as we worked on several environmental questions that were clearly linked to natural sciences. The fact that pupils made calculations about time and distance, worked with statistics and measurements and used mathematics in other ways remained somewhat in the background. There is a difference between boys and girls. The girls show to a greater extent than the boys that interest in a subject increases when they use the equipment. This difference is not insignificant. It is difficult to put forward reliable reasons for this result, but it may be that boys are more fascinated than girls by the technology, while girls manage to maintain greater academic focus while performing the various activities.

We can see on the basis of the answers that there is increased interest in natural sciences. There are no more pupils who respond with a clear “yes” to increased interest in the subject, but many more say that they have gained “a little more” interest in the subject. Thus, the number who says that they have not become more interested is smaller.

As mentioned, natural sciences was more obviously embedded in the activities of the project, Therefore, it has probably been easier for the pupils to see that hand held technology is suitable when working on natural sciences than when working on mathematics. The pupils are even clearer about increased interest in environmental studies. The number of pupils who have not become more interested in this subject is more or less unchanged, but there are far more who say they have clearly become more interested. In both subjects we can see a clear trend that girls’ interest has increased to a greater degree than that of the boys.

CONCLUSIONS

The evaluation work clearly showed that the use of hand held technology can help achieve academic goals in science teaching. Pupils and teachers point to high motivation and activity during the project: two fundamental factors in teaching. The pupils also report increased interest in the subjects, something which indicates in itself that this type of technology has a positive effect on teaching. The girls report to a greater extent than the boys an increased interest in the subject this is interesting and not easy to explain.
The digital tools used in this project are relatively advanced and generally have a high user threshold. It has therefore been necessary to give the schools a lot of training and support. The goal for the future must be to make greater use of technology that has a lower user threshold, is more stable and “mature”, is less specialised and is cheaper. Development happens quickly; during the course of this project, the development of more accessible technology has been evident.

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INTRODUCTION

In Italy, teachers’ training and professional development has been delivered through blended e-learning since 2001. The Agenzia Nazionale per lo Sviluppo dell’Autonomia Scolastica (ANSAS), a national board for educational research, has been designing the learning strategies (PuntoEdu), developing the e-learning platform and creating materials for courses that have been attended by more than 7000 teachers.

Given the number of people involved, ANSAS had the chance to observe via monitoring of online behaviour, questionnaire based surveys and classroom observations, how teachers have used ICT in their personal and professional life for almost ten years. This case study presents what we consider the most significant changes in the use of ICT by teachers with a brief analysis of the main issues.

ICT IN THE ITALIAN EDUCATION SYSTEM: FROM THE COMPUTER LAB TO TEACHERS’ PROFESSIONAL DEVELOPMENT

The introduction of digital technologies in Italian schools dates back to 1985, when the Ministry of Education launched a programme to introduce computers in Maths and Physics education in secondary schools. Digital technologies have been considered useful mainly for scientific or technical education until the late ‘90s, when the first Ministry of Education initiative Programma Nazionale delle Tecnologie Didattiche (PNTD) provided funds to purchase digital technologies (desktop computers, multimedia authoring software, projectors) for all school levels.

During the period of this programme basic training was provided to teachers between 1997 and 2001. In some schools, where teachers were familiar with ICT, they were asked to design multimedia resources for curriculum activities. The training was intended to develop teachers’ digital literacy, but encountered strong cultural resistance among teachers, especially because ICT was hardly considered a learning tool. As a consequence, teachers who attended the training, learnt how to manage a file system or to connect to the Internet, but they didn’t get any support in applying these skills when teaching subjects like Italian, Maths, Art and Design or Geography. Besides, school management remained basically “pencil and paper” and until the second half of this decade the use of technology was strongly discreional with no effect on teachers’ careers. As a result, despite the investments and the training, a significant number of Italian teachers did not use ICT in their profession for a long period.
In 2001, e-learning became a strategic asset for teacher training and professional development. The Ministry of Education charged ANSAS (at the time named INDIRE) to design a learning model and to develop an e-learning platform (PuntoEdu) to provide courses on curricular, cross-curricular subjects and teaching methodologies (Processi di Innovazione per l’Inglese e l’Informatica nella formazione della scuola primaria), training activities for new in-service teachers, (NEOASSUNTI), updates for school managers (ATA), courses to support teachers in the implementation of the Education Ministry’s policies and guidelines, and professional development initiatives for the use of digital technology in learning and teaching (FORTIC, DIGISCUOLA, LIM, PONTEC).

PuntoEdu courses, which have been used by teachers for the last ten years, follow a blended learning model: teachers attend face to face classes and perform “on the field” activities, but they are also required to work online. Courses typically provide a selection of online learning materials and activities such as web quests, simulations and case studies designed to practice “learning by doing”. During this process, teachers are guided by a tutor, usually an expert colleague selected by ANSAS, who supports them to personalize the learning path, to develop a project, to evaluate their results and to perform self-assessment. PuntoEdu is also designed to support online collaborative processes: teachers work in groups of 20 people in an online virtual classroom (EDULAB).
In the last ten years, a large digital literacy training programme has been implemented through PuntoEdu courses. Due to its mission, ANSAS had the chance to monitor the online behaviour of these teachers collecting a significant amount of data about their habits and their digital skills. Besides their online behaviour, ANSAS also recorded teachers’ perceptions about ICT (via questionnaire surveys) and observed classroom practices using ethnographic methodologies. ANSAS worked in partnership with universities such as the Catholic University of Milan and the Genova University to collect and analyse the data.

THE SCUOLA DIGITALE INITIATIVE

Concerning the ICT infrastructure, the most recent data from teachers was collected by ANSAS in 2009. The survey shows that schools own on average 27 PCs plus 4 laptops to be used for learning activities and school management. Only 2, 19% of schools don’t have any Internet access while 58% of them are equipped with Wi-Fi connections. Computers and the Internet are available in computer labs for the 22, 4% of the schools surveyed, but only in 7% of the cases technology is available in all the classrooms.

The survey was addressed to 30000 teachers from about 4.000 out of junior secondary schools all over the country. The data were collected during the first year of the Scuola digitale initiative at the beginning of the TPD programme.
The use of digital technologies for teaching and learning activities is left to the initiative of the teachers in 40% of the schools surveyed and is mainly directed to extra curricular activities, in spite of the guidelines from the Ministry of Education. In many cases, the use of digital technologies happens in the computer lab and is only used by teachers who are skilled in using ICT as learning and teaching resources, while other teachers do not consider them useful for their job.

The infrastructure and school management do not harness ICT in teaching practices. In 2008, the Ministry launched the Scuola digitale initiative, a programme providing schools with funds to improve the technological equipment available in each classroom. The three year initiative started with the first action in 2009 and provided more than 8000 classrooms in lower secondary schools (age 11-13) with an Interactive Whiteboard (IWB).

To support the Scuola Digitale initiative, ANSAS provided a Teacher Professional Development (TPD) programme focused on the integration/creation of digital resources for lessons planning and development. As part of the programme, teachers had to test their project and materials on the field and report to a tutor/coach figure. The deployment of Interactive Whiteboards had also an impact on teachers’ discretionary use of ICT. As technology was installed in their workplace, many of them had to cope with it for the first time in their professional life. This represented an issue, mainly for older teachers involved: in fact more than 70% of the teachers who attended the TPD programme were between 46 and 56 years old.

PUNTOEDU UNIVERSE: DIGITAL SKILLS, ONLINE BEHAVIOUR AND CLASSROOM PRACTICES

To outline the changes in the use of the elearning platform and, more generally, in the personal and professional use of ICT by teachers during ten years of PuntoEdu courses, four groups of data are presented below:

The first group refers to the number of drop outs recorded along the years: the drop out rate refers to the number of teachers that explicitly decide to quit the course or which don't complete the course activities.

The second group of data, collected typically at the beginning of each course through a survey, reports about the changes in the familiarity with technologies from 2003 to 2009. The case study tries to make connections between the two groups of data.

The third group summarises data on teachers’ online behaviour in the Punto Edu e-learning platform. As these data are collected by tracking teachers’ online activities (log in, access to materials and to forums, chat and web conferencing tools), we consider them as a valuable source to compare with the surveys’ results.

The last group presents data about the use of ICT in teaching practice and its perceived usefulness.
In 2001 e-learning was a novelty in professional development courses for teachers. Many teachers were not prepared to deal with ICT. Many, even those who had acquired the European Computer Driving License (ECDL) certification, were not ready to understand how and why they had to work online to improve their professional skills. As a consequence, the number of trainees that abandoned the courses was quite high during the first five years: on average 1 out of every 10 participants dropped out during courses about the 2003 school Reform in 2003/04 and in 2005.

The drop outs can not only be related to the lack of digital skills. In 2005, for instance, the Internet connection was an issue for many teachers as 66, 77% connected from home without a flat rate. In other cases, the drop outs may be related to the quality of the course or to the lack of perception that e-learning could be an asset for professional development. Only in 2008 a good level of satisfaction occurred as a survey from NeoAssunti showed 65,12% of teachers who took part in an annual (online course) for newly appointed teachers declared a satisfaction level between 4 and 5 within the range 1 (not satisfied) to 6 (fully satisfied).

It is interesting to note that, compared with 2003/04 and 2005, drop outs lowered in 2007-2009, except for the courses on ICT as Tecnologie per la didattica (ICT as a pedagogical tool): 19% of teachers taking part in the basic course and 13% taking part in advanced courses formally abandoned the course.

