

Mapping Digital Competence: Towards a Conceptual Understanding

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Preface

With the 2006 European Recommendation on Key Competences,¹ Digital Competence (DC) has been acknowledged as one of the 8 key competences for Lifelong Learning by the European Union. Digital Competence can be broadly defined as the confident, critical and creative use of ICT to achieve goals related to work, employability, learning, leisure, inclusion and/or participation in society. DC is a transversal key competence which, as such, enables acquiring other key competences (e.g. language, mathematics, learning to learn, cultural awareness). It is related to many of the so-called 21st Century skills which should be acquired by all citizens, in order to ensure their active participation in society and the economy.

This report is part of a project on Digital Competence, launched by the IS Unit at JRC-IPTS² under an Administrative Agreement for DG Education and Culture. The project aims to contribute to better understanding and development of Digital Competence in Europe. It is being carried out between January 2011 and December 2012.³ The objectives of the project are:

- *To identify* the key components of Digital Competence (DC) in terms of the knowledge, skills and attitudes needed to be digitally competent;
- *To develop* DC descriptors that will feed a conceptual framework/guidelines that can be validated at European level, taking into account relevant frameworks currently available;
- *To propose* a roadmap for the possible use and revision of a DC framework and descriptors of DC for all levels of learners.

The project aims to achieve these objectives in collaboration and interaction with stakeholders on European level.

This report contributes to the first work package of the project, by reviewing and mapping different concepts and understandings relating to digital competence. It presents conceptual discussion based on literature, and first suggestions for an overall approach to understanding digital competence in the 21st century. These will contribute to the following phases of the project.

¹ Official Journal L 394 of 30.12.2006.

² The Institute for Prospective Technological Studies (IPTS) is one of the seven research institutes that make up the European Commission's Joint Research Centre (JRC).

³ For more information, see: <http://is.jrc.ec.europa.eu/pages/EAP/DIGCOMP.html>

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Executive summary

Technologies are increasingly being used in society and the economy, and this is transforming ways of working, studying, communicating, accessing information and spending leisure time, among others. Being able to benefit from digital tools and media can support all the spheres of life in society today. The Internet and especially social technologies are increasingly used by all groups of citizens. However, how citizens use these technologies and what benefits they gain as a result may vary a lot. Research shows that digital usage does not lead to improvement or development of advanced digital competence as such. Furthermore, not all groups of people have enough interest, confidence, social support or opportunity to begin developing their digital competence. People without sufficient digital competence are at risk of becoming excluded from important activities, not being able to take full advantage of the opportunities available, and they may even endanger themselves in their usage of digital tools and media. Digital competence divides have a tendency to coincide with and possibly increase other social and economic divides. Therefore, actions for encouraging digital competence development for all citizens, regardless of their age, profession or current ICT use, are needed.

Digital Competence is recognized as one of the eight key competences for lifelong learning by the European Union, summarized as “involving the confident and critical use of Information Society Technology (IST) for work, leisure and communication”. Its importance is highlighted in the flagships of the Europe 2020 strategy and especially in the Digital Agenda for Europe 2010. This report is part of a study on Digital Competence, launched by the IS Unit at JRC-IPTS under an Administrative Agreement with DG Education and Culture to contribute to this policy context. The report aims to develop a conceptual understanding of digital competence, clarify different related notions and recognize the main elements of digital competence needs in current and future society. The report is based on literature and interactions with experts and policy officers at European and international level. This report is therefore a building block which contributes to the wider overall objective of drawing up common guidelines for supporting digital competence development in Europe.

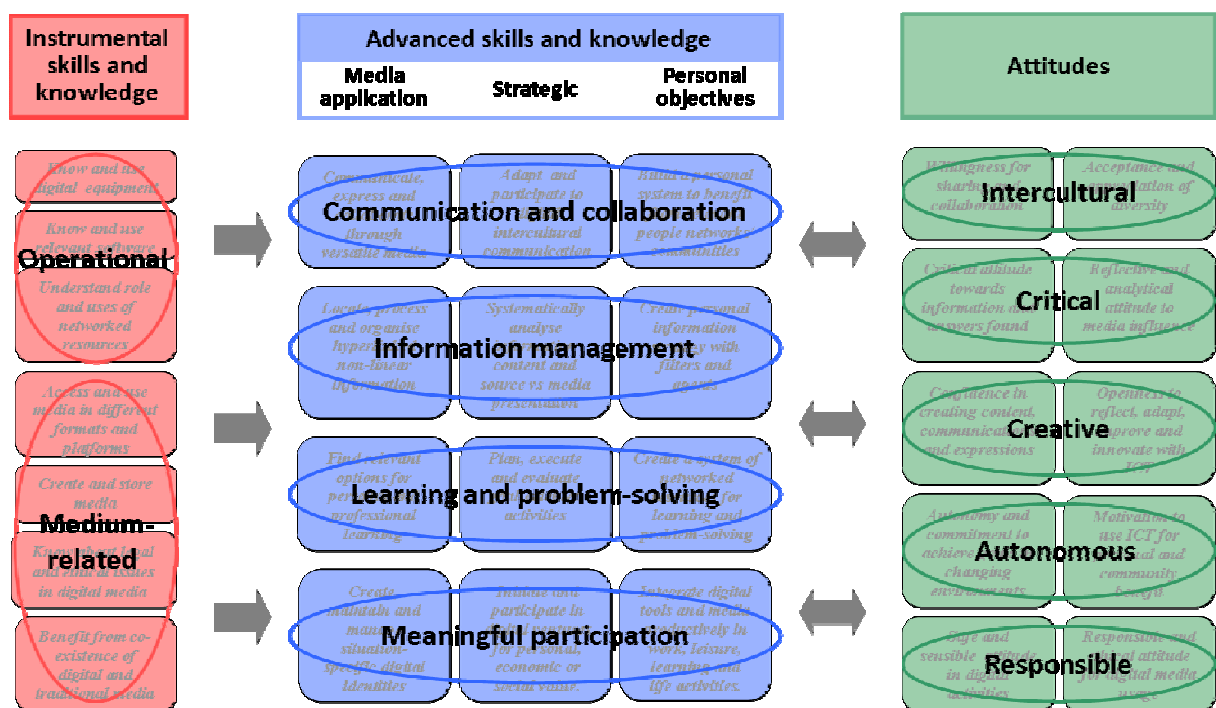
The literature highlights that digital competence is about essential life skills and assets in the information society. Developing digital competence should be considered as a continuum from instrumental skills towards productive and strategic personal competence. Mastering basic tools and computer applications is only a first step towards advanced knowledge, skills and attitudes. Furthermore, digital competence perspective should also include popular cultural practices in the scope of the competence to be cultivated. Digital competence needs to be developed all the time with the changing tools and practices people use in their work, study and leisure time. Therefore, guidelines for digital competence development should include two levels: 1) the conceptual level of recognizing the main areas of digital competence, and 2) operationalised learning and assessment tasks to be carried out with contemporary tools and practices. In this way, the conceptual level framework can remain stable while allowing regular revisions and adaptations to target group specific settings on an operationalised level. This report concentrates on the conceptual level.

The aspects of digital competence are so varied that no common concept or globally-agreed definition exists. The fact that there are many and various concepts relating to digital competence reflects its importance. Research and literature on different concepts highlight the different aspects of digital competence that people need in order to benefit from digital tools and media. This report reviews the main concepts used: ICT literacy, Internet literacy, media literacy, information literacy and digital literacy. These overlap in various ways, and the report elaborates a mapping of their relationships. All of them include aspects which should be considered in cultivating overall digital competence. This report suggests that it is not useful to focus on elaborating an all-compassing definition, but rather concentrate on the aspects and elements which are needed to learn the

necessary competence for current and future digital environments. This is the basis for the conceptual model developed in the report.

European policies have taken several approaches to digital competence. The policy approaches emphasize different perspectives and often have elaborated their own specific concepts and definitions to highlight the desired aspects. DG Information Society and Media (INFSO) emphasizes inclusion to the digital society, DG Enterprise and Industry (ENTR) promotes ICT skills as necessary for innovation and industry, DG Education and Culture (EAC) highlights digital competence as a key to lifelong learning, and DG Employment, Social Affairs and Inclusion (EMPL) recognizes digital competence among the necessary new skills for new jobs. All these perspectives complement each other. Furthermore, all of them highlight that the main issue today is no longer access to and use of technologies, but the capability to benefit from them in meaningful ways for life, work and learning. European measurements currently concentrate more on measuring access and use than skills (i.e. measure quality of use) or competence (i.e. measure attitudes and strategies for use). However, work on improving measurements to support competence objectives is underway.

The report proposes a conceptual model of digital competence considering following main areas: 1) Instrumental knowledge and skills for digital tool and media usage; 2) Advanced skills and knowledge for communication and collaboration, information management, learning and problem-solving, and meaningful participation; 3) Attitudes to strategic skills usage in intercultural, critical, creative, responsible and autonomous ways. Instrumental knowledge and skills are a precondition for developing or using more advanced skills.



Developing a conceptual model for digital competence is only a first step. Collaboration with stakeholders to refine the main components and to elaborate operationalised learning and assessment items is needed in order to develop guidelines that are usable and useful on a European scale for digital competence development. The study described in this report will contribute to and be further developed in the upcoming phases of the IPTS DIGCOMP project. The reader is encouraged to follow the progress and results of the project at the project website: <http://is.jrc.ec.europa.eu/pages/EAP/DIGCOMP.html>

1 Introduction

Technologies are increasingly being used in society and the economy, and this is transforming ways of working, studying, communicating, accessing information, or spending leisure time, among others. Internet and especially social technologies are used for various purposes by different groups of citizens, and are also being appropriated for new social activities. Through online spaces, citizens can access resources, follow, interact, and create and share with other people globally. People from all age groups are participating in different types of online networked activities, which can support work, learning and citizenship (Ala-Mutka, 2008). However, not all of them have received any support for developing digital competence.

The variety and scale of usage has changed the needs for technology- and media-related competences. Increasing usage of participative approaches on the Internet strengthens its importance as a media. At first, the main concern was to ensure access to computers and the internet, then the focus shifted towards application usage skills, and now the emphasis is on the confident, productive and critical usage in social and global internet environments. This shift from 'digital access divide' to 'digital usage divide' has been noted in digital divide research and policies, as reviewed e.g. by van Deursen (2010) or Livingstone et al. (2005). The digital participation gap is framed not just in terms of access to computers and the internet but also by the effective use of a range of media and communications platforms and services (Livingstone et al., 2005). Along with tool usage skills, people need to have the motivation and the competence to strategically and innovatively apply these tools in different work and life contexts, for their own benefit, and that of their community, the economy and the environment.

1.1 *Relevance of digital competence for citizens and society*

According to ComScore, 365 million Europeans used the internet in April 2011.⁴ Europeans spend the equivalent of one day a month online (24:20 hours), ranging from the Netherlands and United Kingdom with more than 30 hours to Italy (16:02 hours) and Austria (13:11 hours). Social networking, photo sharing and community activities are among the fastest growing activities. By the end of 2010, 84.4% of European 15+ internet users were using social networking sites. Young users (15-34) are increasingly participating in social networking activities (+32% growth in year 2010) while at the same time decreasing their use of other applications such as emails, instant messengers and portals. The older users (35+) are also increasing their social networking usage (+38% growth in 2010), while at the same time remaining active email users (+6% growth in 2010). (ComScore, 2011)

1.1.1 Benefits to be obtained

Digital competence could benefit citizens, communities and the economy and society in general in various areas. Van Deursen (2010) defined five areas in which citizens can gain personal benefits from internet usage: social, economic, political, health and cultural. All these areas contribute to specific and societal-level benefits. This categorization is also useful for a discussion on the needs and benefits of digital competence, and will be used in this section.

Social benefits. Internet provides new opportunities for people to connect with the people they know, with the communities they are interested in, or to create new connections based on their interests. Traditional location-based communities are losing significance for many individuals who

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http://www.comscore.com/Press_Events/Press_Releases/2011/6/comScore_Releases_European_Engagement_and_Top_Web_Properties_Rankings_for_April_2011

have created their personal mobile community through networks (Ala-Mutka, 2010). 63% of individuals in EU27 used the internet for communication in 2010 (Eurostat data). Research has shown that ICT can also contribute to the social and cultural integration of immigrants and ethnic minorities (Redecker, Hache, & Centeno, 2010). Technologies provide a means for communication for people who might not be able otherwise to interact socially (e.g. the elderly, workers in remote locations, or family members far away from each other). Cody et al. (1999) found that the elderly who learned to use the Internet had more positive attitudes toward ageing, and higher levels of perceived social support and connectivity.

Health benefits. As already mentioned, the internet increases social quality of life for those far away from their social circles, or those who belong to specific groups. The rise of various communities also provides new support systems for patients with rare diseases, parents with children with diseases, or people in rehabilitation after operations. There are resources created by individuals but also by professionals and sometimes with professional editorial control.⁵ Overall, plenty of health information and community resources are available online, and their usage is high. For example, Pew/Internet found that 61% of adults (83% of internet users) in the US look online for health information (Fox & Jones, 2009). According to Pew/Internet, internet is the third most common option to look for health information, after asking health professionals (86%), or friend or family member (68%). 52% of online health inquiries are on behalf of someone other than the person doing the online search. The ComScore survey found that women claimed to turn more often to the internet and web sites (60%) for health information than to friends, family and significant others (51%), although they still relied heavily on professionals (82%).⁶

Economic benefits. Digital competence has become a major issue for employability, because of the need for ICT professionals in all sectors and also because ICT is now used in all types of tasks. Employers perceive that in five years, 95% of all jobs will require ICT skills (Proofpoint, 2007). In 2010 in EU27, 52% of people employed used computers, and 94% of enterprises had internet access and 96% used computers (Eurostat data). Van Deursen (2010) reviewed research examples and found that workers with internet skills have better access to desirable jobs and workers using computers get better pay than those who do not. Digital competence also has other economic effects for the general consumers, as the better digitally equipped ones are able to search for lower prices and buy or sell products and services through various channels. The ability to benefit from ICT is important for any entrepreneur, as it provides easily set up platforms for innovative businesses even if they have a very narrow target group (Lindmark, 2008), making new products and services possible, and supporting crowdsourcing models for product development.

Civic benefits. Digital tools and media provide a vast range of resources, which enables people to access up-to-date information from various sources and therefore be better informed of ongoing events in their country and the world. These tools also empower people to express their concerns and ideas, or report issues more visibly. Furthermore, citizens with digital competence can use digital environments for setting up platforms for social innovations, such as launching collective actions for a local community or for helping victims of disasters (Ala-Mutka, 2008). Examples show how internet has been used to launch collaborative applications for increasing the transparency of organizations through the information released by the citizens⁷ (Osimo, 2008). Governments and public organizations are also developing online public services and experimenting with participative

⁵ See, for example, <http://www.ganfyd.org>, <http://wellness.wikispaces.com/>

⁶ ComScore press release January 22, 2008. available at http://www.comscore.com/Press_Events/Press_Releases/2008/01/Women_More_Likely_to_Use_Internet_For_Health_Information

⁷ See, for example, <http://theyworkforyou.com/>, <http://www.wikileaks.org/>

approaches where citizens can contribute to improving the services and governance for themselves and for others⁸ (Ala-Mutka, 2008; Osimo, 2008).

Cultural benefits. Internet and various social platforms also provide a new stage for people to share their personal expressions and interact with the audience if they so wish. For example, the reasons given by US bloggers for blogging were creative expression (77% of respondents), sharing personal experiences (76%), and sharing practical knowledge (64%) (Lenhart & Fox, 2006). People can also show their professional or artistic competence through online portfolios and showcases, thereby developing their professional identity and credibility. Digital tools and media also provide new dimension for lifelong learning opportunities. They provide a means of developing innovative learning and teaching with student-centred approaches and of connecting schools in organized education approaches (Redecker, Ala-Mutka, Bacigalupo, Ferrari, & Punie, 2009). Furthermore, the various communities and networks where knowledge is developed and exchanged provide people with informal and non-formal learning as part of their personal activities, even when they do not set out to learn (Ala-Mutka, 2008, 2010). Workers and professionals have a new and effective means of supporting tasks and developing knowledge with other professionals all over the world through internet-based communities of practice.