Around 30% of participants in the basic course and (25% in the advanced course) quit some online or face to face activity. In this case, the reason may be connected to teachers' expectations: as the courses were intended to develop pedagogical skills for the integration of ICT in school, those who expected a more technical training were clearly disappointed. 53% of the drop outs were connected to the lack of adequate digital skills, but tutors reported that in 41% of the cases even teachers who finished the course did not have the basic prerequisites to attend online activities. Since Punto Edu are blended learning courses, many of these teachers could only finish the course with the support of the tutor during face to face sessions. In these cases, courses turned into a training activity with ICT regardless of the subject of the course.
This same issue was apparent in the *Scuola digitale* course about IWBs: even though the drop outs were below 10%, 24%, the teachers stated that they required more technical training about IWBs authoring software and ICT in general.

**OUTSIDE PUNTOEDU: TEACHERS USE OF ICT IN PERSONAL AND PROFESSIONAL LIFE**

In 2004, 68% of the teachers accessed the Internet once a week and 13% didn't use it at all. They did not make significant use of communication tools: more than 70% didn't communicate through forums or chats, only 5% were using emails in their job on a daily basis and 41% just "*in case of necessity*". Reviewing these data, we may say that at that time Italian teachers were just becoming acquainted with the Internet as a digital library to search resources (70%) or as source of information (45%).

We must clarify that these data refer to a group of teachers which basically volunteer for the TPD programme, which is not compulsory and has no effect on teachers' career. As a consequence, there are a number of teachers which remain "below the line" and the scenario we describe is incomplete. With this limitation, the data we collected in 2008/09 for different courses (*Digiscuola, Tecnologie per la didattica, Scuola digitale*) seems to point to a general improvement. In 2008, 93% of the teachers accessed the Internet from one to three times a week (82% in the south regions). It's interesting to notice that the percentage of teachers that do not use the Internet at all is more or less the same (12%). The number of teachers, which use emails on a daily basis, raised to 72%.

Still in 2008/09, 41% of those who attended the courses perceived themselves as inadequate in terms of digital skills, especially when the TPD programme was about the use of technology in teaching practices. This may be linked to the fact that ICT is more used for school management (97%) than for classroom activities. The Internet is used to retrieve resources for the creation of...
learning materials (61, 28%) and 29% of the teachers declare to use web 2.0 services. Forums are used mainly to communicate with colleagues (33, 78%): which could be an effect of the PuntoEdu TPD model, which privileged forums to support tutor-trainees’ interactions and communication among peers during the last years.

INSIDE PUNTOEDU: TEACHER’S BEHAVIOUR IN THE ONLINE ENVIRONMENT

By tracking and monitoring teachers’ activities in PuntoEdu, ANSAS compared the survey results with data about users’ online behaviour.

Given the general level of Italian teachers’ digital literacy in 2003, the first blended learning courses revealed an intense online activity: 85% of the teachers had been using PuntoEdu e-learning platform once a week, entering an average of 5.38 messages and using web conference tools in 44% of the cases. These positive results may be connected to the fact that e-learning, at least the early stages of PuntoEdu, attracted mostly a niche of teachers who were already familiar with digital technologies or with ANSAS courses.

Two years later, online activities dropped dramatically. In the 2005 e-learning platform, 42% of the teachers did not post any message in forums and only 0.78% posted more than 5. 19% of the teachers did not attend ANSAS online tools at all.

In general online activity of teachers increased during 2007-2008 courses. Messages posted in virtual classrooms vary from 46 (Apprendimenti di base – Matematica) to 80 (Apprendimenti di base – Linguistica) for each virtual classroom. Teachers surveyed did not consider chat and

![Chart showing teacher access to Punto Edu for DL59 courses: 24% accessed 3 to 4 times a week, 17% only once a week and 36% never accessed to the elearning platform](chart)

In comparison with data collected in 2003, on average 2.3 messages are posted for Apprendimenti di base – Matematica and 4 messages for Apprendimenti di base – Linguistica

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9 In comparison with data collected in 2003, on average 2.3 messages are posted for Apprendimenti di base – Matematica and 4 messages for Apprendimenti di base – Linguistica
instant messaging tools very useful for their online activity, while they seemed to appreciate web conferences. 70% of teachers attended at least one web conference.

Despite an increased familiarity with online communication tools, forums in particular, “content is king” in PuntoEdu and the e-learning platform is considered more as a library than a collaborative environment. Generally speaking, teachers behave like in a first generation e-learning environment, and mark a cognitive distance from the PuntoEdu model, designed to support cooperative learning and peer communication. Further studies should investigate if the resistance is related to PuntoEdu instructional design or if it can be associated to the fact that teachers, though improving in technical skills, are still not fully “digital literate” in order to be able to take advantage of online communication tools.

The interest in learning materials increases when teachers are expected to use technology in the classroom for course assignments. This is the case of the Digiscuola (2008), a TPD programme about the use of digital content in the classroom. Teachers, mainly Italian and Maths teachers from upper secondary schools, were asked to choose or produce digital content and to report on its use in classroom activities. This activity was the final assignment of the course.

In those cases, teachers and tutors seem to be focused on face to face classes and “on the field” activities. As a consequence 65.4% of the teachers surveyed in the Digiscuola programme did not use the e-learning platform and 90% of those who used it did not post any message in online forums. Similar behaviour was observed in the Scuola digitale course about IWBs, in 2009, where 18% of the tutors declared they had mainly used emails to communicate with teachers.

FROM PUNTOEDU TO APPLICATION IN THE CLASSROOM

Though Punto Edu had an impact on teachers’ professional culture, the perceived value of ICTs and e-learning as an asset is still controversial. The survey on teachers that attended Apprendimenti di base (basic training) in 2008 is revealing: online learning is considered easy (70%) and effective, especially to manage and personalize learning time (90%), but traditional face to face classes are still preferred by 60% of the teachers as they allow more interactions among peers and more spontaneity. During the years, the level of satisfaction with blended learning for teachers’ professional development has generally increased: in 2003, 55.43% of the teachers considered PuntoEdu courses a positive experience, while in 2007 the percentage raised to 90%.

Even if ICT and e-learning are now considered an asset for teachers’ professional development and Italian teachers’ digital skills have increased in general, technology still has hardly been introduced into daily teaching activities. The lack of infrastructures mentioned above represent a constraint, but data collected from recent quantitative and qualitative research about ICT use in the classroom may be helpful to make a few assumptions on how digital skills are related to the introduction of digital technologies in the teaching practice.

Teachers’ perception of what digital skills they should have provides a few elements for a critical reflection about the problem. Still in recent years (2008/09), teachers seem to consider technical
abilities the most desirable kind of knowledge for themselves and for their professional activity. When teachers start ANSAS courses they look to enhance their personal digital skills and for technical training (such as those provided by ECDL). This last issue has been particularly relevant in the Scuola digitale course about IWBs: a qualitative investigation on the online community of the course (Parigi, 2009) reveals that the majority of the teachers expected training on IWB’s authoring software, and not a TPD programme on the integration of ICT in lesson planning, students assessment, classroom management.

The key questions are: do we have to meet these expectations? Do we have to pursue this kind of training to ensure an effective use in teaching and learning practices? Is it enough to be a digitally literate person to be a digitally skilled teacher?

Based on the data collected we may assume that teachers would definitely answer yes to the first two questions, we are not sure that they would answer the same to the third. In the survey about the Tecnologie per la didattica courses, both basic and advanced teachers pointed out that they wanted to learn more on how ICT can be embedded in different subjects such as Math, Italian, Geography or History.

The need to evolve from personal to professional skills can also be derived from the practices observed on the field during Digiscuola and IWBs courses in 2008 and 2009. In Digiscuola, secondary schools were provided with funds to buy digital learning materials to use in Maths and Italian classes: 90% of the schools bought the learning objects but only 35, 7% used them and mainly (32%) as a supplement to traditional resources, such as the textbook. 39% of the teachers considered the content not useful for their purposes.

This may be related to the quality of the content, but what emerges from the observation of the teaching practices in the IWB courses, seems to be that teachers have problems to find/ adapt technology for their purposes even when they are free to create their own digital materials. Even though the course encouraged the use of Interactive Whiteboards as a shift from traditional “pencil and paper” lessons, preferably supporting student centered methodologies, there were still 20% of the teachers that used whiteboards mainly for simple writing and 25% as a projection tool. This in spite of the training tutors provided about the IWBs software functionalities. In other words, even teachers who had seen some of the advanced functionalities, for instance to create interactive exercises or to manage the use of multimedia resources did not actually use them.

Both in Digiscuola and in the IWB courses, technology was considered useful to raise students’ attention (66,67%) or to improve their participation (54,93%). 28% of the teachers considered digital technology “catchy” and motivating for the students. Quoting the teachers themselves
from the online community we recorded expectations and beliefs\textsuperscript{10} on how IWBs may help to fill the gap with the so-called “digital natives”.

Though these are valuable aspects, consistent with what teachers experience on the field, we must notice that very few of them are able to go beyond very general statements and identify more specific purposes for the use of digital technology in teaching and learning, such as the pursuit of a learning goal.

**CONCLUSION**

As a conclusion, we would like to point out that ANSAS is at a turning point in developing teachers’ digital skills. Due to investments in infrastructures and to the ANSAS TPD model, a large number of Italian teachers became digitally literate persons as they became able to use ICT for personal development in the last ten years. However, this process does not correspond to a comparable growth and maturity in the use of the technology in Italian classrooms.

Despite many other factors which inhibit the effective integration of ICT in the classroom, one major observation is that teachers despite their skills, still cannot identify specific purposes for including ICT and consider digital technology a sort of “black box” that will solve some generic communication and motivation problems. To pursue an effective use of ICT in schools, we should be able to shift from personal skills development towards more professional development goals. This lines up with the UNESCO’s *ICT Competency Standards for teachers*’ framework and with more professionally oriented TPD models such as *TPCK - Technological Pedagogical Content Knowledge* model by Mishra and Khoeler (2006).

The issues pointed out in this case study will be taken in account in the next ANSAS TPD programmes about the use of ICT in school. In this perspective, for the 2011/12 edition of the *Tecnologie per la didattica* courses, both basic and advanced, we are currently working on re-designing the learning model to focus on the development of professional digital skills. In this process, the main challenge will be the design of tools to assess these particular types of skills.

\textsuperscript{10} “The IWB will finally be a revolution for our teaching practices” “IWBs will turn our students into active learners”, “the presence of IWBs in our classrooms will definitely change our way to teach” “Students’ motivation will increase”, “The IWB is a tool that will help us to speak our kids’ language”, “IWBs will help learning because it gains our students’ attention”
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INTRODUCTION

The following case study describes a newly developed assessment scheme to assess Digital competence of pupils finishing Year 4 in almost all primary schools in Bergen, a large Norwegian municipality. The Norwegian national curriculum consists of several competence aims regarding the use of digital tools in different subjects and at different grades (e.g. after Years 2, 4, 7 and 10 in compulsory schools). Therefore, the digital competence aims after Year 4 were the starting point in the process of developing assessment themes and tasks.

NATIONAL BACKGROUND - ICT AS A BASIC COMPETENCE

In 2006, the ability to use Information and communication technology (ICT) became one of the five basic competencies required in Norwegian elementary schools. These basic skills are as follows (The Norwegian Ministry of Education and Research, 2004):

- The ability to express oneself orally,
- The ability to read,
- The ability to do arithmetic,
- The ability to express oneself in writing,
- The ability to make use of ICT.

The decision to add digital competence as a basic competence was historically new both nationally and internationally. The ability to make use of ICT was not defined as a distinct subject; instead the ability to use digital tools is embedded in different subject syllabuses. This gave the schools and teachers the opportunity to organise teaching and learning activities to help pupils become digitally literate within the context of a given subject (e.g. learning how to use digital tools to make presentations or to solve complicated problems). The schools and teachers are asked to emphasise the development of basic skills. New subject syllabuses were worked out for all subjects in the 10-year compulsory school, and the new subject syllabuses contain clear aims for what pupils should know after Years 2, 4, 7 and 10.

ASSESSING DIGITAL COMPETENCE AGAINST THE NATIONAL CURRICULUM

The aim of the assessment project was to give pupils who were finishing Year 4 in primary school an opportunity to demonstrate how they make use of ICT according to the description of the digital competence aims in the national curriculum. The project was carried out in collaboration with education administrators from the municipality. They were responsible for distributing the test and gathering pupils’ scores. All schools in the municipality use the same
Learning Management System (LMS); therefore, the LMS was used to distribute a web-based assessment and a self-report questionnaire. The schools managed the physical booking and organisation of data rooms and computers. Planning the project started in February 2010, the tasks were developed in March, the pilot study containing 120 tasks was run in April, the selection of 60 tasks was made in the beginning of May, the test was completed in the middle of May and a brief report was finished in August 2010.

Inspired by the National Educational Technology Standards for Students\textsuperscript{11} three theoretical themes were selected and matched with the digital competence aims of the Year 4 curriculum (The Norwegian Directorate for Education and Training, 2010). The selection of these themes was done in collaboration with the municipality’s education administrators. The themes are as follows:

**Functional knowledge**: This is concerned with pupils’ understanding of the basic ICT concepts and knowing how to use ICT (for example, how to open software, print documents and change font effects).

**Information knowledge**: This concerns how pupils gather information, how they evaluate sources and how they integrate knowledge from different sources. It also concerns aspects of Internet safety. Some example tasks are as follows:

- “Find source material for his or her own tasks in the library or on the internet” (the Norwegian language curriculum);
- “Collect and systematise data with and without digital aids” (natural science curriculum);
- “Comply with simple rules for privacy protection when using the internet” (social studies curriculum).

**Digital production**: This concerns a pupil’s ability to use software in reading, writing, presenting, etc. Some example tasks are the following:

- “Present historical topics using written text, drawings, images, film, models and digital tools” (social studies subject curriculum);
- “[...] create, store and retrieve texts using digital tools” (the Norwegian language curriculum);
- “[...] present the results with and without digital aids” (natural science curriculum);

The use of ICT “allows new possibilities [...] in the production, composition and editing of texts” (the Norwegian language curriculum).

\textsuperscript{11} The International Society for Technology in Education (ISTE)
METHODOLOGY USED

The final assessment consists of 60 tasks to measure functional knowledge, information knowledge and digital production (twenty tasks per theme). Additionally, the pupils were asked to complete a self-report questionnaire with fourteen questions about gender, use of computers, motivation and cultural capital.

The design of the assignment tasks and questions was built on the experiences from a previous assessment in the same municipality, and approximately twenty identical tasks were used both in 2009 and in 2010. The assessment in 2010 consisted of 32 hotspot questions, where the students have to click on the correct area within an illustration or image, 23 multiple-choice questions and five questions testing text recognition (Crisp, 2007). The multiple-choice questions consisted of questions with four or five answers. The questions with text recognition demanded pupils to gather the appropriate information from a text or an illustration.

PRACTICAL EXAMPLES

Hotspot tasks. Pupils were given pictures of available software, and they were asked to click on the correct icon or text in order to open a file, print a document, create a bold font style, etc. One example of hotspot task is shown in Figure 1 where the pupils are asked to click the area in the picture below in order to get a bold font style.

![Hotspot task example](image)

Figure 1: Example of a hotspot task. The pupils are asked to click on the area in the picture to get a bold font style

Multiple-choice questions. As an example, the pupils were asked, “[What] does the Italian word ‘piazza’ mean?” The pupils could use any available Internet resources. Another example was “Selma has posted some pictures of herself on the Internet. Who is able to see these pictures?” Another example of a multiple-choice question is presented in Figure 2.
When a filename ends with .pps, it means that the file is a
• picture
• spreadsheet
• presentation
• text document

Figure 2: Example of a multiple-choice question where the pupils have to choose between four different alternatives

In Figure 2 pupils have to answer one question about “when a filename ends with .pps, it means that ...” The pupils are asked to choose between four different alternatives, and only one alternative is correct.

Text-recognition tasks: Pupils were asked to copy a sentence or an expression and paste it into an open document field. This text can be found by browsing the Internet or the text can be a part of the task. Figure 3 contains an example of the latter, where pupils are given a text and asked to copy the underlined text and place it into the open document field.

<table>
<thead>
<tr>
<th>Question</th>
<th>Copy the underlined text below, and paste it into the open field</th>
</tr>
</thead>
</table>

Additional Search Activities
The electronic database searches were supplemented with a review of articles cited in recent meta-analyses and narrative syntheses of research on distance learning, including those for teacher professional development and career technical education. The analysts examined references from these reviews to identify studies that might meet the criteria for inclusion in the present review.

Open field:

Figure 3: An example of a text-recognition task. Students are asked to copy the underlined text and place it into an open field

ANALYSIS

Each task was analysed by checking the difficulty of the task, the consistency of the scores and the discrimination of the tasks (Crocker & Algina, 2007). Firstly, the difficulty of the task is examined to avoid very easy or very difficult multiple-choice questions.

Internal consistency is typically a measure based on the correlations between different items on the same test (or the same subscale on a larger test). It is important that each task is consistent and correlates with the theme. The consistency of the scores is measured by the Cronbach's alpha, and high levels of Cronbach's alpha indicate high consistency between the items included in the analysis. It measures whether several items that propose to measure the same general construct produce similar scores. A high correlation between the task and the theme can be an
FINDINGS

A total of 2618 pupils answered the web-based assessment. Analysis of the data reveals that functional knowledge, information knowledge and digital production do have acceptable levels of Cronbach’s alpha (Frisbie, 1988, p. 29).

The results from each of the three themes in the assessment – functional knowledge, information knowledge and digital production – are distinguished as three proficiency levels. Level 3 indicate that the pupils can make use of ICT, according to the competence aims, on their own. Approximately 35 – 40 % (depending on which theme) of the pupils are placed on level 3. Level 1 is the lowest level, and level 1 means that the pupils are not able to make use of ICT. Approximately 10% of the pupils are found on level 1. Level 2 indicates that the pupils sometimes can make use of ICT one their own and sometimes with guidance or instruction. All the schools are provided with feedback about the percentage of pupils found at each proficiency level within each of the three themes.

The overall results from the assessment indicate large diversity in digital competence between the pupils from the municipality, completing the assessment. The majority of the pupils achieved high average scores on the assessment. However, approximately 10% of the pupils received total scores below “the critical limit”, indicating that these pupils lack digital competencies and are not able to make use of ICT as described in the competence aims. A similar trace of diversity in the levels of scores in digital competence was also found in the Norwegian ITU Monitor 2009 biannual survey (Berge et al, 2009; Hatlevik, 2010). Results from the ITU Monitor 2009 indicate the existence of a substantial variation in digital competence between the students, and this variation occurs in all three school years examined: Year 7, Year 9 and Year 12.