Societal benefits. ICT usage has penetrated all areas of work, business and services. Previous paragraphs demonstrate how digital competence and access to ICT can benefit people in different ways. The transform survey found that 66% of people considered that internet had helped them to enjoy leisure time, get good education (60%), find a good job (58%), engage in lifelong learning (55%), improve conditions for setting up their own business (53%) and enjoy quality of life (51%). These benefit the society and economy as a whole. Furthermore, ICT has a special role in encouraging innovation and developing new solutions to societal challenges such as sustainability. ICT professionals are needed in all sectors and according to recent estimations by eSkills monitor project, this need is increasing more than the availability of respectively skilled people in the upcoming years.⁹ Already, 55% of ICT workers are outside the ICT industry. Ensuring digital competence for ICT workers and the people benefiting from the services is crucial for the growth and recovery of the European economy.¹⁰

1.1.2 Risks to be considered

In 2010 in EU27, 69% of individuals had used internet in the last 3 months, and 26% had never used it. However, 93% of the 16-24 age group were among internet users, while 54% of the 55-74 age group had never used it. Another divide has an educational basis: only 47% of people with low education used internet in the last few months, while 92% of those with high education had done so. This highlights the need to ensure that everybody has the opportunity from early on in their education to see the value of digital tools and media and acquire the skills to use them. Another lesson from the statistics is the necessity to develop learning opportunities for those who have already finished with formal education, but who need digital competence to participate in society and for their work and personal lives. Furthermore, parents need an understanding of digital competence in order to protect, support and educate their young children in digital usage. For

⁸ See, for example, <http://www.patientopinion.org.uk/>, <http://petitions.pm.gov.uk/>

⁹ http://www.eskills-monitor.eu/documents/e-Skills%20Monitor2010_brochure.pdf

¹⁰ See the eSkills 2009 conference outcomes, <http://www.eskills-pro.eu/>

example, recent data shows that currently 77% of 13-16 year olds and 38% of 9-12 year olds in Europe use social networking sites, and not all of them are aware of the privacy settings.¹¹

Personal safety and privacy. Internet creates additional new risks to those of traditional media or offline discussions with friends. Publicly disclosing personal contributions often builds a permanent visible trail, which may even affect employability later. For example, the Careerbuilder survey in 2009¹² showed that 45% of US employers use social networking sites to research job candidates, and 35% of them had found content that caused them not to hire the candidate (e.g. inappropriate photographs or information, content about drinking or using drugs, badmouthing colleagues). As the usage of social networking sites increases, it is crucial that users understand that those sites (without the appropriate privacy settings and critical skills) can lead to loss of control of personal data, and to having it delivered to third parties for commercial purposes. Publishing personal data online can also expose users to identity theft, harassment or other unwanted results. A recent US consumer report (ConsumerReports.org, 2011) found that 15% of Facebook users had posted their current location or travel plans, and roughly one in five had not used Facebook's privacy controls. In addition to the risks people create for themselves in computer environments, they can be exposed to various technical risks such as malware and also to malicious people. In 2010, 31% of people in EU27) who had used the internet in the previous 12 months had experienced security problems (Eurostat data).

Responsible, ethical and legal usage. Through online contributions, people can cause harm not only to themselves but also to others. For example, 21.4% of US companies have detected exposure of sensitive information in blogs or similar tools by employees, and this has often led to disciplinary actions towards the employee (Proofpoint, 2007). People also often post sensitive information about their friends and colleagues, regardless of the 'harm' this may do them (Get Safe Online, 2007). The US consumer report (ConsumerReports.org, 2011) found that 21% of those with children at home had posted these children's names and photos, which may expose them to harassment. In schools, cyberbullying via social computing is a concern for both students and teachers and as many as 43% of students may have experienced online bullying (Palfrey, Sacco, boyd, DeBonis, & Tatlock, 2008). People are also often unaware of the IPR norms and rules. For example, Chou et al. (2007) found in their survey that only 66% of 244 students answered correctly about acceptable uses and, furthermore, only 37% could choose the correct reason for their answer.

Critical understanding of the digital media. Online content affects people's decisions and activities, and therefore it is crucial that they understand its nature as a resource, where the validity of information has not necessarily been verified. Van Deursen and Van Dijk (2009) reported that in the performance test of internet skills, with participants from different target groups and educational levels, nobody really evaluated the information found. On the internet, the responsibility for evaluating the trustworthiness and value of information is for the reader and receiver, and it is important that they understand this. Studies show that for example, 34% of European internet users have decided, based on a blog, not to buy a product (Deere, 2006; E. Hargittai, 2009). Even more worrying is that 7.9% of respondents in an eUser study decided not to follow a doctor's advice, and 19.5% not to go to a doctor, because of online information. Educational institutes have been banning Wikipedia usage, as students have not shown they have the skills to use it critically and responsibly (Ala-Mutka, 2008).

¹¹ See:
<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/11/479&format=HTML&aged=0&language=EN&guiLanguage=en>

¹² Careerbuilder press release, August 19, 2009, available at
http://www.careerbuilder.com/share/aboutus/pressreleasesdetail.aspx?id=pr519&sd=8%2f19%2f2009&ed=12%2f31%2f2009&siteid=cbpr&sc_cmp1=cb_pr519

Increasing inequalities. A major challenge is to ensure that all users learn to benefit from the various digital opportunities available, and at the same time are aware of and able to deal with possible risks that come with digital global media usage. Digital competence is critical for both people and organizations, for keeping up with developments and innovating new products and processes. Special attention is needed to avoid further divides between people who use digital tools and media, and those who do not. Those who have no access and skills to benefit from digital tools and media are also excluded from the new possibilities they provide. van Deursen (2010) suggests, based on his research, that the Internet strengthens traditional forms of social inequality. The economic, social, health, cultural, and civic benefits are more available for those who are already in a better position in this regard, and less available to those most in need, such as the low-skilled, unemployed, or the elderly without social support.

DiMaggio et al. (2004) make the following observation:

"... Internet competence is related to the satisfaction users derive from their experience, the extent to which they find it stressful or rewarding and therefore the extent to which they persist in Internet use and acquire additional skills.... Based on these observations we might expect inequality in competence to deepen inexorably, as skilful users find the Internet rewarding and acquire greater skill; and less able users grow frustrated and turn away." (DiMaggio et al., 2004, p. 378)

Although computer and internet use is increasing among all groups of people, this does not imply that they develop the strategic skills needed to benefit from it in different aspects of life. They may simply remain at the level of using some specific (gaming, communication) applications, as suggested by the findings of van Deursen (2010). Therefore, internet use as such should not be considered as proof of digital competence, and policies and educational approaches should aim to provide awareness and learning opportunities about digital competence for all.

1.2 Objectives of the study

The Recommendation of the European Parliament and the Council (2006) recognized eight key competences for lifelong learning: communication in the mother tongue; communication in foreign languages; mathematical competence and basic competences in science and technology; digital competence; learning to learn; social and civic competences; entrepreneurship; and cultural awareness and expression. Ensuring that all have these key competences is a priority for European and Member State policies, as recommended at European level in the Europe 2020 Strategy (European Commission, 2010b), and supported by the flagships "Digital Agenda", "New Skills and Jobs", "Youth on the move" and "Innovation Union".

Digital competence is defined in the recommendation as "involving the confident and critical use of Information Society Technology (IST) for work, leisure and communication". It is defined as being "underpinned by basic skills in ICT: the use of computers to retrieve, assess, store, produce, present and exchange information, and to communicate and participate in collaborative networks via the Internet". The Digital Agenda for Europe 2020 (European Commission, 2010a) confirms digital competence as one of the key competences which are fundamental for individuals in a knowledge-based society, emphasizing that it is essential to educate European citizens to use ICT and digital media and particularly to attract young people to ICT. Key actions consist of proposing digital literacy and competences as a priority for the European Social Fund and also developing tools to identify and recognize the competences of ICT users, linked to European Qualifications Framework (EQF) and other tools (see below). Most importantly, the Digital Agenda foresees, by 2013, the development of EU-wide indicators of digital competences and media literacy.

The Education Council conclusions on the joint progress report on the implementation of the "Education and Training 2010 work programme" (Council of the European Union, 2010) emphasize that further work on developing and implementing the key competences framework within the school sector and also in VET and adult learning is absolutely essential. A common 'language' is needed to bridge the worlds of education/training and work to make it easier for citizens and employers to see how key competences and learning outcomes are relevant to work and occupations.

This report is part of a study on Digital Competence, launched by the IS Unit at JRC-IPTS under an Administrative Agreement with DG Education and Culture. This study aims to contribute to this policy context and especially to developing a common language and framework for understanding digital competence and other relevant competences linked to it. The overall IPTS study on Digital Competence (DC) is being carried out between January 2011 and December 2012. The objectives of the study are

- *To identify* the key components of Digital Competence (DC) in terms of the knowledge, skills and attitudes needed to be digitally competent;
- *To develop* DC descriptors that will feed a conceptual framework/guidelines that can be validated at European level, taking into account relevant frameworks currently available;
- *To propose* a roadmap for the possible use and revision of a DC framework and descriptors of DC for all levels of learners.
-

The outcomes of the project will be

- a consolidated draft proposal for a DC guidelines/framework, compatible with EQF but also applicable outside formal education, and
- a roadmap on how to realize and revise the DC guidelines/framework.

This report contributes to the first work package of the project: "*Mapping Digital Competence: Towards a conceptual understanding of DC*". The aim of this work package is to develop a conceptual understanding of DC by clarifying the different relating notions and mapping how "digital competence" relates to them, based on literature and interactions with experts and policy officers at European and international level. As a result, a conceptual discussion and clarification of digital competence will be provided as one of the building blocks for drawing up guidelines to digital competence development.

1.3 Research and reporting approach

This report aims to gather and analyse the information and knowledge about different concepts and approaches as documented in literature and other resources. These results will be enhanced by interviews and consultations with some of the key experts and policymakers involved in the activities and policies mentioned above, in order to develop the final results of this work package of the study.

Research for preparing this report has aimed to cover the most relevant aspects and sources when considering the status and developments of digital competence in Europe. Not all the possible literature, projects, organizations etc are covered, nor was this intended. The selection of topics and approaches has been made on the basis of their relevance and visibility in the related research and their potential for European scale implementation. The following tools have been used to prepare the review and analysis presented in this report:

- Literature search from scientific publication databases using the terms "digital competence", "digital skills", "digital literacy", "media literacy", "information literacy", "e-skills", "ICT literacy", "technology literacy", and their different combinations;

- Systematic browsing of the latest issues of selected scientific journals on the area of technologies and education, in order to review relevant new results and terms;
- Review of European Commission policies and activities relating to digital competence;
- Review of reports and studies from international organizations with known activities relating to information society and learning digital skills (for example, Unesco, OFCOM, Pew/Internet, FutureLab, ECDL, Microsoft);
- Dynamically iterated and refined internet searches through Google search with various terms relating to digital skills, literacy and competence, in order to find projects, sites and other recent and relevant information, which could not be found through the traditional research means or with existing field knowledge.

The conceptual understanding of the different aspects and their relationships has been built through visual mindmapping tools, and some of these mapping exercises will also be reproduced as diagrams in this report. Through them, the report aims to build a structured story of the rich, dispersed yet converging landscape of digital competence, which is also always changing.

The report is structured as follows. Chapter 2 introduces issues that must be considered when approaching the labels given to digital competence and other related skills and competences. Chapter 3 reviews the most important concepts and their variations from the research literature point of view and draws a map of the relationships of the different concepts. Chapter 4 describes the typical concepts used in European policy discussion and activities. Chapter 5 discusses the new emphasis given to specific competence elements in the 21st century and relates these aspects with digital competence. Chapter 6 suggests a structure and main elements to considering digital competence for 21st century. Chapter 7 gathers together the main conclusions of the report.

2 Considerations for conceptualising digital competence

The review of the literature and initiatives relating to digital competence revealed a complex landscape of definitions and concepts. This has been and still is making it difficult to achieve consensus on learning objectives or assessment tasks for digital competence.

The perception, emphasised more and more in all the literature on this topic, is that digital competence is about essential life skills for all, even labelled as "survival skills in the digital era" (Eshet-Alkalai, 2004) or "vital assets in information society" (van Deursen, 2010). Another major theme is the need to consider different elements of digital competence. Knowledge and technical usage skills of specific tools and media are required elements but need to be complemented with cognitive skills and attitudes, which should guide the individual activities. Tool and media-related issues change rapidly with technical developments, but cognitive aspects, though they are more difficult to develop, do not change as quickly with technical environments.

Before going into the review and discussion of different concepts in the next chapters, this chapter reviews some basic terminology to be used in the rest of this report. Furthermore, this chapter introduces the reader to the different approaches to digital competence.

2.1 Literacy continuum from basics towards higher competence

No dictionary definition for either digital competence or digital literacy could be found in English Dictionaries, such as Webster¹³ or Chambers.¹⁴ And even if such definitions existed, they could not reflect a wide consensus, as the field has been developing very quickly – personal computers started entering homes, offices and (sometimes) schools only in the 1980's. However, it is useful to study the definitions of the existing components of this compound term, as they provide valuable insights for understanding the current concepts.

2.1.1 Competence

An online search of the Chambers 21st Century Dictionary and Thesaurus provides the following definitions:

Competence and competency (noun): 1) capability; efficiency. 2) legal authority or capability. 3) [old use] sufficient income to live comfortably.	Competent (adj): 1) efficient. 2) having sufficient skill or training to do something. 3) legally capable.
Digital (adj): 1) showing numerical information in the form of a set of digits, rather than by means of a pointer on a dial. 2) denoting a process or a device that operates by processing information that is supplied and stored in the form of a series of binary digits. 3) [<i>electronics</i>] denoting an electronic circuit that responds to and produces signals which at any given time are in one of two possible states. 4) belonging to or involving digits in any way.	

¹³ <http://www.merriam-webster.com/dictionary/>, accessed 14.12.2010.

¹⁴ <http://www.chambersharap.co.uk/chambers/features/chref/chref.py/main>, accessed 14.12.2010.

From these definitions above, it can be deduced that being competent means having sufficient skills and capability to be efficient in something. Therefore, being digitally competent should mean having sufficient skills and capability to be efficient with digital processes and devices.

2.1.2 Literacy

'Competence' is a term that has entered the educational discussion as a separate term more recently. However, it has been a part of the conceptions of 'literacy' for a long time, as reviewed and discussed by Bawden (2001). Chambers' current definitions¹⁵ state:

Literacy (noun)	Literate (adj)
1) the ability to read and write. 2) the ability to use language in an accomplished and efficient way. (etymology: 15th century, from 'literate')	1) able to read and write. 2) educated. 3) [<i>in compounds</i>] competent and experienced in something specified.

Bawden (2001) suggested in his analysis that the word 'literacy' can present three different concepts:

- a simple ability to read and write
- having some skill or competence
- element of learning

His review suggests that the word 'literacy' has always had (at least) a dual meaning. For centuries, the term meant being well educated and well-read. Lately, its meaning has started to include more the competence aspect, i.e. being able to make effective use of information gained, for example:

"Literacy involves the integration of listening, speaking, reading, writing, and critical thinking; it incorporates numeracy. It includes a cultural knowledge which enables a speaker, writer or reader to recognize and use language appropriate to different social situations. For an advanced technological society ... the goal is an active literacy which allows people to use language to enhance their capacity to think, create and question, in order to participate effectively in society." (Campbell, 1990)

2.1.3 Functional literacy

As was demonstrated above, the understanding of the concept of literacy has evolved towards the competence aspect of making effective and efficient use of the basic abilities of reading and writing. Furthermore, the aspect of using these abilities for learning and contributing to public good has become more prominent. This has been emphasized by the creation and use of the term '*functional literacy*', defined by Unesco as follows:¹⁶

*A person is **literate** who can with understanding both read and write a short simple statement on his everyday life.*

*A person is **functionally literate** who can engage in all those activities in which literacy is required for effective functioning of his group and community and also for enabling him to continue to use reading, writing and calculation for his own and the community's development.*

¹⁵ <http://www.chambersharrap.co.uk/chambers/features/chref/chref.py/main>, accessed 14.12.2010.

¹⁶ See UNESCO recommendation concerning the International Standardisation of Educational Statistics at http://portal.unesco.org/en/ev.php-URL_ID=13136&URL_DO=DO_PRINTPAGE&URL_SECTION=201.html

It is often this competence component of literacy that researchers identify as needing improvement, especially when considering skills for further learning. Around the fourth grade, when learners should change from reading narrative texts to reading more informative texts, or change from "learning to read" to "reading to learn", gaps begin to emerge between children who previously had been on similar levels (Sanacore & Palumbo, 2009). This, furthermore, is often related to children's socio-economic status: those from low-income and middle-income families do not perform as well as those from higher income families and the risk of widening gaps between the two groups is created. The OECD (2010b) suggests that even 20% of the reading literacy gaps between groups with different socio-economic status could be closed if the learners had knowledge of effective strategies to summarize information. Lankshear and Knobel (2008b) conclude that literacy in the sense of decoding and encoding is not the same as the literacy that provides access to the learning that counts for school success.

It is worth noting that a similar distinction between basic abilities on one hand and strategies for their effective cognitive application on the other are also often discussed in the context of digital literacy. In the digital context, users' basic abilities to use digital devices and media should progress into critical and effective strategies for the use of these tools in tasks and learning. Functional medium-related abilities are a prerequisite for the successful application of strategic higher level skills. However, van Deursen et al. (2011) showed that internet experience only contributes to medium-related skills and not to the strategic content-related skills in the digital environments. Therefore, specific support for developing these skills is needed.

What clearly emerges from the literature is that literacy should be considered as a continuum, with progressive stages where the basic abilities are only the first step. The upper end of the continuum contains increasing levels of cognitive competence in using the literacy in question for tasks, learning, creating and expressing new ideas, and this involves issues such as attitudes and social and cultural aspects. Furthermore, 'literacy' is not tied to reading and letters, but can mean more generally being 'skilled', 'competent' in something, i.e. describing the basic abilities and then progressing to effective forms of using them for one's tasks and further learning.

2.2 Terminology of competence components

As the objective of the DIGCOMP project is to develop comprehensive digital competence, not just at the lower end of literacy continuum, it is important to recognize the necessary elements of the higher level concept. The project aims to support framework and guidelines development, which would be compatible with the European Qualifications Framework (EQF) (European Parliament and the Council, 2008b). Therefore, the main competence components to be discussed follow the EQF structure composing of knowledge, skills, and attitudes.

Knowledge

'Knowledge' means the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices that is related to a field of work or study. In the context of the European Qualifications Framework, knowledge is described as theoretical and/or factual. (European Parliament and the Council, 2008a)

Skills

'Skills' means the ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the European Qualifications Framework, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity

and the use of methods, materials, tools and instruments). (European Parliament and the Council, 2008a)

In this report, practical skills are referred to as 'instrumental skills', meaning that tool and medium-related knowledge and skills are instrumental for developing or applying advanced (cognitive) skills that rely on using these tools or media. The term 'advanced skills' is used in the report as referring to the application of instrumental digital skills for specific tasks or strategies.

Attitudes

'Attitudes' are conceived as the motivators of performance, the basis for continued competent performance. They include ethics, values, and priorities. They can also include responsibility and autonomy.

Competence

There are two slightly different definitions of 'competence' in the recent European policy recommendations. In the Key Competences Recommendation, 'competence' is defined as *a combination of knowledge, skills and attitudes appropriate to the context* (European Parliament and the Council, 2006). In the European Qualifications Framework recommendation, 'competence' is seen as the most advanced element of the framework descriptors and is defined as *the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development*. Furthermore, in the context of the European Qualifications Framework, competence is described in terms of responsibility and autonomy.

Both these definitions agree that competence is the highest level element, including knowledge, skills and the way these are applied in certain contexts. The typical descriptors for competence in EQF, responsibility and autonomy, can also be seen as personal, social and methodological attitudes. Therefore, there is no essential difference between these two definitions. In order to maintain the compatibility with both of them, the following working definition is suggested: *'competence' is an ability to use knowledge and skills with responsibility, autonomy and other appropriate attitudes to the context of work, leisure or learning*.

2.3 Different focuses and approaches

As discussed above, even the basic concepts of literacy and competence have been changing and developing over time. The same has happened and is happening to the concepts related to digital tools and processes. This is caused by the constant and rapid development of the technologies and their usages for different purposes, which makes possible and creates new activities and objectives. Digital tools and processes are becoming everyday intermediaries for all types of tasks, and an integral part of any skill and competence. Therefore, elaborating separate definitions for literacy and competences within and outside digital environment is becoming meaningless.

There are two main approaches to this confusing realm of concepts and definitions: 1) via a high-level conceptual definition, which describes issues on abstract level, and stays immune to changes in the operational aspects of technologies; 2) recognizing specific knowledge, skills and competence demonstration elements that are important for the overall objective and creating a listing that serves learning and assessment of the person's capacity in the area specified. This latter approach, however, is by nature highly dependent on the current digital tools and possible activities, and therefore needs regular revision. The middle way is to develop a conceptual definition that composes of different types of elements, of which some are tool-related and require regular revision and others are on a higher cognitive level and thus remain valid, although the practicalities change.

It is important to realize that emerging real-life needs and practices in digital environments are not necessarily those that have been defined by education and training authorities. Furthermore, some knowledge and skills (tool and medium-related) can be developed through experience and self-learning, while other aspects (strategic and cognitive) require education and guidance.

2.3.1 Convergence of general and digital concepts

Many of the concepts and definitions now used in the digital world context come originally from a time when digital technologies did not exist. Sometimes the digital world context is made explicit with a compound term (digital literacy, electronic literacy, e-literacy), but sometimes the context of the concept is to be understood implicitly (information literacy, media literacy). When discussing a concept that has a broad meaning already, e.g. information literacy, and the additional aspects that digital tools and processes bring to it, people can easily end up with different focuses although they use the same concept. Bawden (2001) finds both examples where information literacy is considered mainly from the viewpoint of digital resources, and others which emphasize the need to consider different forms of information, including non-digital sources.

However, if we consider that more and more tasks and resources in society today rely on digital tools and digital processes, separating the digital from the general is difficult. For example, PISA 2009 reading literacy assessment also included measurements of students' competences in understanding and using information in the digital medium (OECD, 2010c). Furthermore, the operationalisations of information and media literacy definitions now typically include an aspect of digitally-mediated information and materials (e.g. UNESCO Information literacy indicators¹⁷ and OFCOM Media literacy audit¹⁸). It could be said that after more than 20 years of considering general and digital skills and competences as separate skills sets, we have entered an age where they are, and should be, fully converging. This overlap and convergence of concepts leads us to make two recommendations:

- 1) the digital concept should also consider the knowledge, skills and attitudes considered necessary in the respective general 'parent' concept. This is especially important when the objective is *not* to concentrate mainly on the operational aspects of digital tools but on their critical, effective and competent application.
- 2) the digital concept should include the literacy and competence to consider tools, resources and activities *outside* digital realm, for example, when something might be better achieved through other than digital means or by combining different tools and media. As will be seen later, Gilster (1997) included this aspect into his definition and understanding of digital literacy.

2.3.2 Conceptual and operationalised approaches

In the introduction to their book, Lankshear & Knoble (2008b) distinguish between *conceptual* definitions and *standardized operational* definitions of digital literacy. The operational definitions describe a set of skills, tasks, and performances as the elements of digital literacy/competence, while conceptual approaches typically involve (possibly in addition to specific skills) cognitive and socio-emotional aspects of acting in a digital environment, such as awareness, understanding and reflective evaluations. These broader definitions allow context-specific operationalisations, which have a

¹⁷ More information about UNESCO Information for All Programme (IFAP) available at: <http://www.unesco.org/new/en/communication-and-information/intergovernmental-programmes/information-for-all-programme-ifap/priorities/information-literacy/>

¹⁸ More information about OFCOM Media Literacy Research available at: <http://stakeholders.ofcom.org.uk/market-data-research/media-literacy-pubs/>

common basic starting point, but differing implementations which utilize different tasks and activities according to the available tools and resources or according to the different target groups.

The major difference between these two approaches is in their implementability when planning and assessing related education and training approaches. Conceptual definitions are typically high level and do not provide concrete guidance for teaching or assessing the skills and competences in question. Operationalised approaches provide clearly defined knowledge objectives or operationalised tasks for skills measurement, which can be assessed in a standardized way. Standardized assessment approaches are important tools, which can ensure that all learners, however different they or their settings are, end up with good capabilities to perform in these tasks. The main challenge here is to find and describe typical tasks and learning objectives and ways to assess whether learners have achieved these objectives.

When considering the suggested continuum-type approach to literacy/competence, the operationalised approach can be quite easily applied to the issues at the lower-end of the continuum, when the issues to be learned are practical tasks and knowledge. However, towards the higher levels of competence, where attitudes and productive pursuit of one's own objectives and learning should be considered, standardizing tasks and measurements becomes difficult. Bawden (2001) concludes: *"it is tempting, ... to express these ideas in terms of sets of particular skills to be learnt, and competences to be demonstrated. While this may be valid for some limited purposes, it is too restrictive overall."* Higher level competence requires personally developed ethics, attitudes and expertise, which contain elements that are hard, if not impossible, to put in a simple general list. In reality, current frameworks more often concentrate on ensuring the skills and capabilities at the lower end of the digital literacy/competence continuum.

2.3.3 Schooling versus social construction of digital competence

Surveys and research show that people are using technologies more outside schools and educational places than inside them. The PISA 2009 survey showed that 86% of 15 year-olds say they frequently use computers at home, but only 55% do so at school (OECD, 2010a). Eurostat 2010 data for 16-24-year-olds in EU27¹⁹ show that although 92% used internet at home, only 47% used internet in their places of education. For people over 25 years, their home usage remains at 92%, but their usage in educational places is only 4%, as many of them do not anymore attend formal education. Eurostat data from 2007 shows that 71% of 16-74 year-olds²⁰ in EU27 said they had learned ICT skills themselves by doing and 67% said they had learned ICT skills with the help of their peers. Many people today are using digital tools and media, possibly without having (had) any systematic or guided approach to learning digital competence. Different perceptions of this phenomenon can be found in the literature and are discussed below.

Sefton-Green et al. (2009) claim: *"Digital competence among young people today seriously upsets assumptions about learning in schools, because it seriously confronts those earlier conceptions of literacy and learning as being the primary symbolic powers of schooling."* They suggest that there is a gap between the conception of digital competence at schools or in academic education, and the social practices between people in the digital environments outside school hours. *"We note different conceptions of digital literacy among teachers and students... this also illustrates the institutional barriers that are frequently raised when bringing digital literacy from the policy level down to the school level, and when trying to use a mandated conception of digital literacy to change educational*

¹⁹ From those who had used internet in the last three months. Eurostat Information Society Statistics data at: http://epp.eurostat.ec.europa.eu/portal/page/portal/information_society/data/database

²⁰ From those who had ever used a computer. Eurostat Information Society Statistics data available at: http://epp.eurostat.ec.europa.eu/portal/page/portal/information_society/data/database

practice" (Sefton-Green et al., 2009, p. 117). They argue that the concept of digital literacy should be analysed more at the intersection of formal and informal learning domains where "top down" and "bottom up" approaches meet.

Following the same lines, Lankshear and Knobel (2008a) suggest taking a socio-cultural view of digital literacy, seeing it as a set of social practices and meaning making through digital tools and processes. By starting to participate in digital activities, people learn specific skills, situated knowledge and attitudes in task-specific and social contexts, in a practical and personally effective way. This may provide skills that are relevant in the quickly developing practices with changing technologies, but not yet reflected in more slowly changing educational plans and official concepts of digital competence. The book on digital literacies edited by Lankshear and Knobel (2008a) highlights the importance of taking these aspects into consideration in developing politics for digital literacies. They suggest taking an expansive view of digital literacies that includes popular cultural practices and everyday practices like workplace blogging, online shopping and participation in online networking (Lankshear & Knobel, 2008b). This provides a means to develop an approach to digital competence that embeds the basics of being literate, competent and able to learn more in digital environments into the everyday lives of learners and educators.

As seen above, the literature highlights the importance of considering the practices emerging in informal digital use for developing organized education approaches for digital competence. However, although there is plenty of evidence of people learning digital skills – the type they need for their tasks in their specific context – by themselves and supported by their peers, this does not remove the need for teachers, instructors, and guided structured approaches to learning. The often mentioned 'digital natives' generation may be very fluent and creative in using digital tools for some purposes, but still lack some of the important competences for their decisions and actions in the digital environment, e.g. critical information literacy (Ala-Mutka, Punie, & Redecker, 2008). Van Deursen (2010) found that internet use experience only contributed to the operational and formal internet usage skill, i.e. the ability to use computers, files and internet applications. The higher level cognitive skills to critically search and select information, or strategically advance towards specific goals did not improve with internet experience. Educational level had a positive effect on all skills.

Furthermore, there is considerable debate about whether the naturally technologically-competent young generation really exists, see e.g. Bennett et al. (2008). There are many types of digital divides among these young people. Their skills are affected, for example, by socio-economic status (E. Hargittai, 2010) or by the location and social context of technology access (Brandtweiner, Donat, & Kerschbaum, 2010). Furthermore, since people have different learning styles and capabilities, some of them simply need more help and guidance than others. As pointed out by Gee (2007): *"just giving access to technologies for young people is not enough, they need adult mentoring and rich learning systems, otherwise the full potential of these technologies is not realized for these children."* (Gee, 2007, p. 138). Furthermore, as there are many groups at risk of digital exclusion among adults (e.g. the elderly, the unemployed, and the low-skilled), organized educational approaches are needed to increase their interest, skills and confidence for digital participation. Education and training on digital competence should not concentrate only on the young as there are plenty of other citizens who are already past the formal education phase but need to develop their digital competence as well.

Therefore, there is a place and need for organized educational systems in ensuring and supporting equal access to learning the important aspects of digital competence for all groups of citizens. However, institutions need to follow the practices developing outside training programmes, in order to provide people with useful and current digital competence for their work, lives and further learning.

2.4 Summary of issues for consideration

This chapter has aimed to introduce and discuss aspects that open up the reader's understanding of the issues and tensions relating to digital competence. For the objectives of this report, i.e. mapping and developing a conceptual understanding of digital competence, the following important lessons have been learnt:

- Literacy is a very wide concept. It includes competence aspects (attitudes, etc.) and is used for a variety of topics other than basic reading and writing. The broadness of the term gives rise to misconceptions as different people may consider it on different levels and with different focuses. This may also affect people's interpretations of 'digital literacy' or 'digital competence'.
- The literature suggests that literacy should be seen as a continuum from instrumental skills to productive competence and efficiency. The basic skills and tools (reading/writing/mastering computer applications) must be mastered but they are only the first step in acquiring other knowledge, skills and attitudes that are built upon their usage.
- As digital practices are being developed by users themselves, and new skills needs are created through these practices, the definition of digital competence should take a wide view and also include popular cultural practices and personal everyday practices into the scope of competence to be developed and cultivated. Several stakeholder groups should be consulted in order to detect needs for change that have been developed through the social practices of different groups of people.
- There should be a separation and balance between the broader notion of digital competence and operationalisation for measurable learning and assessment/certification objectives. Combining both these aspects when working with digital competence allows the conceptual level understanding to remain the same, while the operationalisation of tool and practice-related aspects should be revised regularly in order to follow the changes in technical environments and major social practices.

3 Key concepts and their elements in research literature

The skills and competences relating to activities in the information society are discussed in the literature through various concepts. The choice of a concept depends on the discipline of the discussant (e.g. information sciences or media studies) and on the aspects that are being focused on (e.g. task-specific skills or general capabilities). From the literature reviewed, two works are referred to often for their coverage, thoroughness and usefulness for the objectives of this report. Firstly, Bawden provides an in-depth review of the digital literacy concept and its relationship to other concepts (Bawden, 2001, 2008). Secondly, Martin reports the DigEuLit project results in various publications, e.g. (Martin, 2006; Martin & Grudziecki, 2006), with conceptual elaboration and a suggested framework for developing digital competence. Based on this and also other literature, the five most commonly used categories of concepts are introduced and discussed in this section.

In this chapter, specific elements of knowledge, skills and attitudes are presented graphically on the right side of the text. These boxes pick out new aspects one at a time, in order to help the reader construct an overall picture of the various considerations that should be included in the discussion of competence needs in the digital environments.

3.1 Computer literacy, ICT literacy

The terms 'Computer literacy' or 'ICT literacy' are commonly used in various contexts, with variations such as '*IT literacy*' or '*technology literacy*'. As reflected by the terms themselves, these concepts typically emphasize the aspects of knowing and being able to use computers and related software. Since the late 1990's, however, when the understanding of the needs for reflective skills in technology usage began to increase (Martin, 2008), more advanced interpretations can also be found.

According to Bawden's review (Bawden, 2001) computer literacy has been most commonly considered in the literature through a pragmatic skills-based approach: "*In practice, this translates to an introduction to the skills required to operate a variety of computer applications packages – word processing, databases, spreadsheets, etc. – together with some general IT skills, such as copying disks and generating hard-copy printout.*" This narrow understanding of the skills required for computer use is quite frequent (van Deursen, 2010). This often results in educational settings in tool-oriented approaches, where teaching is reduced to relatively trivial software instruction.