Further analysis of the scores from the pupils completing the assessment at Year 4 reveals that the number of books at home, an indication of pupils’ social background, is positively significantly correlated with the scores of digital competence. Social/socio-economic background is also positively related to digital competence according to other studies in Norway (Hatlevik, 2009) and studies in Australia (MCEECDYA, 2010).

The analysis reveal a positive correlation between the three digital competence themes and “mastery orientation goals” – defined as having a focus on self-development, mastery and learning according to individual standards (Darnon, Butera & Harackiewicz, 2007; Elliot and McGregor, 2001). Pupils with high levels of mastery orientation goals are motivated to learn and develop on their own. They judge their own leaning achievements according to their own standards. Positive correlations between digital competence and mastery orientation goals is also found in other studies (Hatlevik, 2009, 2010), and one explanation is that mastery-orientated pupils are eager to learn as much as possible in school.

Further, there is no significant correlation between the amount of time the pupils report to spend on the computers at school, and their achievements in the assessment of digital competence. One reason for this can be that it is how pupils use the computer (e.g. learning to achieve the
competence aims) is more important than how often they access it. (Berge et al, 2009; OECD, 2010).

Finally, the results indicate that females are performing slightly higher than males. In the last decade, females in the Norwegian school system have performed better in many subjects compared with males.

CONCLUSIONS

LESSONS LEARNT

Today, “digital natives” is a term commonly used to describe adolescents and children. However, there is diversity among the so-called “digital natives”. On the one hand, a majority of pupils attained high scores on the assessment; on the other hand, a small group of pupils (approx. 10%) are left behind and are not able to make use of digital tools on their own. When examining factors influencing pupils’ digital competence, the results reveal that social background and mastery orientation are positively related to digital competence.

INSIGHTS GAINED FROM THE PROJECT

It is important to use the competence aims from the curriculum as a starting point when developing tasks and questions. Unfortunately, some of the competence aims are rather vague, and it therefore becomes necessary to speak with teachers, school leaders and educational administrators about the interpretation of these competence aims. This study also benefited from conducting a pilot study before choosing the final tasks. Finally, our experience from the project is the importance of having a sufficient number of tasks in order to obtain acceptable levels of consistency.

The education administrators from the municipality are using the information from the assessment, together with other information about pc-ratio and frequent use of LMS, in their annual formal meetings with the schools. In this way, the digital competence aims in the curriculum are put on the school administrations agenda, and hopefully also on the teaching agenda.

Today the municipalities assessing digital competence may provide their pupils with a digital advantage because their schools are given feedback about their pupils’ levels of achievement. Thus, the school leaders and teacher can use this information to develop and improve the teaching to obtain the competence aims in the curriculum.

NEXT CHALLENGES

We are designing new assessment tasks in order to develop a systemic knowledge base and to gather evidence-based knowledge on assessment. One important challenge when trying to disseminate the experiences from this case study is how the school leaders and teachers can use the information from the assessment in their administration and teaching practice. This means how to provide feedback in a way that facilitates an efficient and sustainable use of ICT.
in teaching and learning activities. The use of ICT in school and the technology itself are rapidly changing. Therefore, it is necessary to identify and emphasise other aspects of digital competence, e.g. collaboration and creation. However, the themes and tasks in the assessment have to be in alignment with the competence aims set out in the national curriculum.
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OECD (2010). Are the New Millennium Learners Making the Grade? Technology use and educational performance in PISA. Paris: OECD.
SLOVAKIA: IN-SERVICE TEACHER TRAINING PROJECT FOR INFORMATICS TEACHERS IN PRIMARY AND SECONDARY SCHOOLS

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INTRODUCTION

The following case study describes in detail the national project of in-service training for primary and secondary schools teachers. It is aimed at teachers teaching the subjects Informatics (subject taught at the end of primary school and in secondary school) and Informatics Education (subject taught from grade 1-4 in primary education). This training has been developed because of the lack of sufficiently trained teachers in this area and to provide involved teachers with notebooks. Within this initiative the aim is to teach 1,500 teachers between 2009 and 2011. Teachers’ participation is voluntary, teachers will receive credits and 200 teachers will have the possibility to reach full qualification as Informatics or Informatics Education teachers. The project is funded from EU structural funds. The training for 3 different target groups will be described as regards the scope, form and content. A concluding paragraph outlines the project outcomes, results and challenges.

INFORMATICS AND INFORMATICS EDUCATION AS SEPARATE SUBJECTS

Subjects related to ICT were already taught on an optional basis in secondary grammar schools in Slovakia in the 1980s. Most of them covered programming and computer systems. At that time the Faculty of Mathematics and Physics at Comenius University, was the only faculty in the former Czechoslovakia preparing future teachers of Informatics. From 1986 the subject Informatics (a computer literacy subject) was introduced into the upper secondary school curriculum as compulsory within one year. Informatics (basics of computer science) was introduced as an elective subject in the 2 final years of upper secondary general studies. However, there was a constant lack of qualified informatics teachers. Informatics was taught by teachers of related subjects, mostly maths or physics teachers, who have received qualification by an in-service training institution. The capacity of these institutions to run these programmes was limited. The development of ICT and its use in other subjects has shown the need for training of other subjects teachers in this area. The Ministry of Education provided large scale basic ICT-skills training for the majority of teachers (85%) in the year 2005-2006. The pedagogical teacher training institutions and universities also began to offer courses on ICT. There were only a few specialized courses offered for Informatics teachers, mostly technologically oriented (e.g. Excel, Internet, etc...).
From 2008 parallel to school reform, informatics became part of the curriculum for primary and secondary schools. A new compulsory subject “Informatics education” is taught from the second to the fourth grade of primary school at least one hour a week. The subject “Informatics” is compulsory from the fifth to the ninth grade of primary school and is to be thought at least 0.5 hour per week. In secondary schools the subject “Informatics” is taught from grade 1 to 3 and is to be thought at least 1 hour per week. Schools can provide elective subjects in their school curriculum to some extent. Many schools increased the hours to teach “Informatics” providing advanced course offers. ICT is integrate into the curriculum not only as a separate subject “Informatics”, but also as a key competence which can be introduced in other subjects and in the framework of interdisciplinary projects.

The main aim of “Informatics” is to teach students to understand fundamental concepts, practices and techniques used when working with data and information in computer systems. It develops students’ skills in obtaining, processing, storing and publishing information and builds students’ informatics literacy i.e. leads them to effectively use information resources with respect for the legal and ethical use of information technologies and products. Informatics also develops students’ thinking skills, their ability to analyze and synthesize, generalize, to seek appropriate strategies for addressing problems and to verify them in practice.

Unfortunately, there always has been a shortage of Informatics teachers at the second level of primary schools (grades 5 - 9) and at secondary schools. Teachers at the first level of primary schools (grades 1 - 4) are not prepared for teaching Informatics yet, since the educational reform only started 2 years ago. However, all incoming teachers gained computer literacy education during their studies.

**LACK OF SUBJECT TEACHERS TO TEACH INFORMATICS AND INFORMATICS EDUCATION**

The on-going educational reform in Slovakia brought about significant changes, as for instance a new distribution of subject areas, reduction of the subject content, and a greater flexibility for schools in creating their own school curriculum. This includes the introduction of a new subject Informatics education in the national curriculum for the first stage of primary school (grades 1 - 4) and the increase in the number of hours for the subject Informatics in the second stage of primary schools and secondary schools. This change, however, requires a sufficient number of qualified teachers of informatics in primary and secondary schools, which was not the case.

Therefore, the Ministry of Education, in the framework of the operational program Education, launched a national in-service teacher training project for informatics teachers and Informatics education teachers in primary and secondary schools.

The strategic objective of the project – to design, develop and implement innovative teacher training supported by digital technologies – is being achieved through the following two specific objectives:
➢ To develop and implement accredited training modules for three target groups: Informatics Education teachers (teachers in first level of primary school), non qualified and qualified teachers of Informatics in primary and secondary schools.

➢ To equip learners with digital technologies needed for their effective education, which they will use in their teaching process later on.

The selection of teachers - 1500 as part of the project- was based on a questionnaire and motivation letter with regional and school stratification. The questionnaire asked about their work in schools in relation to digital technology – in which subjects they use technology and for what purposes, in which projects they are involved with their students, for which informatics/programming/computer science competitions they prepare their students, what training in digital technology did they attend, whether they lectured some training for other teachers and the like. In the motivational letter candidates had to write about their professional growth. The application was evaluated by a Commission in the Training Center, which selected the most successful candidates.

OVERVIEW OF THE TRAINING PROGRAMME

The first goal is implemented through educational activities focusing on each target group. The aim is to provide a total of 1,500 teachers of Informatics and Informatics education in primary and secondary schools of all types with high-quality education necessary for the implementation of Informatics as an important subject of the new curriculum.

The training is organized around 4 content modules, which are divided into sub modules: 1) The comprehensive development of participants’ own Digital Literacy, 2) the Modern School 3) special training in informatics and Informatics Education 4) Didactics of Informatics and Informatics education.