**Know and use
computer
equipment**

**Know and use
relevant
software**

However, there are also examples of broader definitions of computer literacy, which go beyond the simple skills approach and involve their critical usage for personal and social benefit. Bawden (2001) cites some early examples such as:

- 'whatever a person needs to be able to do with computers and know about computers in order to function in an information-based society' (Hunter, 1983) in (Bawden, 2001)
- 'computer literacy has to do with increasing our understanding of what the machine can and cannot do' (Horton, 1983) in (Bawden, 2001)

**Understanding potential
and limitations of ICT**

As early as 1999, the US National Research Council (Committee on Information Technology Literacy, 1999) criticized the concept of computer literacy with its skills connotation as being far too modest; they preferred the term '*IT fluency*', to emphasize and encompass the need for skills, an understanding of concepts and an intellectual capability for abstract thinking about information. The

new concept was not widely used, but at the same time research literature also started to consider more information-related skills when discussing ICT literacy and its objectives. Understanding of ICT literacy began to shift towards information literacy. Since then, several authors have discussed the relationship between computer literacy and information literacy. These are typically seen as distinct but interrelated (Bawden, 2001).

3.2 Internet literacy, network literacy

The networked nature of information and related processes is sometimes referred to as 'Internet literacy' or 'Network literacy'. Sometimes network/internet literacy is also used in the literature in the broad sense of 'digital literacy', but more often it refers to the specific aspect of using networked resources, media and communications. McClure (as cited in Bawden 2001) suggests that the basic components of network literacy should include:

- knowledge:
 - an awareness of the range and uses of networked resources;
 - an understanding of the role and uses of networked information in problem solving and 'basic life activities';
 - an understanding of the system by which networked information is generated, managed and made available;
- and skills:
 - retrieval of specific types of information from networks;
 - manipulation of networked information; combining, enhancing, adding value;
 - use of networked information to help make work-related and personal decisions.

Knowledge of the role and uses of networked resources

Find and manipulate information in hyperlinked non-linear form

Use networked resources for personal decisions

McClure notes that these issues are not 'add-ons' to traditional literacy, but rather part of a wider notion of literacy in an electronic society, and will require other literacies to be in place.

Van Deursen (2010) elaborated and validated a definition of 'Internet skills', which considers internet as a medium that is more demanding than simply computers or other traditional media. The definition includes four skills categories, representing two main types: medium-related and content-related skills. Internet as a medium requires specific **operational skills** for using internet browsers, search engines and forms and **formal internet skills** for navigating in the internet and maintaining a sense of location. These are prerequisites for practising and developing content-related internet skills, which include **information internet skills** for locating, selecting and evaluating information and **strategic information skills** for successful goal-oriented activities in the internet. van Deursen showed that this definition of internet skills was valid for tasks in different content domains.

Know and use relevant software functionalities for networks

Maintain sense of location and purpose in internet

Complete goal-oriented activities in internet

As seen above, network/internet literacy relates to the competence of managing and benefiting from the overwhelming amount of information and resources available in internet. Therefore, it is related to information literacy, which will be discussed in the following section.

3.3 Information literacy

Information literacy is one of the most commonly mentioned digital world related concepts in the research literature. The concept emphasizes the identification, location, evaluation, and use of media

materials (Livingstone et al., 2005). The usage of 'Information literacy' concept has increased considerably in the literature since 1990's (Bawden, 2001), together with the increasing take up of the computers and internet, and the increased availability of information. Bawden (2001) notes that the concept has been considered by some people as connected to 'library literacy' or 'bibliographic instruction', but it is more commonly considered as a broader concept, which also includes the effective use of computer and multimedia technologies.

Information literacy is becoming a crucial skill in an information society, where information is in abundance, and easy access to it through digital means is available for all. Those who know how to find and use it for their benefit are in much better position than those who do not. The Alexandria proclamation of 2005²¹ states:

"Information literacy empowers people in all walks of life to seek, evaluate, use and create information effectively to achieve their personal, social, occupational and educational goals. It is a basic human right in a digital world and promotes social inclusion in all nations."

This is elaborated into five main elements of information literacy by Unesco (Catts & Lau, 2008) as follows:

- Recognize information needs
- Locate and evaluate the quality of information
- Store and retrieve information
- Make effective and ethical use of information
- Apply information to create and communicate knowledge

**Locate and evaluate
information**

**Store and organize
information**

**Effective and ethical
use of information**

Unesco notes that Information literacy is an integral aspect of adult competences and today very much related to ICT: *"people can be information literate in the absence of ICT, but the volume and variable quality of digital information, and its role in knowledge societies, has highlighted the need for all people to achieve IL skills. For people to use IL within a knowledge society, both access to information and the capacity to use ICT are prerequisites."* (Catts & Lau, 2008, p. 7). It is important to remember, however, that information literacy is a general competence, and not restricted to only digital environments.

**Communicate
information and
knowledge**

Bawden (2001) elaborates the work of Dupuis (1997) into a list of principal elements for creating and nurturing information literacy taking into account both printed literature and the Internet, which provide an increased variety of information presentation and communication formats:

- understanding the information world, including information technologies, while understanding that not all information is found on a computer;
- assessing information need, and articulating what information is needed;
- assessing and selecting resources, and searching effectively, including an understanding of the structure of literature, the distinctions between controlled and uncontrolled vocabularies, between precise and comprehensive searching etc;
- evaluating and interpreting information, in different formats and media, and employing critical analysis;
- manipulating and organising information;

**Understand
traditional and new
information sources**

**Assess and articulate
information need**

**Search and select
resources effectively**

**Interpretation of information
in different formats**

²¹ http://portal.unesco.org/ci/en/ev.php-URL_ID=27055&URL_DO=DO_PRINTPAGE&URL_SECTION=201.html

- communicating to others the location and content of information found, including citation practices and the integration of new information into an existing body of knowledge.

**Process and
communicate
information into
knowledge**

Bawden (2001) suggests in his review that a link between **information literacy and learning** has been a consistent theme in the development of the concept, and has strongly coloured the meaning of the term. Information literacy has often been considered as a vital tool for lifelong learning. American Library Association Presidential Conference on Information Literacy in 1989²² already noted that *"...Ultimately information literate people are those who have learned how to learn. They know how to learn because they know how information is organised, how to find information, and how to use information in such a way that others can learn from them. They are people prepared for lifelong learning, because they can always find the information needed for any task or decision at hand."*

Several authors regard **critical thinking** as an important component of information literacy, which becomes even more important with digital environments with plenty of information easily available. For example, Brouwer (1997) sees information literacy as centred around critical thinking with five components:

- distinguishing between information and knowledge;
- asking key questions about information, what the source is and what assumptions are contained within information;
- assessing the usefulness, timeliness, accuracy and integrity of information;
- nor being content with the first six 'hits' on a search;
- questioning/checking answers provided by technology tools.

**Critical thinking
towards
information and
answers found**

3.4 Media literacy

Media literacy as a term had low presence in literature before digital media proliferation, and started to expand later than information literacy, in the late 1990's (Bawden, 2001). The term "media literacy" accounts for the more traditional media including print and audio-visual media like radio and television, but also for the Internet. An early use of the term "information literacy" had much in common with media literacy, and Bawden suggests that most authors who have considered the interrelation of these concepts prefer to see media literacy as a component of information literacy. These concepts do have clear similarities. This section does not aim to provide a comparison of these concepts, but rather to bring up and to highlight the issues that media literacy discussion adds to the competence needs in the digital environments, on top of those already discussed.

While information literacy tends to focus on the ways in which information is accessed and evaluated, definitions of media literacy focus on the nature of various genres of media and the way in which messages are constructed and interpreted (Martin, 2006). Bawden (2008) put it: *"Information literacy" implies competences in actively finding and using information in "pull" mode, while "media literacy" implies an ability to deal with information formats "pushed" at the user.* While information literacy is crucial for people's learning and personal development, media literacy highlights the skills for developing and maintaining one's independence and productive participation as a citizen in the (digital) media filled world.

**Engage in and
participate in
digital media**

²² Final report of the ALA conference available at:
<http://www.ala.org/ala/mgrps/divs/acrl/publications/whitepapers/presidential.cfm>

Originally media literacy as a field of research has developed from the critical evaluation of mass media; it was meant to be a protection from what many people perceived to be the treacherous effects of mass media (Martin, 2006). Research literature on media literacy commonly cites the media literacy definition originating from 1992 Aspen Media Literacy Leadership Institute: "... *the ability to access, analyze, evaluate and create media in a variety of forms.*" (Thoman & Jolls, 2003). This definition is reflected by many other organizations. For example, Australian Communications and Media Authority refer to digital media literacy as *ability to access, understand and participate or create content using digital media*.²³ In Europe, UK Office of Communications (Ofcom) has provided a commonly cited definition, which is defined in collaboration with their stakeholders. They consider Media Literacy as '***the ability to access, understand and create communications in a variety of contexts***'.²⁴ The Ofcom Media Literacy Audit reports²⁵ provide the following elaboration:

- Access includes take-up of media devices, volume and breadth of use.
- *Understand* includes interest and competence in using the features available on each platform, extent and levels of concern, trust in television and online content and use of television and internet security controls.
- *Create* includes people's confidence in engaging with creative content and their interest in carrying out creative tasks, most notably using social networking sites.

Access media in different formats and platforms

Know and use media related mechanisms

Create with confidence media and expressions

Brandtweiner et al. (2010) add additional higher-level competences, which require reflection and critical thinking in their four major dimensions of media literacy:

- selecting and using the appropriate media and contents (knowledge about media, usage and participation);
- understanding and evaluating media contents (analysis and evaluation);
- recognizing and responding to the influences of media contents (self-reflection);
- identifying and evaluating the circumstances of production (seriousness and credibility).

Select and use appropriate media

Analyse and evaluate media content

Reflect media influence

Identify media production circumstances

3.5 Digital literacy

'Digital literacy', sometimes also referred to as *electronic literacy (e-literacy)*, is the concept that often is considered to include many of the knowledge, skills and attitudes mentioned in the concepts reviewed above. "*Digital literacy touches on and includes many things that it does not claim to own*" (Bawden, 2008). Martin (2006) suggests that this may be due to several reasons, such as the effect of digital tools and media take-up in highlighting the similarities between various literacies, or the evolution of all literacies from focusing on applications towards identification of generic cognitive abilities, processes and critical attitudes. He suggests that "*Digital literacy may have merit as an integrating (but not overarching) concept that focuses upon the digital without limiting itself to computer skills, and which comes with little historical baggage*".

²³ http://www.acma.gov.au/WEB/STANDARD/pc=PC_311470

²⁴ <http://stakeholders.ofcom.org.uk/market-data-research/media-literacy/about/whatis/>

²⁵ See, for example, http://stakeholders.ofcom.org.uk/market-data-research/media-literacy/medlitpub/medlitpubrss/ml_childrens08/

Both Martin (2006) and Bawden (2008) acknowledge that the concept has been first introduced and made known in the sense it is used today by Gilster (1997), who explained it as an *"ability to understand and use information in multiple formats from a wide variety of sources when it is presented via computers"*. Gilster did not approach the concept through skills listing but from this general and broad approach which allows the interpretation and operationalisation of the concept to develop as needed. He emphasized more critical thinking than technical competences, highlighting as an essential aspect *"the ability to make informed judgments about what you find on-line"*. Therefore, although the digital literacy definition was introduced already 14 years ago, it still remains relevant, and often referred to in the literature.

Gilster put forward the idea that new media require new skills for both navigating with networked technologies and interpreting the meaning of digital messages. *"Not only must you acquire the skill of finding things, you must also acquire the ability to use these things in your life"*(p.2). Gilster also included the notion that digital literacy must involve an understanding of how to complement digital resources with others, and not to give up other sources of information because of Internet.

Benefit from ICT for personal life tasks and objectives

Bawden (2001) summarizes Gilster's core competences as follows:

- the ability to make informed judgements about what is found online, which he equates to 'the art of critical thinking', the key to which is 'forming a balanced assessment by distinguishing between content and its presentation';
- skills of reading and understanding in a dynamic and non-sequential hypertext environment;
- knowledge assembly skills; building a 'reliable information horde' from diverse sources, with 'the ability to collect and evaluate both fact and opinion, ideally without bias';
- searching skills, essentially based in Internet search engines;
- managing the 'multimedia flow', using information filters and agents;
- creating a 'personal information strategy', with selection of sources and delivery mechanisms;
- an awareness of other people and our expanded ability [through networks] to contact them to discuss issues and get help;
- being able to understand a problem and develop a set of questions that will solve that information need;
- understanding of backing up traditional forms of content with networked tools;
- wariness in judging validity and completeness of material referenced by hypertext links.

Critical evaluation of content vs presentation sources

Knowledge building from diverse and non-sequential information sources

Manage incoming information

Create personal information strategy

Benefit from people networks

In his review and discussion of digital literacy, Bawden (2008) draws a list of skills and competences associated with digital literacy, which reflect the practical needs in a world where through digital tools and media there is an overwhelming amount of information. The list adds to the previous items the following two issues:

- awareness of the value of traditional tools in conjunction with networked media
- being comfortable with publishing and communicating information, as well as accessing it

Understand the value of traditional tools and resources in conjunction with digital

Being comfortable with digital communications

Martin and Grudziecki (2006) report results of a European project, where they considered the development of digital literacy as 'the ability to succeed in encounters with the electronic infrastructures and tools that make possible the

world of the 21st century' and developed a framework approach for learning and training it. In the conceptual part of the project, they elaborated a comprehensive definition for the concept of digital literacy:

'Digital Literacy is the awareness, attitude and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyze and synthesize digital resources, construct new knowledge, create media expressions, and communicate with others, in the context of specific life situations, in order to enable constructive social action; and to reflect upon this process.' (Martin & Grudziecki, 2006).

This is the most comprehensive short definition of digital literacy found in the literature. Martin (2008) also further elaborated its meaning, concluding that:

- Digital literacy involves being able to carry out *successful digital actions embedded within life situations*, which may include work, learning, leisure, and other aspects of everyday life;
- Digital literacy, for the individual, will therefore *vary according to his/her particular life situation*, and also be an *ongoing lifelong process* developing as the individual's life situation evolves;
- Digital literacy is broader than ICT literacy and will *include elements drawn from several related "literacies"*.
- Digital literacy involves acquiring and using knowledge, techniques, attitudes and personal qualities, and will include the ability to *plan, execute and evaluate digital actions in the solution of life tasks*.
- Digital literacy also includes the ability to be aware of oneself as a digitally literate person and to *reflect on one's own digital literacy development*.

Apply several skills and competences in digital environments

Plan, execute and evaluate own digital actions

Reflect own digital literacy skills and development

3.6 Conceptual mapping

Many literacy concepts which arose in pre-digital contexts were then developed and extended with the emergence of digital tools and media opportunities. This development will probably continue and trying to freeze concepts under one definition would not only be impossible but also lose its relevance quickly. For example, Unesco suggest that at any time, a new situation may require a new level of information literacy (Catts & Lau, 2008).

Figure 1 illustrates how the typical definitions make the concepts overlap considerably. Different interpretations of the concepts make it impossible to have a general agreement about the exact overlap in relation to different digital competence areas. This figure follows from the concept discussion above, and aims to show the following main points:

- ICT literacy is typically the narrowest digital concept, and mainly concentrated on technical knowledge and usage of computers and software applications.
- Internet literacy adds to the tool-related knowledge and skills the considerations and ability to successfully function in networked media environments.
- Information literacy and media literacy concepts largely overlap. However, some different foci can be detected in that information literacy is more about finding, organising and processing information, whereas media literacy is more about having the skills to interpret, use and create media for one's own benefit and participation. A critical attitude is important in both of them.

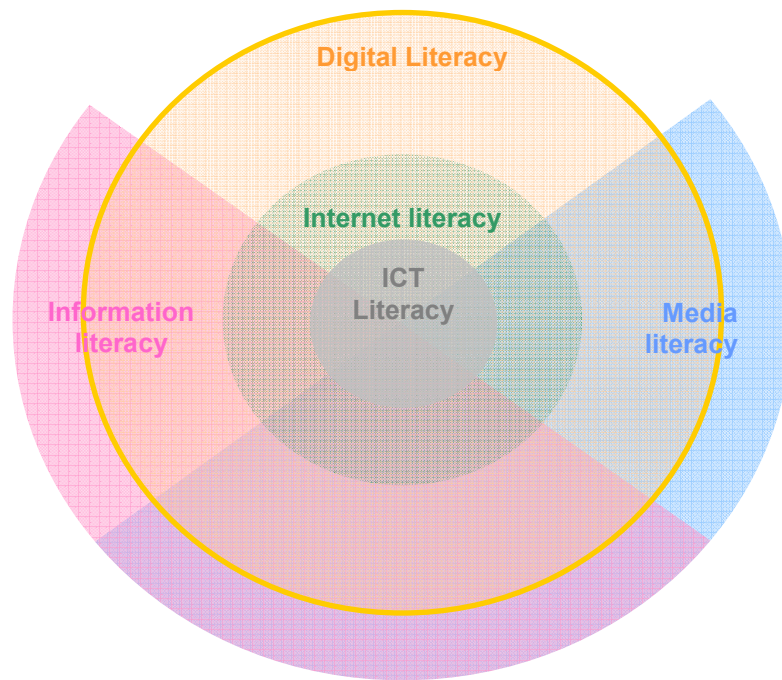


Figure 1 : Mapping digital literacy together with other related main concepts.

- In the digital domain, digital literacy is the broadest concept, and as originally defined by Gilster (1997), includes the main aspects of the other concepts, and further aspects for using digital tools responsibly and effectively for personal tasks and development, benefiting from people networks.
- Information literacy and media literacy cover both digital and non-digital domains, i.e. they also contain issues that are not in digital literacy. But many of their main aspects are very important in the digital domain.
- Furthermore, although not shown in the picture, literacy as a basic concept of understanding information and communicating with culturally agreed symbols and rules is important and supports all the other literacies.

The main result of this chapter is not to select and propose one concept definition for the basis of the framework development, but to recognize the essential elements of all the most important concepts. Literature supports this, as e.g. Martin (2006) argues that searching for '*one literacy to rule them all*' would be fruitless. In a similar manner, Bawden (2008) highlights the importance of explaining the concept rather than aiming to agree on a specific common concept. Martin (2006) concludes: '*A multitude of literacies may be confusing and inconvenient, but it represents the reality of social life, where perspectives and situations vary immensely and are constantly changing. Literacies point to perceptions of need and empowerment in society, and a changing society will inevitably continue to create new ones.*'

4 European policy approaches for digital competence

Digital competence has been approached from different angles by different actors in European policy. The policy discussions use sometimes same concepts as introduced in the literature and reviewed in the previous chapter. In other cases, policy actors have launched their own concepts in order to promote and communicate their specific interests and viewpoints.

This chapter will briefly review the main concepts, and related European policy activities in the area of digital competence. As these concepts and approaches are based on and linked to the concepts reviewed in the previous chapter, no new 'building blocks' for digital competence are introduced in this chapter. The objective is to show the reader how European policies have conceptualized and focused the policy approaches on digital competence related issues.

4.1 Digital literacy

The Digital literacy concept is mainly used in the policy work of DG Information Society,²⁶ and it was defined in the European Commission working paper (European Commission, 2008a) as:

Digital literacy is the skills required to achieve digital competence... Digital literacy is underpinned by basic technical use of computers and the Internet.

This definition mainly reflects functional (instrumental) tool and internet usage skills, i.e. corresponds with the concept of 'ICT literacy' as reviewed in the previous section. It also emphasizes its position as an instrumental lower-level concept by stating that it is a skills requirement leading into digital competence. This digital competence refers to the Key Competences definition (European Parliament and the Council, 2006), which will be presented in Section 4.4. In the same Commission working paper, the development of Information society and focus on Digital literacy was considered on three stages:

- Stage 1: digital literacy to improve access
- Stage 2: promoting basic ICT user skills
- Stage 3: improving quality of use and participation in the Information Society

The focus on the third stage has been increasing only recently, and this would also call for elaboration of the concept. The recommendations of the high level expert group on Digital Literacy²⁷ recognize that the concept needs to be broadened and aligned with the media literacy framework, as well as emphasize awareness and quality of use, including critical and creative thinking and skills.

Digital literacy is linked with DG INFSO's e-Inclusion²⁸ work, which aims to achieve that "no one is left behind" in enjoying the benefits of ICT. e-Inclusion means both inclusive ICT and the use of ICT to achieve also more general inclusion objectives, such as inclusion of specific groups at risk of exclusion (elderly, immigrants, low-skilled, unemployed, special needs population). It focuses on active participation of all individuals and communities in the information society. e-Inclusion policy, therefore, aims at reducing gaps in ICT usage and promoting the use of ICT to overcome exclusion, and improve economic performance, employment opportunities, quality of life, social participation and cohesion.

²⁶ See Digital Literacy website: http://ec.europa.eu/information_society/tl/edutra/skills/index_en.htm

²⁷ See: http://ec.europa.eu/information_society/eeurope/i2010/docs/digital_literacy/digital_literacy_hlg_recommendations.pdf

²⁸ See e-Inclusion website: http://ec.europa.eu/information_society/activities/einclusion/index_en.htm

The digital literacy development in Europe has been supported by various studies commissioned by DG INFSO, such as Digital Literacy Review,²⁹ framework programme research projects to boost ICT competences,³⁰ Digital literacy community on the e-Practice platform³¹ and TeleCenter Europe.³² Digital literacy development projects have also been supported by the Education, Audiovisual and Culture Executive Agency (EACEA) under Education and Training³³ and Lifelong learning³⁴ programmes.

Digital literacy and e-inclusion were important topics in the i2010 strategy,³⁵ and continue to be so in the current Digital Agenda for Europe³⁶. Digital Agenda highlights digital literacy, e-inclusion, eLearning and e-skills (see next section) as important areas for action. There are also items to improve usability and accessibility, which support digital competence development and application by target groups with special needs.

- Action 57: Make digital literacy and competences a priority for the ESF
- Action 58: Develop tools to recognize and identify competences of ICT practitioners and users
- Action 59: Make digital literacy and skills a priority of the "New skills for new jobs" Flagship
- Action 60: Promote higher participation of young women and women returners in ICT
- Action 61: Develop an online consumer education tool on new media technologies
- Action 62: Propose EU-wide indicators of digital competences and media literacy
- Action 63: Systematically evaluate accessibility in all revisions of legislation
- Action 64: Make sure that public sector websites are fully accessible by 2015
- Action 65: Memorandum of Understanding on Digital Access for persons with disabilities
- Action 66: Member States to promote long-term e-skills and digital literacy policies
- Action 67: Member states to implement provisions on disability in Telecoms Framework and AVMS
- Action 68: Member States to mainstream eLearning in national policies

4.2 e-Skills

e-Skills is the concept used by DG Enterprise and Industry³⁷ and ICT industry. It aims to reflect the different levels of ICT skills needs from basics towards ICT professionals and entrepreneurs. The European e-Skills Forum adopted in 2004 a definition of the term "e-skills" covering the following three main categories:

- *ICT user skills* represent the capabilities required for the effective application of ICT systems and devices by the individual. ICT users apply systems as tools in support of their own work. User skills cover the use of common software tools and of specialized tools supporting business functions within industry. At the general level, they cover "digital literacy".
- *ICT practitioner skills* are the capabilities required for researching, developing, designing, strategic planning, managing, producing, consulting, marketing, selling, integrating, installing, administering, maintaining, supporting and servicing ICT systems.

²⁹ http://ec.europa.eu/information_society/eeurope/i2010/digital_literacy/index_en.htm

³⁰ http://ec.europa.eu/information_society/activities/einclusion/research/competence/index_en.htm

³¹ <http://www.epractice.eu/community/digilit>

³² <http://www.telecentre-europe.org/>

³³ http://ec.europa.eu/education/archive/elearning/projects/051_en.html

³⁴ http://eacea.ec.europa.eu/llp/project_reports/project_reports_ict_ka3_en.php

³⁵ i2010: Social inclusion, better public services and quality of life:

http://ec.europa.eu/information_society/eeurope/i2010/inclusion/index_en.htm

³⁶ See Digital Agenda website: http://ec.europa.eu/information_society/digital-agenda/index_en.htm

³⁷ See the E-Skills website: http://ec.europa.eu/enterprise/sectors/ict/e-skills/index_en.htm

- *e-Business skills* correspond to the capabilities needed to exploit opportunities provided by ICT, notably the Internet; to ensure more efficient and effective performance of different types of organisations; to explore possibilities for new ways of conducting business/administrative and organisational processes; and/or to establish new businesses.

eSkills Communication³⁸ (European Commission, 2007a) adopted this definition and five key action lines for a long-term European e-skills agenda: Promoting long-term cooperation and monitoring progress; Developing supporting actions and tools; Raising awareness; Fostering employability and social inclusion; Promoting better and greater use of e-learning. Several outcomes for e-skills promotion have resulted from related multi-stakeholder activities, such as:

- European e-Competence Framework³⁹ and European e-Competence curricula development guidelines;⁴⁰
- European e-Skills and Careers portal⁴¹ and a European e-Skills week as awareness raising tools on European and national levels;
- Several studies about e-Skills needs and development in Europe.⁴²

4.3 Media literacy

Media literacy is considered by European Commission as an important factor for active citizenship in today's information society.⁴³ The definitions used in the official documents emphasize tool-related skills as well as critical attitude and understanding of safe usage.

*Media literacy is the ability to access the media, to understand and to critically evaluate different aspects of the media and media contents and to create communications in a variety of contexts.*⁴⁴

'Media literacy' refers to skills, knowledge and understanding that allow consumers to use media effectively and safely. Media-literate people are able to exercise informed choices, understand the nature of content and services and take advantage of the full range of opportunities offered by new communications technologies. They are better able to protect themselves and their families from harmful or offensive material. (European Parliament and the Council, 2010, p. L95/96)

Media literacy is noted to be a fundamental competence not only for the young generation but also for adults and elderly people, for parents, teachers and media professionals. Media literacy work in European level is supported both by the European Commission and the Council of Europe.⁴⁵

The Audiovisual Media Services directive (AVMS)⁴⁶ requires the Commission to report on the levels of media literacy in all Member States by December 2011 and every three years thereafter (European Parliament and the Council, 2010). The Commission communication "A European approach to media literacy in the digital environment" outlines major achievements and objectives on the area (European Commission, 2007b). Important recent achievements include:

³⁸ http://ec.europa.eu/enterprise/sectors/ict/files/comm_pdf_com_2007_0496_f_en_acte_en.pdf

³⁹ <http://www.ecompetences.eu/>

⁴⁰ http://ec.europa.eu/enterprise/sectors/ict/files/curriculum_guidelines_report_april_2010_en.pdf

⁴¹ <http://eskills.eun.org/web/guest/home>

⁴² See reports at http://ec.europa.eu/enterprise/sectors/ict/documents/e-skills/index_en.htm

⁴³ See Media Literacy website: http://ec.europa.eu/culture/media/literacy/index_en.htm

⁴⁴ Definition on the Media Literacy website, http://ec.europa.eu/culture/media/literacy/index_en.htm

⁴⁵ See Media and Information Society website: <http://www.coe.int/t/dghl/standardsetting/media/>

⁴⁶ http://ec.europa.eu/avpolicy/reg/tvwf/index_en.htm

- Awareness raising through brochures and factsheets,⁴⁷
- Studies on Media literacy and its assessment,⁴⁸
- Internet literacy⁴⁹ website by the Council of Europe,
- Safer Internet Program⁵⁰ for protecting and empowering children online, focusing on end-users such as parents, teachers and children themselves.

4.4 Digital competence

European Parliament and the Council (2006), based on the Communication of DG Education and Culture, have approached digital skills and competences from the lifelong learning point of view, defining Digital Competence as one of the 8 (eight) Key Competences for Lifelong Learning:⁵¹

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: the use of computers to retrieve, assess, store, produce, present and exchange information, and to communicate and participate in collaborative networks via the Internet.

The key competences provide a reference framework to support national and European efforts to achieve the objectives they define. This framework is intended for policy makers, education and training providers, employers and learners. It further defines that essential knowledge, skills and attitudes related to this competence should require:

- *A sound understanding and knowledge of the nature, role and opportunities of IST in everyday contexts:* in personal and social life as well as at work. This includes main computer applications such as word processing, spreadsheets, databases, information storage and management, and an understanding of the opportunities and potential risks of the Internet and communication via electronic media (e-mail, network tools) for work, leisure, information sharing and collaborative networking, learning and research. Individuals should also understand how IST can support creativity and innovation, and be aware of issues around the validity and reliability of information available and of the legal and ethical principles involved in the interactive use of IST.
- *The ability to search, collect and process information and use it in a critical and systematic way,* assessing relevance and distinguishing the real from the virtual while recognizing the links. Individuals should have skills to use tools to produce, present and understand complex information and the ability to access, search and use internet-based services. Individuals should also be able use IST to support critical thinking, creativity, and innovation.
- *A critical and reflective attitude towards available information and a responsible use of the interactive media.* An interest in engaging in communities and networks for cultural, social and/or professional purposes also supports this competence.

DG EAC has supported several studies on key competences and ICT usage for learning and education as a means of both improving digital competence of learners and their preparedness for lifelong learning in information society.⁵² A peer learning group of representatives of the ministries of the Member States⁵³ developed a final report highlighting the importance and suggestions for ICT skills

⁴⁷ See Media Literacy website: http://ec.europa.eu/culture/media/literacy/index_en.htm

⁴⁸ See reports at: http://ec.europa.eu/culture/media/literacy/studies/index_en.htm

⁴⁹ http://www.coe.int/t/dghl/StandardSetting/InternetLiteracy/default_en.asp

⁵⁰ http://ec.europa.eu/information_society/activities/sip/index_en.htm

⁵¹ See website http://ec.europa.eu/education/lifelong-learning-policy/doc42_en.htm

⁵² See reports at: http://ec.europa.eu/education/more-information/moreinformation139_en.htm; See also JRC-IPTS studies for DG EAC at <http://is.jrc.ec.europa.eu/pages/EAP/eLearning.html>

⁵³ <http://www.ksll.net/PeerLearningClusters/clusterDetails.cfm?id=8>

and ICT usage in education and training.⁵⁴ Also DG INFSO has been and is supporting research on assessing and developing the ICT usage at schools and for enhancing learning.⁵⁵ As mentioned before, the Digital literacy concept often used by DG INFSO is linked to Digital competence as a basic requirement that leads to the competence.

The New Skills for New Jobs initiative⁵⁶ lead by DG Employment, Social Affairs and Inclusion recognizes the importance of digital competence across the sectors. The staff working paper,⁵⁷ accompanying the communication on New Skills for New Jobs (European Commission, 2008b) noted: *"Across sectors, transversal and generic skills such as problem-solving and analytical skills, self-management and communication skills, linguistic skills, digital competences are more and more valued on the labor market."* Furthermore, it states that *"the digital competence, the skill for confident and critical use of ICT, is now taught, but progresses are insufficient. ICT is both a topic and a new means for learning new skills for new jobs, providing multiple routes and tools for learning within organized education and through informal peer support with internet-based networking approaches"*. The importance of Digital competence is highlighted also in the report from the Expert group on New Skills for New jobs (2010) set for the Commission.

4.5 Other concepts

There are also other concepts used in the policy documents and initiatives, when referring to skills and competences in the information society. Sometimes these refer to a specific application area, such as 'eGovernment skills', and are used as a generic expression about the skills needs for participating in the activities in question. There are also some more generic concepts with increasing usage in the recent policy discussions, and these will be quickly reviewed in this section.

eCompetence

In the European policy context, the term 'e-Competence' has been used in different meanings and contexts. Currently, the term is mostly used and known from the work of European Committee for Standardisation (CEN) on developing a European e-Competence Framework⁵⁸ for ICT practitioners. This framework defines 36 competences that are relevant for ICT professions. The definition of 'competence' formulated by their experts is: *Competence is "demonstrated ability to apply knowledge, skills and attitudes for achieving observable results"*.⁵⁹ The term e-competence is used to refer in general to these competences recognized and described in the framework.

There is also some variation in the usage of the term, as for example DG INFSO used this term earlier as a generic reference for ICT skills *"...need for Europeans to develop their eCompetences so that they have the correct skills, knowledge and attitude to get the most out of today's dazzling array of Information and Communication Technologies (ICTs)"*.⁶⁰ The term can also be found in the literature, e.g. (Cobo Romani, 2009), as referring to the digital skills needed on a broad level. Therefore, the meaning of the term depends on the context, varying from basic ICT skills to advanced general or specific professional competence.