➢ Digital literacy: The aim is to develop comprehensive digital literacy, which includes e.g. to work with modern digital technologies and software tools (education portals, e learning, virtual labs, robotic kits, Internet based projects, search activities, modeling, conceptual maps, interactive boards, mobile learning etc.). Further, the development of teacher competencies for lifelong learning, knowledge of safety issues and risks for children in cyberspace, social and legal aspects of information society and so on.

➢ Modern school: In this area, participants should get acquainted with the modern theories of cognition and modern views of the school as a space for reflection, investigation, communication and cooperative learning, new - constructivist forms of learning, new forms of motivation and evaluation of students, alternative education systems, and the role of digital technologies to overcome various forms of inequality. As a part of this line, the role of digital technologies for the development of higher order thinking skills of the pupil (we look for meanings, we make critical judgments, we are creative, we express ourselves, we present ourselves, we think and solve problems, we make decisions, we learn to teach, we do research, etc.) is being discussed.
Informatics and Informatics Education: This area concerns specialized training in the subject adapted for the various target groups.

Didactics of Informatics and Informatics Education: Participants familiarize themselves with the objectives of the subject, curriculum, and its methods, with the didactics to work with standard software, graphics, text, numbers, graphs, multimedia, audio, photo and music, Internet, didactics of algorithms, programming and management of digital equipment (robots and other).

The second specific aim to equip learners with digital technologies is fulfilled by providing participants with a notebook, a projector and a USB key. Participants received them at the beginning of their education and they use them actively throughout their education to obtain and store materials, solve tasks and develop the final project, as well as to communicate with tutors and colleagues and implement their training results into their teaching. The project started in the autumn 2008 and are running for three years. In the first year there was prepared very specific curriculum, provided material and equipment for participants and also the training in one of the target groups started (there are three target groups in the project – see below). In the second and third year two periods of the education in the two other target groups proceeds. Trainees are divided into study groups of about 20 participants. Education under the project takes place in five training centers and covers the participants from all the Slovakia. Study groups are organized by residence, so that participants could not attend training over a long distance. The training take place on Fridays and/or on Saturdays, for 4-8 hours (according to the target group, see below). Participant's application form for this training is to be signed by his/her school director. This signature confirms that the teacher will be relieved of teaching in the training days. Since this is a pilot project, teachers' participation in it is voluntary.

Participants in all three target groups complete their education by defending their thesis in front of an examining board and passing the final examination in the form of scientific debate on any of the topics of the modules completed. As a final project, participants can describe new educational methods or tools, model lessons, educational research; prepare a new activity book or educational software.

The new training courses for all three target groups are accredited by the Accreditation Commission for further education. Participants successfully complete their education, if they successfully complete all required study modules and fulfil all required obligations, develop and defend their thesis and successfully pass the final exam. After successful completion of training, participants receive a certificate with nationwide validity issued according to the laws on continuing education.

Training to Become a Teacher of Informatics Education

The first target group are teachers of the first stage of primary school (grades 1.-4.). The subject Informatics Education is taught according to the new curriculum from the second class in primary school for one hour per week. The pre-service teacher training curriculum did not cover Informatics Education until now. This course is the first step towards filling this gap by training 700 teachers.
Teacher training lasts one year and consists of 130 hours. The training begins with a four-day training camp (32 hours), followed by 10 meetings every 1-3 weeks (six hours per meeting), a final training camp of 2.5-day (20 hours) and the work on the thesis (18 hours). During the project, two training courses of this kind take place (one in the academic year 2009/2010 and the second in 2010/2011). The training course is organized around subjects consisting of one or several modules. The basic training unit of the course is a 6-hours module.

The curriculum in this activity corresponds to the above-mentioned four content modules: Digital literacy of the teacher – minimum 24 teaching hours (four modules); Modern School - minimum 18 hours (three modules); Specialised context of informatics education - minimum 36 hours (six modules) and Didactics of Informatics Education - minimum 30 hours (five modules).

List of all subjects taught:

- Digital literacy of the teacher (24 teaching hours, 4 modules)
- Information around us (3 modules)
- Problem solution and basic programming (2 modules)
- Computers and cooperating devices (1 module)
- Modern school in the digital world (1 module)
- Modern teaching (2 modules)
- Didactics of Informatics Education (5 modules)

TRAINING FOR NOT QUALIFIED INFORMATICS TEACHERS

The second target group includes 200 teachers from second stage of primary (grades 5.-9.) and from secondary schools of all types who have no formal qualifications required for the Informatics subject, but who teach it, or who will teach it. This training is conducted solely in the 5 faculties (out of 8) of Slovak universities, which are currently carrying out pre-service teacher training for Informatics teachers of secondary schools by accredited programs of first and second degree who wanted to be a part of a consortium in this national project.

The training lasts five semesters (2.5 years) and consists of 480 teaching hours. In each of the first four semesters there are 12 meetings per 8 hours, in the last one there are 9 meetings and 24 hours for the work on the thesis.

The basic training unit is an 8-hour module. It is organized by subjects consisting of one, two or more modules. The curriculum covers all four lines as follows: Digital literacy of the teacher - minimum 48 teaching hours (six modules); Modern School - minimum 48 teaching hours (six modules); Specialized context of Informatics - 240 hours (thirty modules) and Didactics of Informatics Education - 120 hours (fifteen modules). After the training the university allows
participants to pass the national examination and obtain a qualification for teaching Informatics.

List of all subjects taught in this group of teachers:

<table>
<thead>
<tr>
<th>Introduction, Informatics in general education (1 module)</th>
<th>Robotics in education (1 module)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic digital literacy (1 module)</td>
<td>Didactics of robotics (1 module)</td>
</tr>
<tr>
<td>Digital literacy of the teacher (2 modules)</td>
<td>Principles of educational software (2 modules)</td>
</tr>
<tr>
<td>Mathematics for Informatics (3 modules)</td>
<td>Social and historical aspects of informatics (1 module)</td>
</tr>
<tr>
<td>Programming (9 modules)</td>
<td>Small programming languages (1 module)</td>
</tr>
<tr>
<td>Digital world (1 module)</td>
<td>Didactics of programming (1 module)</td>
</tr>
<tr>
<td>Education in the digital world (3 modules)</td>
<td>Selected chapters of informatics (3 modules)</td>
</tr>
<tr>
<td>Digital technologies for teacher (2 modules)</td>
<td>Basics of pedagogical research (1 module)</td>
</tr>
<tr>
<td>Didactics of Informatics (5 modules)</td>
<td>Databases (1 module)</td>
</tr>
<tr>
<td>Operating systems (3 modules)</td>
<td>Didactics of programming for primary school (2 modules)</td>
</tr>
<tr>
<td>Internet (3 modules)</td>
<td>Didactics of programming for secondary school (2 modules)</td>
</tr>
<tr>
<td>Algorithms and data structures (2 modules)</td>
<td>Didactics of informatics on primary school (1 module)</td>
</tr>
<tr>
<td>Computer systems (5 modules)</td>
<td>Preparation of final exam in secondary school (1 module)</td>
</tr>
</tbody>
</table>

FURTHER TRAINING FOR QUALIFIED INFORMATICS TEACHERS

600 qualified Informatics teachers form the third target group of the project. These teachers regularly upgrade their knowledge in their subject, they tend to follow current developments in science and technology and are able to use and adapt new technologies in the teaching process. There is not much offered to teacher by in service establishments so they have to
upgrade their knowledge and skills on their own. Therefore, this activity appears to us as an important systemic step. Training lasts one year and consists of 160 hours structured as follows:

- two semesters of direct and distance learning (e-learning) - with 80 hours,
  - each semester, 10 weeks, four hours of teaching per week,
- each semester four-day training camp - with 64 hours,
- work on thesis - 16 hours;

The basic unit of education is an 8-hour module. Training topics are organized into subjects consisting of one, two or more modules. The modules are designed in such a way as to cover the training of single lines: Digital literacy of the teacher – minimum 16 teaching hours (two modules); Modern School – minimum 24 teaching hours (three modules); Specialized context of Informatics Education – minimum 64 teaching hours (eight modules) and Didactics of Informatics – minimum 40 teaching hours (five modules).

The curriculum is divided into compulsory and optional modules implemented by presence, distant (e-learning) and blended learning.

List of all subjects taught in this group of teachers:

<table>
<thead>
<tr>
<th>Didactics of Informatics (3 modules)</th>
<th>Modern school (2 modules)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital literacy of the teacher (2 modules)</td>
<td>Computer systems (1 module)</td>
</tr>
<tr>
<td>Programming (1 module Imagine, 2 modules Object Pascal)</td>
<td>Modern technologies in education (1 module)</td>
</tr>
<tr>
<td>Programming (1 alternative module - Imagine / Object Pascal)</td>
<td>Didactics of programming (2 modules)</td>
</tr>
<tr>
<td>Programming (1 alternative module - JAVA, PHP, Python)</td>
<td>Selected chapters of informatics (1 alternative module)</td>
</tr>
<tr>
<td></td>
<td>Web technologies and web publishing / Multimedia (1 alternative module)</td>
</tr>
</tbody>
</table>
CONCLUSIONS

The project will train 1,500 teachers of Informatics and Informatics Education at both levels of elementary and secondary schools. These graduates will be trained in Informatics as a subject; didactics of Informatics as well as in new innovative pedagogies. During the training, participants also significantly develop their digital literacy. Graduates will then convey their new knowledge and skills not only to students but indirectly also to their colleagues and school management.