⁵⁴ <http://www.ksll.net/Documents/Key%20Lessons%20ICT%20cluster%20final%20version.pdf>

⁵⁵ http://ec.europa.eu/information_society/tl/edutra/inno/index_en.htm

⁵⁶ See New Skills for New Jobs website: <http://ec.europa.eu/social/main.jsp?catId=568&langId=en>

⁵⁷ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SEC:2008:3058:FIN:EN:PDF>

⁵⁸ See the European eCompetence Framework website at <http://www.ecompetences.eu>

⁵⁹ http://www.ecompetences.eu/site/objects/download/5256_eCF2.0CWAPartIII methodology.pdf

⁶⁰ http://ec.europa.eu/information_society/activities/einclusion/policy/competences/index_en.htm

Digital fluency

As mentioned before, the term of digital 'fluency' was suggested already in 1999 by US National Research Council (Committee on Information Technology Literacy, 1999). The objective of becoming 'fluent' with technologies is present also in the recent National Education Technology Plan of the United States⁶¹. They suggest an objective of 'Research and information fluency':⁶² *"Students should be able to use a variety of digital media to locate, organize, analyze, and evaluate information from a variety of sources."*

This term has recently also emerged in European policy discussion, as the Expert group on New Skills for New Jobs (2010) suggested setting a new goal for 'digital fluency' of all citizens. They considered this as a fluent level of applying media literacy and digital literacy.

There is no standard definition to digital fluency, but in general, 'fluency' in the context of skills and competences is used to describe a fluent level of their application in all aspects of life. Therefore, digital fluency would mean being fluent in digital competence in the same sense than 'fluency in English' would mean being fluent in using English language for any task or objective.

4.6 Indicators and measurements for digital competence

Specific aspects of digital competence can be measured in different ways, and combined as a proxy of overall digital competence. This is important for individuals who want to reach certain levels, for organizations which need people with given minimum competence levels, and for policy makers who need to follow developments and define further actions to improve people's competence. This section offers a brief overview of the existing European measurements for digital competence, considering their coverage against the objectives of measuring 'knowledge', 'skills', and 'attitudes'.

In general, there are three main types of measurements for the (digital) competence of individuals, with different forms of data collection and measurement items, which leads to different coverage and interpretation needs.

- **User questionnaires** are used to gather information from the users themselves, for example, on paper, online or in telephone surveys. This method typically provides information about people's digital usage, knowledge, perceptions and opinions. These questionnaires can also ask people for their own assessment of their skills, possibly with a guided grid or specific items to help their evaluation. Research has showed that it is difficult to get valid overviews of skills through questionnaires. People (especially young men) overestimate their skills, which they primarily relate to instrumental tool-usage skills (van Deursen, 2010). User questionnaires are used, for example, by the Eurostat Community and Household survey⁶³ and the OFCOM media literacy audit.
- **Analysis of digital tasks** is a more objective means for skills assessment. However, it is more laborious and therefore typically used only for small groups of people and in specific research settings. People are provided with tasks to be completed, and their performance is measured by observing and gathering data about their behaviour during the tasks, and by analyzing the results produced. There are no European-level examples of this type of measurement and assessment, but van Deursen (2010), for example, studied internet skills levels in three studies on different task domains, and found indicators on general internet skills levels of Dutch internet users.

⁶¹ See the website: <http://www.ed.gov/technology/netp-2010>

⁶² This is one of the competences defined in the National Educational Technology Standards for Students (NETS-S), see <http://www.iste.org/standards/nets-for-students.aspx>

⁶³ <http://epp.eurostat.ec.europa.eu/portal/page/portal/microdata/echp>

- **Secondary data gathering and analysis** provides a third method for analyzing digital competence levels and settings. For example, survey questionnaires for experts or organization leaders can provide information about the availability and usage of digital tools and media in their environments. Compiling data from various sources related to digital competence development, e.g. analysis of national policy documents, funding principles, curricula and online services, can provide information about how far specific settings make possible and support developing and using digital competence. For example, the media literacy composite indicator (Celot & Perez Toner, 2009) developed in a study for the European Commission, uses various secondary sources.

The information collected with current indicators and measurement tools at European level is mostly based on survey-based approaches. Obtaining comparable measurements on a large scale is difficult, because there are no generally accepted frameworks for types of ICT usage for example, or knowledge and skills items to be asked. The current major European data sources provide survey-based information on the following aspects:

- **Access and usage.** The Eurostat Community survey gathers information on the types of access to ICT and internet by individuals, households and enterprises and also on the types of devices used for accessing the internet. Furthermore, the questionnaires gather information about the frequency of use and types of activities (selection from a given list) performed. The Riga indicator connects this information with information about the user, with a view to recognizing development among the groups at risk of exclusion.
- **Knowledge and skills.** Eurostat surveys do not specifically measure digital skills or knowledge, but they provide a composite indicator based on the activities that individuals claim to have completed, as a proxy for their skills levels. The Ofcom media literacy audit includes items in the questionnaire that measure the knowledge and understanding of the respondents regarding specific internet-related topics, such as information validation in digital media.
- **Attitudes and motivations.** The Eurostat survey asks people about their concerns about ICT/internet use and their reasons for not using them or not having access at home. However, no information on people's attitudes to use is collected. The Ofcom media literacy audit collects information about people's perceptions of acceptable digital uses.
- **Digital settings descriptors.** The Eurostat surveys gather information from enterprises about their computer and internet facilities, recruitment and employment with digital competence-related vacancies and about training employees on digital competence. Also individuals and employees are asked about their attendance to digital competence training, which shows the reach and coverage of these activities.

A recent Commission document prepared for the Digital Agenda scoreboard⁶⁴ develops an approach based on existing datasets for estimating levels of advanced skills and attitudes to digital competence. It is recognized that no suitable proxies for all aspects exist. Currently, there are no comprehensive and agreed international measurements for any of the components of digital competence. The most advanced efforts can be found from media literacy indicator development and e-Competence definitions for the e-Skills domain.

⁶⁴ http://ec.europa.eu/information_society/digital-agenda/scoreboard/docs/pillar/digitalliteracy.pdf

5 Additional elements for 21st century Digital Competence

In addition to the main concepts introduced in the previous chapter, various new concepts and approaches relating to digital tools and media are emerging (see e.g. Lankshear and Knobel (2008a)). These typically highlight the trend in technology usage towards social and participative digital media and its importance for new forms of communication, expression, living, learning and working.

Perez Tornero and Varis (2010) suggest that the *explosion of information, communication and interaction among people* creates a need for a new *awareness* in a context in which ICT is more vital than ever. They suggest that this awareness must drive the values of a new humanism by situating the person at the core of the media civilisation, emphasise critical sense towards technology, foster a sense of autonomy in global communication context, respect cultural diversity, and revive the idea of the cosmopolitan universal citizen with clear rights and responsibilities. According to the authors, the recent trends in media literacy literature generally emphasise similar aspects.

Jenkins et al. (2006) discussed the new participatory culture, and how education should ensure that every young person has access to it by providing the skills and experience needed to become a full participant. Young people can participate in sophisticated civic, social and leisure activities e.g. through online communities and affiliations where they share digital productions, work together in formal and informal teams, and shape media flows. These often require new types of skills. The necessary new literacies include: play, performance, simulation, appropriation, multitasking, distributed cognition, collective intelligence, (information) judgment, transmedia navigation, networking and negotiation. These literacies emphasise interaction and problem-solving in media-rich social and networked environments.

Recent research and policy discussion both highlight the new needs for working, learning and participating in the digital information society. Transversal and cross-cutting skills in digital environments are particularly important, as is the need to adapt, be innovative and autonomous in the changing world of work and life, where digital tools, environments and media play an integral but changing role. As already mentioned, the Communication on New Skills for New Jobs notes that *"there is a growing demand from employers for transversal and cross-cutting skills, such as problem-solving and analytical skills, self-management and communication skills, linguistic skills, and more generally, "non-routine skills"* (European Commission, 2008b).

These new skills are often labelled as 21st century skills. A working definition provided by the OECD is: *"those skills and competencies young people will be required to have in order to be effective workers and citizens in the knowledge society of the 21st century."* There are different perspectives on what these new skills and competences should include, though they typically agree that digital competence is an integral part of them. This is due to the expectation that working, communication and civic participation will take place in digitally-mediated environments, using digital media tools. Good comparisons and discussion on the topic can be found in for example (Voogt & Pareja Roblin, 2010). Table 3 shows the recent definitions developed by the Partnership for 21st Century Skills (P21)⁶⁵ and Assessment and Teaching 21st Century Skills (ATC21S).⁶⁶

⁶⁵ <http://www.p21.org/>

⁶⁶ <http://atc21s.org/>

Table 1 : 21st Century skills definitions

	P21	ATC21S	
Critical attitude	Learning and innovation skills 1. Critical thinking and problem solving; 2. Creativity and innovation; 3. Communication and collaboration	Ways of thinking 1. Creativity and innovation; 2. Critical thinking, problem solving, decision making; 3. Leadership to learn, metacognition	Learning and problem-solving
Creative attitude		Ways of working 1. Communication; 2. Collaboration (teamwork)	Communication and collaboration
Flexibility and adaptability	Information, media and technology skills 1. Information literacy; 2. Media literacy; 3. Technology literacy	Tools for working 1. Information literacy; 2. ICT literacy	Digital tool and media usage
Cultural awareness		Living in the world 1. Citizenship – local and global; 2. Life and career; 3. Personal and social responsibility (including cultural awareness and competence)	Civic participation
Initiative and autonomy	Life and career skills 1. Flexibility and adaptability; 2. Initiative and self-direction; 3. Social and cross-cultural skills; 4. Productivity and accountability; 5. Leadership and responsibility		Benefiting from digital media in all life aspects
Productivity and responsibility			

The boxes beside the table show skills areas, which are also important building blocks for digital competence. These skills and competences can also be considered as learning objectives, where digital environments are one (and crucially important) space for their demonstration and development. The relationship between digital competence and developing these general skills and competences for the future has been highlighted by various authors in digital competence-related literature. The following sections review briefly related discussions and specific topics raised in the literature.

5.1 Versatile digital media production and usage

Jenkins et al. (2006) point out that digital tools and media have brought about a significant change in the ways of accessing, presenting and interpreting information from static forms (text and still images) to dynamic, graphic and even multi-dimensional forms of delivering information, and furthermore, experiences (animations, interactive simulations, videos, 3D environments, social multiplayer games). Digital tools and the internet have made these powerful media accessible for all, and being able to use and create them increases the benefit individuals can obtain from digital environments and media. Their usage is relevant and beneficial not only for youngsters interested in media and gaming but also for professionals as a means to present information and knowledge in illustrative dynamic forms.

Eshet-Alkalai (2004) proposed and tested a conceptual framework with the following set of literacies as the main components of digital literacy: photo-visual literacy, branching literacy, reproduction literacy, information literacy and socio-emotional literacy. Majority of these elements have to do with the types of media in the technological and networked environments. Understanding visual representations requires different cognitive skills than textual forms of

communication. Furthermore, this definition emphasizes (as did van Deursen (2010)) that people need a capacity for hypermedia and non-linear thinking, accessing and connecting pieces of information when navigating in a self-controlled way.

Eshet-Alkalai (2004) highlights as a major element for digital literacy the 'art of creative recycling of existing materials', labelled as reproduction literacy. This requires multi-dimensional synthetic thinking for creating new combinations from existing materials, but at the same time competence to consider originality, legitimacy and creativity when using other people's work for creating one's own expressions. Erstad (2008) highlights the importance of this 'remixing' in today's digital literacy and students real-life practices, criticizing that schools often lack behind :

Create new by mixing and matching old

Responsible and ethical attitude for digital reproduction

Remixing activities as an essential part of digital literacy represent processes of change in our schools today, from knowledge development being based on predefined content in school books and the reproduction of knowledge provided by the teacher, towards a situation where students take available content and create something new, something not predefined...However, our education system is still fixed in the traditional ideals of literacy. (Erstad, 2008, p. 178)

5.2 Intercultural communication and collaboration

As highlighted by Perez Tornero and Varis (2010), the expansion of internet and various social platforms and communication tools have brought about an unprecedented variety of opportunities for people to connect and participate. Especially social computing applications provide new platforms where people can connect, share and create together and become members or create new networks and communities. Every internet user should be conscious of and able to access relevant networks or communities. Communicating and participating in these environments with people from diverse settings and backgrounds highlights the need to understand and accept diversity in a scale often not experienced in offline environments.

Find relevant networks or communities

Acceptance and appreciation for diversity

An integral aspect of literacy, highlighted already in the review of Bawden (2001) has always been the ability to interpret and use reading and writing as communication means situated to a specific culture and context. Internet makes it possible for people to access settings and communication cultures that differ from their offline environments, and also makes it possible for new, online group or community specific, cultures to be born and flourish. These kinds of community-specific modes of interaction are learned and developed by participants, and newcomers learn them through following and participating. An important competence for participation is to have skills in the forms and ethos of digital communications and to be prepared for different communication cultures in different digital environments.

Flexibility and adaptation to different digital communications cultures

Eshet-Alkalai (2004) suggested *social-emotional literacy* as one of five major elements for digital literacy. This includes both awareness of possible risks but especially skills to benefit from the advantages of global reach in communication and collaboration, made possible by digital environments. He recognizes as important factors willingness to share knowledge with others and ability for collaborative knowledge construction. Teamwork skills, ability to give and receive feedback, negotiate, contribute, share and manage tasks with digital tools and media are very important factors in determining whether

Willingness for sharing and collaboration

Negotiation and task management through digital communications

participation and networking with others becomes a successful and beneficial experience. Digital collaboration may take place within a known work, study or leisure community, but also in open space, such as Wikipedia, where the comments and peer contributors may have very different viewpoints, knowledge levels and cultural background.

5.3 Learning and problem-solving

Martin and Grudziecki (2006) highlight that digital literacy is different for each individual and, furthermore, vary according to one's particular life situation. Therefore, development of digital literacy is a lifelong and individual process, of which each person must take personal responsibility. Skills and attitudes for reflecting on one's own digital literacy development and further needs is, therefore, an important competence in itself for all digitally literate persons. Digital environments also provide opportunities, and are used especially by young people, to explore and develop their digital identity, by creating different kinds of 'public selves' in different spaces. Online participation also provides an opportunity to develop for example different expert identities, through developing and showing one's work and contributions.

Ongoing personal digital development

Demonstrate expertise and learning outcomes

Through digital networks, people can connect with each other because of joint interest, collective task or simply for social connection, building dynamic networks and communities. People from all age groups are participating in different types of online collaborative activities, which can support work, learning, and citizenship (Ala-Mutka, 2008, 2010). This requires skills for building and maintaining one's own digital resources, whether networks, people or material resources, as relevant for the current tasks and interests. Efficient digital resource collection and management can provide significant benefits for one's tasks at work, study or leisure, by providing easy access to relevant advice and support when needed.

Collect and manage connections and resources for learning and task support

In the multiple paths, resources and options of the internet, it is important to have skills to self-directed and goal-oriented activities. Metacognitive skills for recognizing knowledge needs, determining objectives, planning the activities, reflecting progress and evaluating outcomes are in a crucial role in benefiting from the potential of digital environments. This is supported by skills to find valid and relevant options for learning through digital means (formal courses, self-study materials, community of practice), taking into account the desired type of learning outcome and its recognition. Ability to benefit from different types of learning approaches (self-directed, teacher-lead, collaborative) extends the learning options available. Especially self-organising communities provide opportunities to collaborative knowledge construction on almost any topic, but benefiting from it requires skills for personal reflection and autonomy together with collaboration skills. If no suitable opportunities are found, an active learner can set up a new group of its own in order to explore the topic and share ideas.

Plan, execute and evaluate goal-oriented activities.

Find or create relevant options for personal and professional learning

Collaborative learning and knowledge construction

5.4 Productive and safe participation

Cobo Romani (2009) reviewed the main concepts he considered as forming the competence for digital society, and introduced as a new element *e-awareness*. His e-awareness highlights the importance of understanding the potential of ICT as a medium for lifelong learning and citizenship, taking

Awareness of ICT potential for citizen participation, work, leisure and learning

into account legal and ethical aspects. This positive perception is very important, and should be broader than the current personal skills for digital activities. For example, managers, leaders and policymakers do not need to have personal skills for all possible activities in the digital world, but should have the understanding of the existing potential of ICT-based tools, media and processes and their strategic importance.

Know about legal and ethical issues in digital media

Under the LINKED project,⁶⁷ Ilomäki et al. (2010) reviewed and studied digital competence, suggesting that the evolving concept consists of 1) Technical skills, 2) Abilities for meaningful usage in work, study and life, 3) Abilities for critical evaluation, and 4) Motivation to participate in digital culture. The other elements have already been covered in this report, but the aspect of motivation is an important new point to be raised. Digital divides come sometimes from the non-interest of people or groups to take up and use digital technologies. This relates to perception of the utility of these tools for oneself. If no need for new tools or processes is perceived, this easily leads into lack of interest in learning and in taking up new tools.

Interest to use ICT for personal and community benefit

Applying digital tools and media for one's personal needs should be the ultimate objective of all the various skills and literacies. For example, Martin (2008) concluded that digital literacy involves being able to carry out *successful digital actions embedded within life situations*, which may include work, learning, leisure, and other aspects of everyday life. As already mentioned above, this requires awareness of the potential of ICT for these situations, and then successful integration of digital tools and media for one's daily tasks. Following this integration, one should be able to consider improvements and new objectives made possible by the new tools and processes for personally valuable objectives, i.e. innovate in one's daily contexts of life, learning, work and civic participation.

Benefit from digital activities in all life situations (work, civic, social and leisure)

Improve and innovate with ICT

Bawden (2008) suggests moral/social literacy as an important element of digital literacy, referring to sensible and correct behaviour in digital environments. One needs to have skills to protect one's own personal information and other digital materials, understanding the possible risks relating to openness and global visibility of digital media. When creating communications and expressions, i.e. establishing a "digital identity" in a specific environment, one must consider visibility, permanence and traceability of the digital actions and content. Another important issue in the global, information filled spaces with people from all over, with different skills, attitudes and intentions, is to take care of one's own security and privacy and have a healthy critical attitude for new contacts. Eshet-Alkalai (2004) points out that users of the cyberspace need to know how to avoid "traps" as well as derive benefits from the advantages of digital communication, as both of these are there:

Create and manage digital identities

Sensible and correct behaviour (privacy, security)

".. it is not only a global village, it is a jungle of human communication, embracing an infinite quantity of information, true and false, honest and deceptive, based on good will and evil."

⁶⁷ LINKED project is partly funded by DG EAC. The project products and deliverables can be accessed at <http://linked-project.wikispaces.com>

5.5 Enriched conceptual mapping

So far in this report, several elements have been recognised as important for developing digital competence for contemporary and future society. This chapter has highlighted issues which have often been included in the main concepts, and has also highlighted some new cognitive and attitudinal aspects. Based on the reviews in Chapters 3, 4 and 5, Figure 2 suggests groups of skills and attitudes to be considered as important constituents of Digital Competence. These groups have been situated close to the concepts where they are typically emphasized most or to which they are most relevant. However, as mentioned previously, the mapping of these constituent groups together with the concept discussion does not aim to create a master concept. It is simply meant to help the reader to better understand the major constituents of digital competence suggested in this report. These will be elaborated and structured in the next chapter.

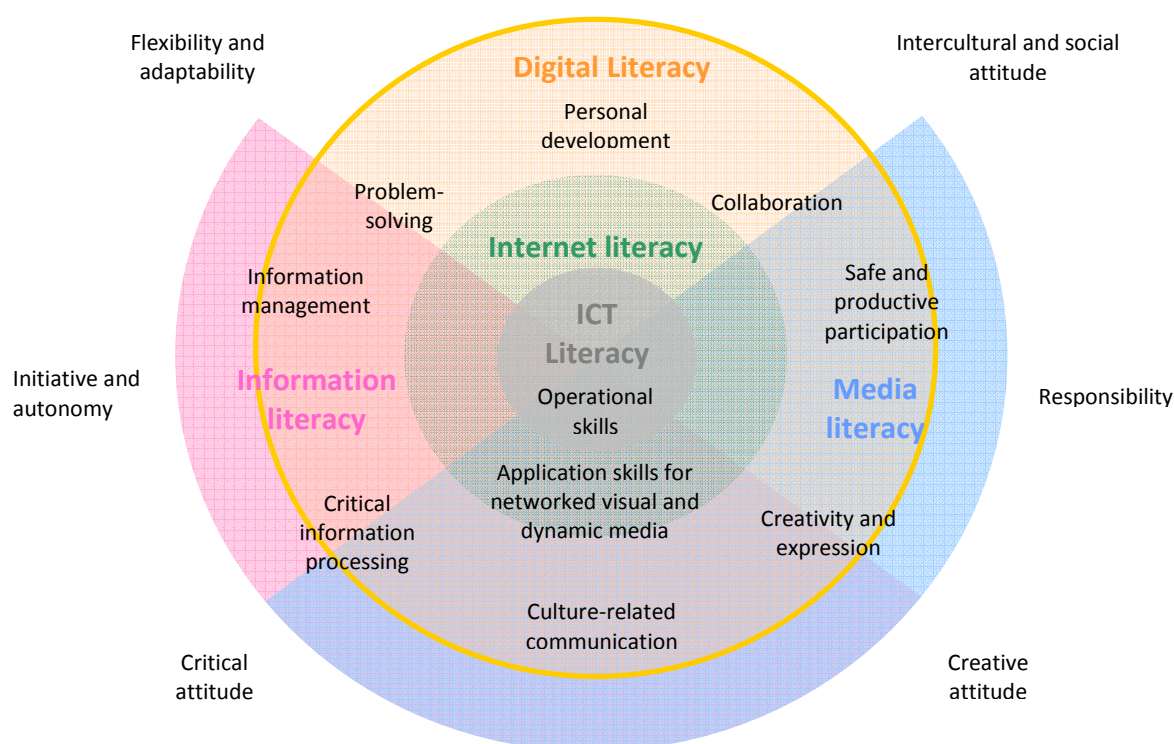


Figure 2 : Digital Competence landscape for 21st century

6 Digital competence for 21st Century

This chapter, as a contribution to the first phase of the DIGCOMP project, suggests a mapping of knowledge, skills and attitudes elements to be considered in learning and teaching digital competence. The objective is not to go into the detail of specific learning items, or to design how these should be assessed. This mapping will provide a suggestion, based on the review and discussion of the previous chapters, of the main digital competence areas and their relationships.

6.1 Construction of the model

The conceptual model is based on the elements recognized as “building blocks” in the review of digital competence-related concepts and issues in the previous chapters.

- All of the building blocks were collected and grouped under specific themes.
- The building blocks were coloured as ‘instrumental’ knowledge and skills (red), ‘advanced skills’ (blue), or higher level competence and attitudes (green).
- Both colouring and wording of building blocks were iteratively refined when overlaps or imbalances between groups appeared. Therefore, there has been two-way interaction between the creation of the model and recognition of the elements.
- Finally, the consistency of the model, elements, and literature discussion was reviewed and revised (removing duplicate discussion, moving misplaced discussion, and where necessary, adding more content and support from relevant literature).

As described, the overall method was not to carry out a strictly scientific literature analysis and then fit the model to the analysis results. Instead, the objective was to provide a logical model that 1) describes digital competence with knowledge, skill and attitude elements; 2) provides a guiding structure for digital competence components and their relationships for further detailing and elaboration; 3) is built from elements that are justified by research literature and can be traced back to it; and 4) is structured in such a way that the structural components can be linked with research and policy literature.

The following three research studies (A, B, C) have influenced the structuring of the model:

A. Based on reviewing several authors, Bawden (2008) drew together a model that includes four main elements of digital literacy, summarised in Figure 3. The **underpinnings** give the basic skill sets which must be present, together with **background knowledge**, which gives the necessary understanding of the way in which digital and non-digital information is created and communicated, and of the various forms of resources which result. **Competences** are basically those elements of digital literacy proposed by Gilster (1997). **Attitudes and perspectives** reflect the ultimate purpose of

digital literacy to help each person learn what is necessary for their particular situation, with an understanding of sensible and correct behaviour in the digital environment. The model proposed in this report makes use of a similar structure of obligatory instrumental elements, several essential

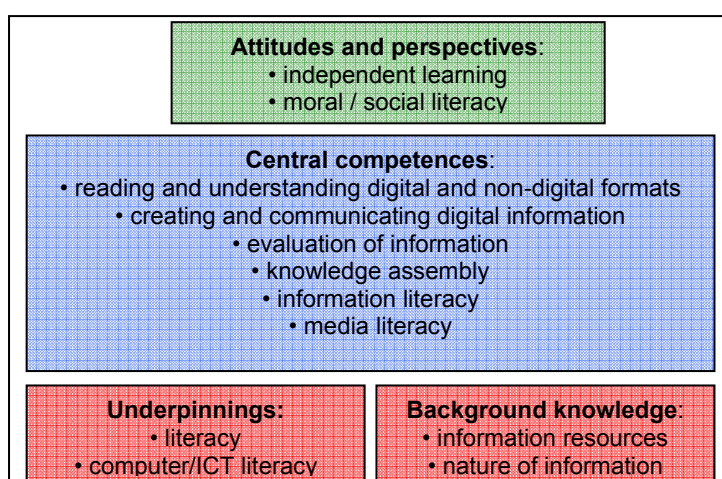


Figure 3 : Digital literacy elements from Bawden (2008).

skills elements supporting each other, and finally crucial attitudes for effective application of the skills in digital environments.

B. The DigEULit project developed a conceptual model and a framework approach and tools for digital competence (Martin & Grudziecki, 2006). These authors highlighted that digital literacy cannot be certified with a standardized diploma, but must be mapped onto the situation of the individual, using a personal development profile. They suggest three stages of development, as illustrated in Figure 4: **digital competence**, **digital usage**, and **digital transformation**. These levels describe the need for all people to have generic digital competence, on top of which they should develop their personal digital usage for professional and other specific purposes. This also leads to innovation and enables creativity through digital transformation in processes and activities at the individual and societal level. The model proposed in this report has a similar emphasis on considering personal application of digital competence as an important element to be developed on the basis of generic skills.

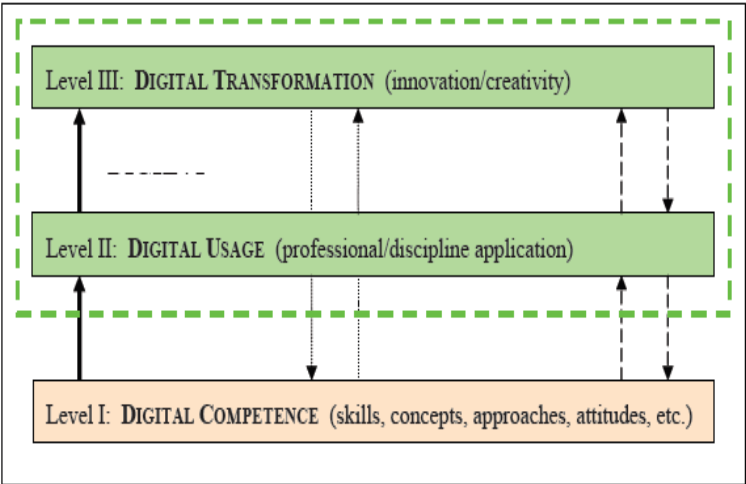


Figure 4 : Digital literacy stages by Martin & Grudziecki (2006).

C. Van Deursen (2010) developed and validated a model for internet skills with four main categories, listed in order of increasing complexity: **operational skills** for using internet browsers, search engines and forms; **formal internet skills** for navigating in the internet and maintaining a sense of location; **information internet skills** for locating, selecting and evaluating information; and **strategic information skills** for successful goal-oriented activities in the internet. The information and strategic skills also include critical and goal-oriented attitudes in their application. In their model, they concentrated on networked information skills. Therefore, it is not directly comparable to overall digital competence, as it is lacking, for example, media creation, communication and collaboration. However, it elaborates on one important element of digital competence and provides useful viewpoints. The model proposed in this report takes note of Van Deursen’s differentiation between medium-related and content-related skills and the research results obtained in testing the model.

Content-related	Strategic information skills Decide goals, act towards reaching them, make right selections, gain the benefits
	Information internet skills Choose resources, define searching terms, select information, evaluate sources
Medium-related	Formal internet skills Navigate with hyperlinks and menus, avoid disorientation in changing web location
	Operational skills Use internet browser, save and open file formats, operate search engines and eForms

Figure 5 : Summary of the Internet skills definition of van Deursen (2010).

6.2 Structural elements of the model

Considering the digital competence-related structures in the literature, building blocks recognized from the concept review were grouped under similar topic headings. Within the topic groupings, skills were arranged according to perceived increasing cognitive complexity where possible. Knowledge and skills were not separated as specific items, as on this level knowledge and skills are related (skills are about being able apply knowledge), though one must note that in progressive

learning and assessment, knowledge and skills are often treated differently. However, aspects of attitudes (ways of thinking that guide skills application) were separated and grouped under topics of their own. Figure 6 shows this organization of revised building blocks, where smaller building blocks are combined to make bigger ones and duplicates are removed.

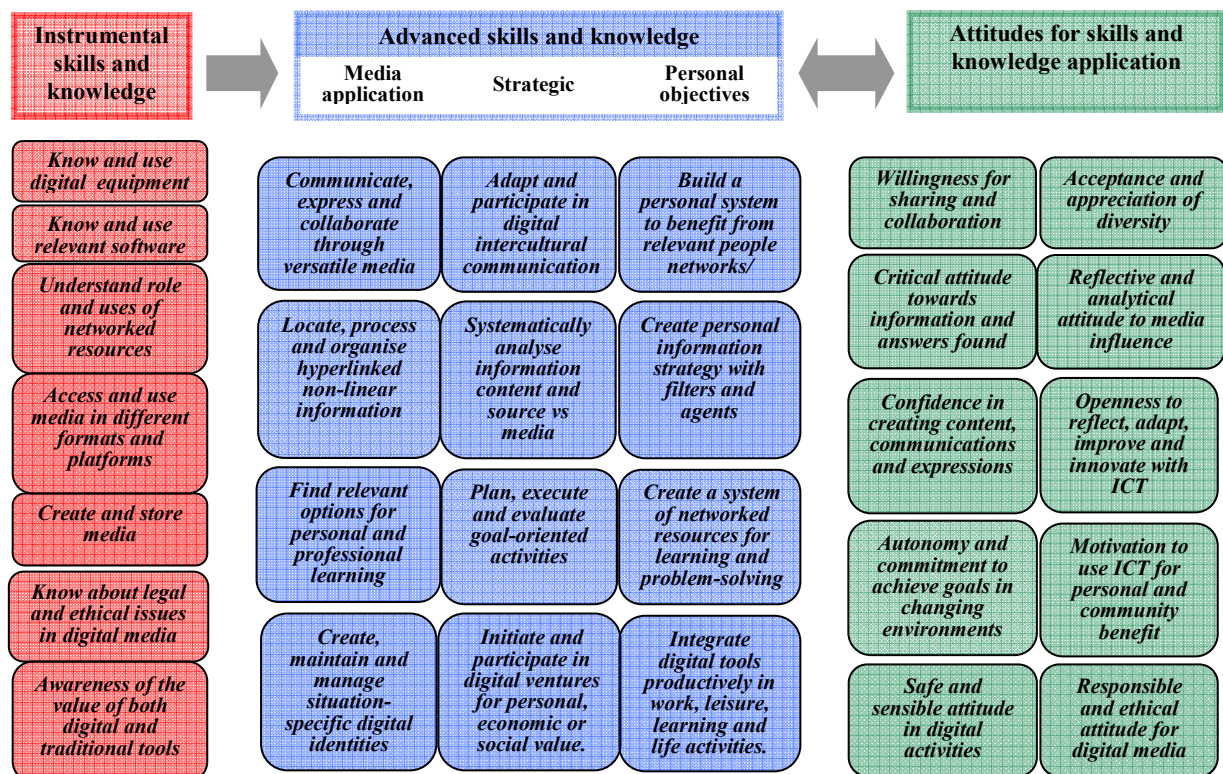


Figure 6 : Knowledge, skills and attitude items contributing to Digital Competence

6.2.1 Instrumental skills and knowledge

Instrumental skills and knowledge contain the abilities needed to use digital tools, considering the nature of networked, visual, dynamic etc. digital media. Not all instrumental skills are necessarily simple: while there are basic technical skills related to tool usage, there are also advanced instrumental skills relating to digital networked media. For every advanced skill area of digital competence, there are specific tools and media-related skills that support it. Many instrumental skills support and are required for several advanced skills at the same time.

Instrumental skills and knowledge are a precondition for effectively applying other skills in digital environments and can enhance the more advanced skills by making new activities possible. For example, an understanding of agents, filters and information flows in networked digital media enhances information skills; the ability to create, manipulate and upload digital photos enhances opportunities for creativity; access and skills to use social networking and gaming sites can support participation, learning and social well-being.

Learning and development of this DC component

Instrumental skills are a prerequisite for developing and applying further related advanced skills. However, not all people need all of them: which instrumental skills they should learn depends on their personal objectives as regards digital competence. Basic knowledge of opportunities, legal and ethical aspects and operating skills are required for all before they start on any independent digital

activities. However, they should be able to select more the advanced instrumental skills (e.g. using spreadsheet software, creating a social network profile) according to what is relevant for them.