The outputs of the project are also accredited courses (their design, structure, scope, form and content) for three types of teacher education, a set of methodology and study materials proven and reviewed by an expert group.

Currently the project is at the beginning of the third year. Training was completed for one group of Informatics education teachers of first level of primary schools – grades 1. - 4. (first target group - 350 participants) and one group of Informatics teachers on the second level of primary and secondary schools (third target group - 300 participants).

During the first year of training the project experts’ board met on several occasions to evaluate the training and coordinate the procedure in various centres. At the beginning, during and also at the end of the study participants filled out questionnaires in which they expressed their expectations and their assessment of the training in terms of content, form and lecturers’ performance.

Based on the answers to the questionnaires, but also on personal interviews with participants, it can be concluded that participants welcomed this type of training and highly appreciated it. Although the groups were very diverse regarding the level of participants, each participant confirmed that he/she has acquired many new skills and knowledge necessary for teaching Informatics.

We consider the involvement of a considerable number of teachers of Informatics and Informatics Education in Slovakia into this training as one of the main challenges. Moreover, we need to prepare the next steps for this kind of training in the framework of continuous education of teachers.
INTRODUCTION

The modern education system should prepare students for life and professional practice, which they will enter in 5-15 years. However, at present we cannot precisely predict the kind of skills students will need in their professional life and for personal development. General competencies such as the flexibility to adapt to different situation and demands, creativity, problem solving and higher order thinking skills are certainly some of the required competences. Digital Competence likewise is a key competence required to be able to deal with the rapid developments of Information and Communication Technology (ICT). Furthermore, it can play an important role in developing the more general competencies as mentioned above.

Today’s teachers act in an environment, where information is becoming increasingly accessible anywhere and anytime, and therefore have an even more important role to guide students in the learning process, to enable them to acquire knowledge and skills in an attractive learning environment. To successfully do so, research shows that the better digitally skilled teachers are themselves the better they can support students’ digital competence. (BECTA, 2003)

The curriculum at universities preparing future teachers should therefore also include courses developing digital literacy. However, digital competence development is only marginally tackled at universities in Slovakia as two studies carried out in 2005 and 2006 showed. One study surveyed the in service teachers’ lifelong learning with the focus on access to ICT resources, ICT skills, and the way they have acquired ICT skills. The second study analysed the ICT course offers of 20 faculties.

The following case study describes in detail the ICT courses developed by the Faculty of Mathematics, Physics and Informatics of the Comenius University in Bratislava to train future teachers in the use of ICT.

NATIONAL BACKGROUND AND PRELIMINARY INVESTIGATIONS

Curricula for initial teacher training in Slovakia are not uniform. Universities (around 20 faculties) prepare future teachers, usually for teaching two subjects for lower secondary and upper secondary education. Each university has its own independent study program approved by the Accreditation Commission, which is a government advisory board. Since not all universities publish details of their study programs (on the web, e.g.), it is not easy to determine whether and
how much attention is paid to digital technologies, digital skills and competencies as offered within initial teacher training at these universities.

To investigate how skilled Slovak teachers from primary and secondary schools are in the use of digital technology two studies were conducted in the years 2005 [Kub05] and 2006 ([Hru05], [HruKub07]). The first study [Kub05] looked at teachers’ lifelong learning practices and in particular whether teachers update their knowledge regularly and how much time they devote to learning weekly, the forms of learning they preferred and their most frequently used information sources. If they referred to information sources related to ICT, it was investigated where teachers gained the basic skills necessary to work with these technologies. One conclusion from the research was that teachers do not update their general knowledge and skills on a regular basis. Furthermore, it was surprising that 43% of teachers younger than 30 years old acquired basic ICT skills through self-learning (see the Fig. 1). We expected higher response rates for categories such as “during the university studies” or “during the high school studies”. These results point to the shortage of ICT related courses in the study programs of universities preparing future teachers. The role of in-service teacher training courses acquiring basic information and digital skills was also marginal.

Apart from teachers’ lifelong learning practices another research was conducted [Hru05] on how universities prepare the future teachers as regards the development of digital literacy. 20 faculties were analysed among which 14 offered ICT courses as compulsory courses or optional courses. The number of hours dedicated to ICT courses was small, only a few faculties had reserved more than 2 hours per week in one term. This means approximately 26 hours to be done as part of the overall study, see Fig 2. In the majority of cases, there is only one subject (lasting 1 or to 2 hours) offered during the whole study programme.

Moreover, ICT courses are introduced at a late stage rather at the end of the study term, as it is common practice in six out of the 14 faculties, which offered ICT courses, see Fig. 3. This is considered as problematic, as students should rather acquire these skills in the beginning of their study in order to apply the skills throughout their studies.

![Fig. 1. Where teachers younger than 30 gained the basic digital skills](image-url)
The general conclusion of both studies was that more attention should be paid to education in the area of digital technology during initial training of teachers. As a result of these studies it was suggested to introducing the compulsory course on digital skills and digital literacy in all faculties of the Comenius University of Bratislava.

### DEVELOPING STUDENTS’ DIGITAL LITERACY AND PROFESSIONAL PRACTICE

It was important in the proposal of these courses to focus not only on the use of new technologies, but also on how to use them to improve and facilitate the learning process and how to develop students’ digital literacy.

The courses can be divided into two main groups: courses to develop general digital literacy (to understand technology concepts and procedures, to use digital technology effectively in every day life, as well as to improve own professional practice, and to use digital technology ethically and legally), and those, which develop subject specific digital literacy (to use modern digital technology appropriate in teaching, to be aware of suitable educational resources, to be able to find and critically evaluate them, to use technology to facilitate the evaluation and documentation of the educational progress of pupils.). Pedagogical topics helping prospective teachers to guide students in their digital competence development were likewise proposed as part of the course.

The Faculty of Mathematics, Physics and Informatics, Comenius University, was the only faculty in Slovakia, which already ran a six-semester course on ICT for all students preparing for teaching profession since the 2000/2001 academic year. The course was taught from the first semester. Its content was slightly different depending on whether it was intended for Informatics teacher students or other subject teacher students. The structure of each semester looks as follows:

**Fig. 2** Number of hours given of ICT courses at different faculties  
**Fig. 3** Number of faculties and in which term ICT courses were set up for the first time
Fig. 4 Former structure of the ICT course for teacher students

As the course has gone along, the need to introduce the subject, the use of digital technologies in education (ICT 4) into initial teacher training of all students emerged. This led to the unification of the course for all teacher students of the faculty (see Fig.5). The adapted course was applied to the academic year 2006/2007 and has been repeatedly improved. Its structure is shown in Fig.5.

Fig. 5 New structure of the ICT course for teacher students.

COURSE DESCRIPTION

The length of the course remained the same. The first two parts (ICT 1 and ICT 2) were revised for students to be able to receive the European Computer Driver’s License (ECDL) Start certification after their graduation.

All six parts of the course are taught in computer labs, where each student has a computer available. The courses are designed as seminars, using different forms of teaching such as instructions, discussions, workshops, including constructivist approaches, as well as e-learning, using a variety of digital tools and the internet in teaching and online learning, where the main communication tool is the Internet.
The content of the ICT course for each semester:

**ICT 1**

Aims and objectives:

- Building on the students' ICT experience gained in schools to develop their ability to use ICT in their own higher education
- Studying the concepts and processes related to ICT
- Showing the possibility of using ICT in the teaching process in primary and secondary schools
- Preparing students for the ECDL-start tests (with at least 50% success rate).

Brief syllabus:

- Local area network and an overview of basic software,
- Windows environment and file management,
- Internet services: communication on the Internet, web,
- Netiquette, legal aspects, licensing, viruses,
- Creating of web pages,
- Text editor,
- Spreadsheets,
- Presentation software,
- Raster graphics, graphic formats.

**ICT 2**

Aims and objectives:

- To give students an overview of the latest ICT software and hardware
- To learn how to install and manage computer networks, know the safety principles of the network
- To deepen their skills in using a word processor, spreadsheet, presentation software and graphics editor
- To prepare for the ECDL Start test as a test to measure basic digital literacy.
Brief syllabus:

- Text editor - advanced techniques,
- Spreadsheets - advanced techniques,
- Presentation software - presentation principles, advanced techniques,
- Vector graphics editor,
- Operating system from the user point of view,
- Computer Networking,
- PC Hardware.

ICT 3

Aims and objectives:

- to become acquainted with a wide range of programming languages for teaching the foundations of algorithms
- to develop logical thinking and problem solving
- to develop creativity and cognitive skills.

Brief syllabus:

- What do the programming languages mean for teaching, a comparison of some programming languages for teaching (Comenius Logo, Karel, Baltic, MicroWorlds, ToonTalk, Imagine Logo, Scratch, GameMaker ...)
- Detailed introduction to Imagine Logo
- Study and development of guidance materials to work with programming languages for teaching

ICT 4

Aims and objectives:

- Familiarize students with the possibilities offered by new information technologies for the learning process;
- Give an overview of modern educational application (for the subject they will teach in the practice, as well as for other subjects)
- Give an overview of educational portals for teachers and students
Familiarize students with Internet projects organized at the school, national and international level

Teach students to use digital technologies in the learning process.

Brief syllabus:

- ICT and digital literacy,
- ICT for the disabled,
- ECDL - Computer literacy,
- Conceptual map,
- Educational portals (for students and teachers),
- Educational CDs and their inclusion in the learning process,
- Virtual laboratories, remote and remote controlled off-road trips, new mobile communication technologies and their use in remote excursions in remote consultations with experts in remote experiments,
- E-learning - a new form of education,
- Robotic kits,
- Educational projects (school, national, international),
- Interactive whiteboards.

ICT 5 OR 6 (FOR INFORMATICS TEACHERS)

Aims and objectives:

Explore the impact of the ICT introduction into our lives.

Brief syllabus:

- Rapid development of information and communication technologies, their entry into our daily lives,
- Changes in relation to ICT,
- What positive, respectively, what risks bring ICT in different areas: education, health, art, commerce and finance, industry and others,
- Copyright infringement, computer crime.
ICT 5 OR 6 (FOR MATHEMATICS TEACHERS)

Aims and objectives:
Basics of ICT usage in teaching mathematics in primary and secondary schools.

Brief syllabus:
- The importance of ICT in teaching mathematics, the Internet as a source of pedagogical and mathematical resources,
- Mathematical Java Applets and their didactical usage,
- Didactical usage of software for drawing plots of functions,
- Didactical usage of graphic calculators,
- The software of Cabri Geometry as a tool of Dynamic Geometry,
- MS Excel for solving school tasks,
- The Derive software and its usage application in school mathematics,
- Other didactical software in school mathematics.

ICT 6 (FOR GEOMETRY TEACHERS)

Aims and objectives:
To prepare future mathematics teachers to use information technology in teaching descriptive geometry.

Brief syllabus:
- Mathematical Java applets and their didactical use - the continuation of ICT 5,
- Use "plotters" - software to draw graphs of functions as an effective tool for the function investigation,
- The use of Derive in teaching mathematics,
- Cabri geometry as a tool of dynamic geometry,
- Cabri Geometry in plane geometry, Cabri Geometry and Solid geometry teaching,
- Cabri geometry and functions,
- MS Excel in solving assignments of statistics and probability,
- Topics for independent work of students.
The aim of the ICT course proposal was to create a subject in which teacher students receive comprehensive training on digital literacy to become familiar with modern digital technologies and to be able to creatively use them for the preparation of lessons, in their own teaching process and for lifelong learning. It is designed to help prospective teachers to develop digital literacy in their students, to monitor and assess its level and to design further developments in this area.

From the course progress and from students' responses as part of a doctoral thesis (HRU08) it can be concluded that the course was of great benefit to students. Many students after the first two semesters successfully completed the ECDL tests and obtained the ECDL START certificate, thus having developed their personal ICT skills development.

Students experienced a variety of modern forms of education (discussions, workshops, e-learning, collaborative problem solving, etc.), which were of benefit to them personally and also as regards their subject. They developed skills useful for their studies as well as in their future practice. They improved transferable key competencies and interpersonal skills such as communication, cooperation, critical thinking and problem-solving skills. Moreover, they developed 3 major components of digital literacy the general component, the use of ICT for personal purposes; the subject component comprising all the necessary aspects of how ICT can be applied within specific subjects; and how to develop digital competencies for students.

The integration of the course curricula for all teacher students into one common course curriculum brought benefits to the course in terms of progress. Students from various disciplines exchanged knowledge and also learnt to accept views and opinions of peers. They recognised the importance of digital technology in teaching and for their personal career development.
REFERENCES


SWITZERLAND: ANALYSING RESEARCH ON THE ROLE OF ICT IN TEACHER TRAINING

Author: Christian A. Gertsch, Swiss Agency for ICT in Education

CHARACTERISTICS OF THE SWISS EDUCATION SYSTEM

In accordance with Switzerland’s federal structure, the tasks in the education system from primary to tertiary level are addressed at three interdependent political levels, i.e. of the confederation, the cantons, and the communes, all of which work together in their respective areas of responsibility. As a rule the higher political level (e.g. the confederation) only passes laws and regulations or undertakes tasks if the lower level (the canton) is not in a position to do so. Moreover, the confederation passes laws only in (the few) cases where the Federal Constitution gives the confederation legislative authority in educational matters. But even in these cases the implementation of the law lies with the cantons, which as a rule take the main responsibility for education. Each canton thus has its own legal regulations for education. ICT in particular is one of those realms which have profited from the long established cooperation between the federal and cantonal levels. **There is no ministry of education at national level in Switzerland.**

In addition, the whole of the education system is characterised by a high degree of local anchoring in the three culturally and linguistically diverse regions of the country. The only exception to this rule is vocational education which is centrally governed at federal level by the Federal Office for Professional Education and Technology (OPET).  

On the whole the responsibility for legal implementation, execution, supervision and financing thus varies greatly within the country depending on the canton, the linguistic region, and the educational level and type of educational institution. Nevertheless coordination and cooperation among the cantons have been established over a long period of time. Some few parameters in education are regulated on an inter-cantonal (which is not the same as national) basis. They are based both on «hard law», which is binding for those which abide by it as well as «soft law» which functions as mere recommendation for the cantons to abide by. In the realm of «soft law» the Swiss Conference of Cantonal Directors of Education (EDK/CDIP) has issued several recommendations concerning ICT, the most recent concerning the overall strategy of the EDK/CDIP with regard to ICT dating from March 1, 2007.  

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In 2004, the Swiss Conference of Cantonal Directors of Education (EDK/CDIP) agreed on recommendations for the initial and continuing training of teachers in the area of ICT.

The appendix to the recommendations lists training objectives which are divided into five categories:

1. Use of standard software and technologies;
2. Use of current modes of communication and information search tools;
3. Knowledge and experience of online teaching and digital teaching methods;
4. Sociological, ethical and economic expertise;
5. Legal aspects of ICT.

It is important to note that these recommendations have no binding status. However, 15 (out of 26) cantons stated in 2006 that the recommendations had influenced their canton’s rationale for integrating ICT. 14

The EDK/CDIP also regulated the recognition of diplomas awarded for the successful completion of in-service ICT training courses for teachers. 15 But no nationwide assessment schemes exist.

ICT IN TEACHER TRAINING

Development of teachers’ competence in ICT use is mainly organised in optional, in-service training courses although some courses have been made compulsory. Demand for courses from 2000 to 2004 was mainly centred on technical competences. However, training is increasingly shifting towards methodological and didactical skills and the practical integration of ICT in teaching and learning. In addition, efforts are currently being made to include pedagogical use of ICT in initial teacher training.

When asked to identify future challenges the Cantonal representatives pointed out the need to achieve better integration of ICT use in teaching. 16

Stratégie de la CDIP du 1er mars 2007 en matière de technologies de l’information et de la communication (TIC) et de médias [http://edudoc.ch/record/30021/files/4_8_ICT_f.pdf]

14 EDK/CDIP recommendations on teacher training in the use of ICT (2004) (in French and German)
http://edudoc.ch/record/24706 (French)
http://edudoc.ch/record/24707 (German)

15 Durch die EDK anerkannte Zusatzausbildungen in ICT (in German / French)
http://www.cdip.ch/dyn/13840.php

16 Lehrberuf - Analyse der Veränderungen und Folgerungen für die Zukunft, EDK 2008
In the year 2009 the Hasler Foundation commissioned a study on the role of ICT in Teacher Training in Switzerland. The foundation is committed primarily to promoting research and training in the field of telecommunications, distributed information systems and related topics. Through its work, the Hasler Foundation actively helps to ensure that Switzerland continues to enjoy high-level know-how in this fundamental area of infrastructure. The Foundation’s existing endowments derive from the former Hasler AG (1852-1986), a pioneer in the Swiss telecommunications industry. The Foundation is a non-profit institution which uses the net income from its assets to serve the progress of telecommunications and the future of Switzerland. The purpose of the foundation is to finance or co-finance carefully selected education and research projects in the area of information and communications technology, and by so doing to contribute positively to the development of Switzerland as an intellectual and economic area.

**MOTIVATION FOR THE STUDY**

The study was undertaken as a sequel to a previous empirical survey, which was also commissioned by the Hasler Foundation in 2008 to gauge the reputation of informatics as a scholarly subject with the population at large and the relative importance of ICT and informatics as subjects in schools at secondary II level. As a result of that inquiry it was found that most teachers confounded ICT and informatics, and moreover that ICT skills were not well understood in their various functions (e.g. as a competence in their own right, as a means or tool for teaching, and as a prerequisite for the study of informatics as a scholarly subject). It was also found that the average teacher’s ICT skills were not really up to the mark. This was found to be the result of a vicious circle: young teachers’ lack of a sound knowledge in ICT related content is
seen a consequence of the poor education and training, which they experienced as pupils and students in ICT related fields, which in turn lead to them becoming poor teachers of ICT themselves. It was concluded that only by laying a sound and solid basis of ICT related knowledge at primary and secondary levels can this vicious circle be interrupted. And a prerequisite for that aim are, of course, teachers who are highly competent in ICT.

It was therefore the declared aim of the **present study on the role of ICT in Teacher Training in Switzerland** to find out how future teachers for primary and secondary level I schools are being prepared for the task of teaching and/or integrating ICT in their later professional career as teachers.

More particularly the study was to provide answers to the following questions:

- What kind of ICT knowledge is regarded as a prerequisite upon entering a teacher training institution?
- Is there an entry examination to test this required ICT knowledge?
- What aspects of ICT are being taught to future teachers: ICT user skills or / and pedagogic / didactic knowledge?
- Are ICT knowledge and/or skills taught as a separate subject or as part and parcel of other subjects?
- What is the overall proportion (in terms of hours or ECTS points) of ICT tuition as against the total of hours of the entire teacher training curriculum?

In order to find answers to these questions the study used three different methods:

1. A pre-study in the form of a desk research of the laws and regulations governing the role and function of ICT in teacher training;

Part 1 of the study looks at the official laws and regulations governing ICT in teacher training and discusses the conceptual framework and terminology which can be derived from official documents.

The result of that discussion together with the analysis of the content of the study plans of teacher training institutions leads to a taxonomy which will be applied in the case studies of part 2.

2. A pre-study in the form of a desk research of the role and relevance of ICT in the framework of the curricula of teacher training institutions;

Part 2 of the study inventories the study plans of all 13 teacher training institutions in Switzerland with a particular view to:

- Stated objectives in the field of ICT and media education
- Official curricula (comprising both compulsory and optional courses) in the field of ICT and media education

3. The main study is made up by individual case studies of four teacher training colleges.
Part 3 of the study provides in-depth case studies of the four (out of 13) most important teacher training institutions involving in-depth document analysis and interviews with decision makers and teaching staff on the role and relevance of ICT in the training practice for future teachers up to secondary I level.

1) DESK RESEARCH OF THE LAWS AND REGULATIONS GOVERNING THE ROLE AND FUNCTION OF ICT IN TEACHER TRAINING.

In the realm of non-binding « soft law » the Swiss Conference of Cantonal Directors of Education (German: EDK, French: CDIP) has issued several recommendations concerning ICT, the most recent concerning the overall strategy of the EDK/CDIP with regard to ICT dating from March 1, 2007. Official documents of the Swiss Conference of Cantonal Directors of Education include those mentioned above in the chapter on “The Context for the Study”. All documents are available in French and German.19

Main results of the desk research are as follows20:

**Official EDK/CDIP policy with regard to ICT and schools**

ICT is to be integrated into the various school subjects. ICT teaching should be guided by the motto “Using ICT to learn” over and above „Learning to use ICT“. It is explicitly stated that teacher training in ICT knowledge and skills must not be persued as a subject matter in its own right but rather it is to be considered as part and parcel of teacher training for individual subjects.

There are no specific targets for ICT training with regard to specific school levels or types. The following general targets are valid for any level or type of school:

- **didactic and pedagogic competence in using ICTs**
- **competence in using standard software and technology**
- **competence in using state of the art tools for communication and information**
- **knowledge and experience in handling digital content**
- **knowledge about social, ethical, economic and legal aspects of using ICT in schools.**


Stratégie de la CDIP du 1er mars 2007 en matière de technologies de l'information et de la communication (TIC) et de médias [http://edudoc.ch/record/30021/files/4_8_ICT_f.pdf]

20 In what follows text in italics renders results of the study.
2) Desk research into the role and relevance of ICT in the framework of the curricula of teacher training institutions.

A detailed analysis of the study plans of the teacher training institutions under scrutiny is available. All documents are being downloaded from the institutions' websites or they are provided by the institutions themselves. In this stage of the pre-study terminological issues arising from the different concepts in the various study plans are also tackled and clarified. This clarification of the terminology leads to a basic taxonomy which was later applied in the case studies.

Results: Adopted basic taxonomy (derived from the contents of the study plans):

Media education is the umbrella term used to encompass technology of media (knowledge of media), didactics of media (skills in using media) and pedagogy of media (attitudes towards media), whereby media encompasses ICTs.

3) Individual case studies of four teacher training colleges

The case studies involve in-depth document analysis and interviews with decision makers and teaching staff on the role and relevance of ICT in the training practice for future teachers up to secondary I level.

Out of the 13 teacher training institutions in Switzerland only the four most important (i.e. Berne, Zurich, Nordwestschweiz [Basel], and Luzern) were selected for the case studies. Together these four institutions are responsible for 64% of the national output of new teachers each year. All four institutions offer teacher training schemes for at least four teaching levels, i.e. preschool, primary, secondary, and further education level. In addition the institutions have their own media center to support any ICT activities offered in the training schemes.

The interviews which were conducted in the course of the case studies in the four selected institutions served to verify and supplement the findings from the document analyses which were effected in stage 2 of the inquiry as well as to provide additional background information concerning the strategic positioning of the general media education framework adopted by the institution in question.

Learning targets, topics and activities retrieved both from the study plans and the interviews were then mapped onto the pre-defined basic taxonomy, which yielded the following result:

<table>
<thead>
<tr>
<th>1. Technology of media</th>
<th>Encompassing</th>
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</thead>
<tbody>
<tr>
<td>1.1. ICT user skills</td>
<td>competence in using standard software and technology</td>
</tr>
<tr>
<td></td>
<td>competence in using state of the art tools for communication and information</td>
</tr>
</tbody>
</table>
In the case studies of the four teacher training colleges the following seven assertions were tested as to their validity. These assertions were derived from the results yielded by the 2008 inquiry\(^\text{21}\) mentioned above.

1. ICT is not offered as a subject in its own right, but always in an integrated manner.
2. ICT is taught in the wider context of media education.
3. ICT is taught as part and parcel of other subjects.
4. ICT is taught from a perspective which is critical of society in general and technology in particular.
5. ICT skills are given priority over and above any knowledge of the pedagogy of ICT.
6. ICT knowledge is taught as optional subjects.
7. The widest choice in ICT related content is offered in further education.

\[^{21}\text{http://www hasilstiftung ch/pdf/ imagestudie_2008 pdf}\]
1. ICT is not offered as a subject in its own right, but always in an integrated manner. With the introduction of the Bologna system „modules“ were introduced as the basic units for learning. Modules are the elements of the study plans, they are examined and credited with ECTS points after each semester. ICTs never appear as a subject but rather as part and parcel of modules in the fields of media education and ICT-didactics. Most modules containing ICTs can be subsumed under user skills, didactics and pedagogy.

2. ICT is taught in the wider context of media education. This assertion is basically valid. ICT is considered to be a basic cultural technique like reading and writing. All colleges consider ICTs – also often called „new media“ to be one among several media technologies.

3. ICT is taught as part and parcel of other subjects. This assertion has proved to be valid in the context of the didactics of individual subjects. Whenever ICTs are taught as part and parcel of didactics they become visible only after analysing the detailed content descriptions for individual modules.

4. ICT is taught from a perspective which is critical of society in general and technology in particular. There is a tendency towards comprehensive media education which encompasses both application and reflexion on ICTs from a critical point of view.

5. ICT skills are given priority over and above any knowledge of the pedagogy of ICT. This assertion is not valid. Quite the contrary is true. Competence in ICT skills is an entry requirement when taking up studies at any of the teacher training institutes under scrutiny. ICT skills are not part of regular study modules, but they can be practiced further in the framework of optional modules. On the whole the emphasis with regard to ICTs is on didactics, both general and subject-specific.

6. ICT knowledge is taught as part of optional modules only. In most cases a mixed offering of compulsory and optional modules is available. In-depth studies in ICTs are also on offer.

7. The widest choice in ICT related content is offered in further education. This assertion is clearly not tenable. There is a much wider range of ICT related content in initial teacher training than in further education. In-service-teachers can choose from a wide selection of courses which are offered by several institutions both from the private and public sectors, but courses are mostly limited to skills practice. None of these offerings were analysed in detail for the present study.

CONCLUSION
To summarize two of the main insights from the study it was found that

- ICT-related content is offered both explicitly in specialized courses on ICT related topics and implicitly as part and parcel of didactic modules dealing with traditional school subjects as well as in general didactics. In order to accurately gauge the importance of ICT related content in the latter two cases it is paramount to initially perform a careful analysis of terminological issues.

- Setting up a taxonomy in order to uniformly describe all findings from both document analyses and case studies has proved to be of prime importance for the interpretation of results. Only against the background of a uniform taxonomy was it possible to harvest insights from very heterogeneous documents and curricula. It was thus possible e.g. to *detect a general shift in focus away from ICT user skills to didactical aspects in the larger framework of media studies*.

Limitations of the study include:

- Part 3 of the study (in-depth case studies) was limited to four training colleges. Even if these four institutions make up 64% of the total output of teachers they nevertheless represent only the German speaking part of Switzerland. It would be desirable to extend the study to institutions from both the French and Italian speaking parts of the country, especially as they partake of an altogether different educational tradition, which sets great store by centralized and normative frameworks in contrast to the more liberal and individualized practices in the German speaking part of the country. This cultural difference may (or may not?) have its repercussions in the curricula and practice of teacher training.

- The scope of the study was restricted to teacher training for primary and secondary I school levels. Teacher training for secondary II level as well as teacher training for vocational schools — which is conducted in specialized institutions at federal level — would merit investigations in their own right.

*Even taking into account its limitations the Hasler Foundation study reveals a great variety in the role that ICT related content plays both in the curricula and the training practices of teacher training institutions. It reaches from concepts which strive to integrate ICTs fully into the curricula of the didactics of individual subjects to concepts where ICT related content is taught as separate subjects.*

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Publisher

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ISBN: 9789490477455 (print)

Published in October 2010. The views expressed in this publication are those of the authors and not necessarily those of European Schoolnet. This book is published under the terms and conditions of the Attribution-Noncommercial 3.0 Unported (http://creativecommons.org/licenses/by-nc/3.0/).