It is possible to learn instrumental skills and knowledge on specific technical courses, and this is often the case. Many basic ICT courses use a tool-oriented understanding of digital competence (ICT literacy) and therefore concentrate on instrumental skills in teaching and assessment.

Related research or examples

Existing frameworks provide good examples about teaching and assessing instrumental skills. For example, the European Computer Driving Licence (ECDL)⁶⁸ provides an elaborated framework of learning items of instrumental skills for digital tool and media application. Furthermore, Hargittai (2005) and van Deursen (2010) have developed indicators that can be used for core skills that support computer, internet and digital media usage.

Van Deursen (2010) shows that internet experience can increase these instrumental skills. Furthermore, these skills are conditional for successful application of advanced skills. People with advanced skills can be hampered by their lack of instrumental skills to such an extent that they cannot complete their tasks in the internet environment. Young people often have higher levels of instrumental skills than adults and the elderly, because of their greater internet usage experience.

6.2.2 Advanced skills and knowledge

Advanced skills and knowledge describe in the suggested model the main areas that people should learn to apply in digital environments, for any content domain and task objective. These skills and knowledge are organised in a progressive order: ability to apply digital tools and media for specific tasks; strategic skills for benefiting from digital environments; integration of these digital aspects in digital environments for one's own daily life and objectives.

Learning and development of this DC component

Van Deursen (2010) suggests that content-related internet skills are best learnt in a context of domain-specific tasks. Therefore, critical information skills development for example should be embedded into topic-based learning, such as history classes at school, job search training for the unemployed, etc.

The progressive order of skills - first those targeted to specific functional tasks, then on a strategic level and finally integrated into personal objectives - is also the suggested order for their development. Later skills benefit from the earlier ones and are not possible to acquire without them. However, it is also possible to consider developing them in parallel on a specific topic.

There is a wide selection of skills and knowledge in this category, and not all people need all of them, particularly if their digital tool and media usage is limited. Therefore, the Digital Competence teaching/learning approach should select the relevant skills areas and levels according to target group needs.

Existing research or examples

It has been shown that surveys do not necessarily provide highly valid measurements of advanced skills. In self-assessments, young people and men often consider they have higher skills levels than is shown in performance assessments (van Deursen, 2010). Older people reveal low levels of self-confidence in surveys, but may have good skills when measured. Van Deursen (2010) demonstrates

⁶⁸ <http://www.ecdl.com/>

how information skills can be operationalised into measurable tasks and indicators. A similar approach could also be used for other advanced skills aspects.

van Deursen (2010) found that adults and the highly educated typically had higher levels of advanced (information) skills than young people, although young people had more experience of ICT and internet usage. The results of Eshet-Alkalai (2004) support this finding.

6.2.3 Attitudes

Attitudes represent ways of thinking and motivations for acting and therefore they shape people's activities in digital environments. Some of these attitudes are often considered integral to the skills application, for example *critical information skills*. However, they are separated here to be presented as attitudes, as they are needed and are applicable in all skills areas.

Learning and development of this DC component

During this study, no specific examples were found suggesting ways to learn the attitudes perspective of digital competence. As these are related to skills, it is logical to learn them in the context of skills application in specific topic domains or relating to specific objectives. Furthermore, the acquisition of desired attitudes can be encouraged by providing personal positive experience of them during the learning phase. For example, teachers' confidence in personal ICT integration as a collaborative educational tool can be encouraged by using collaborative ICT approaches in their own training and teaching practice; critical attitudes can be encouraged by showing their benefits in the skills application for a specific task; the benefits of an autonomous attitude can be demonstrated by showing the potential economic, social and learning benefits for a person with the independence and skills to take advantage of them.

Existing research or examples

Because of the nature of 21st century skills definitions, related initiatives highlight attitudinal aspects and values, and provide good examples. Current initiatives for 21st century competences are developing both learning frameworks and assessment approaches. Two main initiatives worth looking into in order to elaborate the attitude elements for learning and teaching digital competence are the Partnership for 21st Century Skills (P21)⁶⁹ and Assessment and Teaching 21st Century Skills (ATC21S).⁷⁰

⁶⁹ <http://www.p21.org/>

⁷⁰ <http://atc21s.org/>

6.3 Digital Competence conceptual model

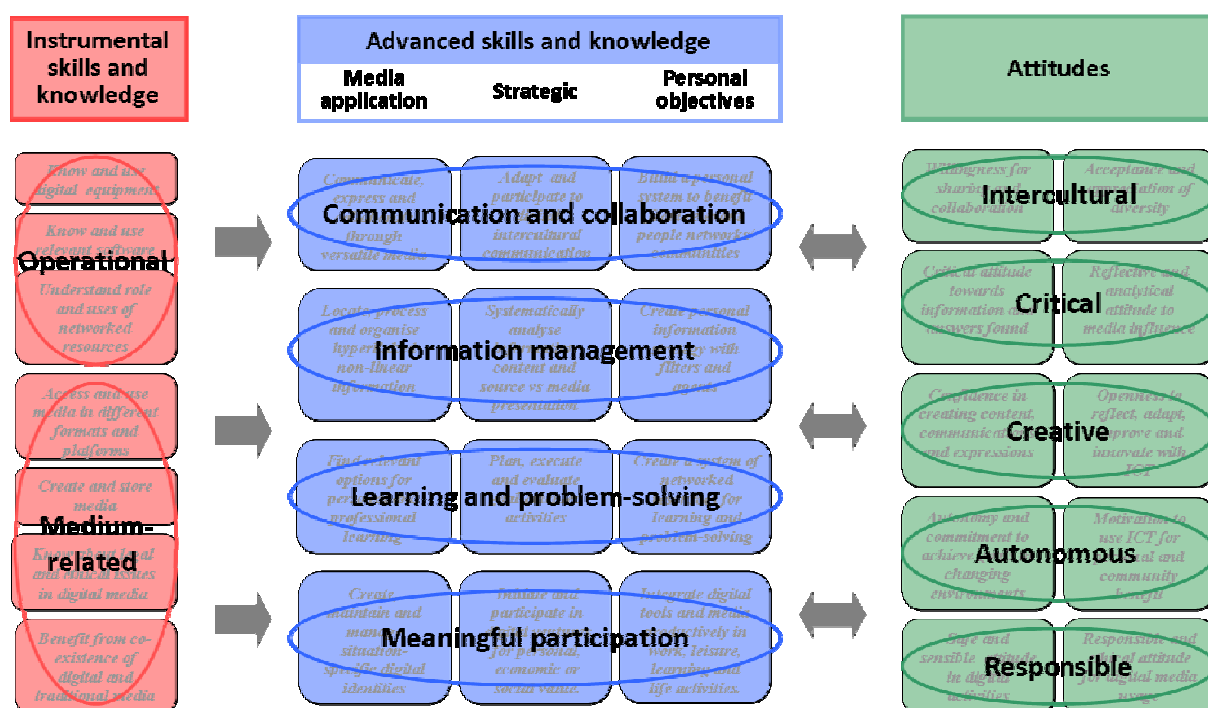


Figure 7: Proposed Digital Competence conceptual model

In the proposed digital competence model, the recognised building blocks were grouped under meaningful clusters within the overall structure. The objective was to identify clusters which would be logically composed of the elements mentioned, and at the same time be backed up as digital competence areas as such. This led to a higher level conceptual model with 6 skills and knowledge areas and 5 attitude areas. Figure 7 presents these areas and how they map onto the organisation of elemental items shown in Figure 6.

The elements underpinning the areas in the model are not on the level of concrete learning tasks or assessment items. They show topics that should be addressed and elaborated in more detail when planning curriculum content or survey measurements. The building blocks recognized in the concept review chapters provide more details for readers who want ideas on how to go forward in implementing the conceptual model. The main competence areas are described below:

Operational skills and knowledge. Operational skills and knowledge reflect the technical operation aspects of digital tools, such as using a mouse, using specific software, or file storage operations. The knowledge aspect relates to awareness of the existence and understanding of the usage of these tools and functionalities. These basic skills and knowledge are prerequisites for any subsequent use of these tools.

Medium-related skills and knowledge. Medium-related skills and knowledge refer to understanding and ability to purposeful and safe use of relevant media. These skills are not only operational but also require understanding and skills for specific opportunities, and awareness of the limitations and possible risks of the medium. This DC area includes aspects such as skills relating to digital networked media (navigation, bookmarks, RSS feeds), multimedia (manipulating digital photos, creating an online profile) and safety in digital global environments (personal privacy, technical security risks).

Communication and collaboration. The skills to effectively express and communicate, understanding the potential and limitations of each type of media format, are crucial in interacting and collaborating in digital environments. Productive collaboration with possibly global reach, furthermore, requires appreciation of and adaptation to the perspectives of people from different cultures. Ultimately, one should be able to construct and maintain a system of personal communication links with relevant people and networks, and thereby benefit from digital environments in extending social and professional networks outside the physical environment.

Information management. Information-related skills and competences are essential in digital environments where the quantity of available information is overwhelming and the quality varies greatly. Everyone needs skills to locate, critically process and organize information for their personal purposes. The practice of analyzing and evaluating information content vs. media presentation and production circumstances needs to become personally integrated and embedded in all internet activities. Ultimately, people should be able to develop their personal information systems for keeping updated and organized with filters for incoming information and personal and shared resource maintenance.

Learning and problem-solving. All people should acquire skills and knowledge to benefit from the digital tools and media for learning, working and problem-solving. People should be able to effectively find and evaluate learning opportunities for their current needs, in both the professional and personal sphere. They should learn to benefit from the right people and resource networks for finding advice. Furthermore, they should have the skills to determine learning goals, plan and carry out activities and achieve desired results in a self-regulated process in the multitude of possible digital paths. Everyone should be able to create their personal system of networked learning resources, organisations and people to support their learning and problem-solving needs.

Meaningful participation. Everyone should be able to find and participate in digital activities, whether individually or in collaboration with others, for personally or socially relevant purpose. They should also be able to locate activities and participation opportunities which are not necessarily available in the local context but would benefit them. This requires skills to understand and create digital identities, in a way suitable for each activity and environment. Ultimately, everybody should be aware of and search for opportunities to integrate digital tools in a meaningful way for their work, learning and life activities so that digital activities become a natural productive part of everyday life as a means of having personal impact on society.

Intercultural and collaborative attitude. As mentioned before, getting the most benefit from digital communications requires an ability to interact with people from different cultures. This is also required for successful collaboration in online communities where people do not necessarily know each other offline, and the success of the interaction depends on their skills to understand and negotiate different perspectives with an open attitude. This relates to a generally social and collaborative attitude, willingness to share and exchange one's ideas and contributions with others for a joint purpose or interest.

Critical attitude. As reviewed in previous sections, a critical attitude is necessary in taking actions in a global online environment where people participate and resources are created with various intentions and competences. As opposed to traditional published media, most often there are no official checks on who can participate or what can be published. Users need embed to their digital activities reflections and considerations about the quality of information and to be constantly conscious of the production circumstances and reliability of the media, the source, and also the suitability of different digital tools and media for their tasks.

Creative attitude. Digital tools and environments provide plenty of resources for almost any need, but the most benefit can be achieved by becoming an active participant and producer instead of a traditional consumer only. Being open and interested in creating personal expressions, joint projects with friends or launching activities for a community provide opportunities for many social and economic benefits on a personal and wider scale. Creativity with digital tools and media can benefit work, learning or hobbies by providing new and innovative means of carrying out tasks or presenting results. Being open to learn or invent, and to adapt and mould existing ways into new models is necessary.

Responsible attitude. Networked digital environments provide plenty of opportunities but activities in them also provide risks for oneself and others. In addition to being critical towards resources and other people, it is important to be always conscious of the visibility and possible consequences of one's own activities. Users must have an understanding of safety issues and embed them into all their interactions and activities in digital environments. They must also consider ethical issues when using materials from other people, or creating materials (photos, posts) that may concern or have impact on others.

Autonomous attitude. As highlighted by many authors, the internet is not a well-structured resource with clear rules and modes of behaviour. One must always be conscious of one's own objectives (nobody else will do it for you) and strive towards them in order to get the most benefit from the internet. This means having the interest and perseverance to search for the best digital tools and media for one's tasks, keeping one's goals clear, and also adapting to and reflecting new circumstances when necessary, in the continuously changing technical environments and social practices for their usage.

6.4 Summary

This chapter has proposed a conceptual model for digital competence that is built on and can be linked back to the concepts and discussion of digital competence in the research and policy literature. As regards this model, the main issues to be noted are:

- It provides a high level overview of the areas that should be covered in order to fully equip people with digital competence for 21st century. The model follows the element structure of EQF by elaborating needs for knowledge, skills and attitudes.
- It does not provide concrete learning or assessment items and is not directly operationalizable into any curricula. However, the report provides a number of issues under each main DC area which can be used as guidelines for more detailed elaboration.
- It suggests relationships between topic areas, which can be used to guide the progress and order of learning. There are prerequisite relationships between the skills and knowledge which should be observed.
- It is structured in a way that allows us to consider the specific needs and levels of different target groups. This can be used as a higher level content planning for different purposes (e.g. up to which level education is provided by government, employer or needs to be paid by the person him/herself).

7 Conclusions

This report has reviewed needs for digital competence, different concepts used to describe and understand it, and also related policy approaches and measurements. Based on these, it suggests a conceptual model for developing digital competence. The model proposes higher level aspects, not detailed enough to be used as learning or assessment items as such. Rather, the objective is to highlight all the different knowledge, skill and attitude areas that should be considered when developing digital competence. The proposed structure is sufficiently flexible to allow the concept of digital competence to be tailored to different target groups of learners and digital users.

The main conclusions of the study presented in this report can be summarized as follows:

- Ensuring digital competence for all is necessary. It provides important benefits and the lack of it can lead to various dangers for children, young people, workers, the elderly, groups at risk of exclusion and all citizens in general. The digital competence needed today does not automatically follow from the use many people make of the internet or their computers.
- The digital competence landscape is multi-layered, and an all-encompassing widely applicable and agreed single definition is difficult, if not impossible, to achieve. It is more useful to aim for an approach which recognizes the main areas and can be adapted according to the needs of different target groups and situations.
- Digital competence for 21st century must include instrumental knowledge and skills for tool and media usage, advanced skills and knowledge for communication and collaboration, information management, learning and problem-solving and meaningful participation. These must be supported by intercultural, critical, creative, responsible and autonomous attitudes.
- Instrumental knowledge and skills are a precondition for developing or using more advanced skills. These must be ensured for all at an appropriate level. However, it is crucial to realize that these instrumental skills are not enough as such; digital competence must be considered as a higher level concept than simply being able to use digital tools and media. The development of safe and productive attitudes should be integrated in learning all levels of skills.
- Developing a high-level conceptual model for digital competence is only a first step. Collaboration with stakeholders and elaboration into operationalised learning and assessment items are needed in order to develop guidelines that are usable and useful on a European scale for supporting digital competence development.

The study described in this report will contribute to and be developed further in the IPTS DIGCOMP project. The reader is encouraged to follow the progress and results of the project at the project website: <http://is.jrc.ec.europa.eu/pages/EAP/DIGCOMP.html>

References

- Ala-Mutka, K. (2008). Social Computing: Study on the Use and Impacts of Collaborative Content *IPTS Exploratory Research on the Socio-economic Impact of Social Computing*: Institute for Prospective Technological Studies, Joint Research Centre, European Commission.
- Ala-Mutka, K. (2010). Learning in Informal Online Networks and Communities: Institute for Prospective Technological Studies, Joint Research Centre, European Commission.
- Ala-Mutka, K., Punie, Y., & Redecker, C. (2008). Digital Competence for Lifelong Learning: Institute for Prospective Technological Studies, Joint Research Centre, European Commission.
- Bawden, D. (2001). Information and digital literacies: a review of concepts. *Journal of Documentation*, 57(2), 218-259.
- Bawden, D. (2008). Origins and Concepts Of Digital Literacy. In C. Lankshear & M. Knobel (Eds.), *Digital Literacies: Concepts, Policies & Practices* (pp. 17-32).
- Bennett, S., Maton, K., & Kervin, L. (2008). The 'digital natives' debate: A critical review of the evidence. *British Journal of Educational Technology*, 39(5), 775-786. doi: 10.1111/j.1467-8535.2007.00793.x
- Brandtweiner, R., Donat, E., & Kerschbaum, J. (2010). How to become a sophisticated user: a two-dimensional approach to e-literacy *New media & society*, 12(5), 813-833. doi: 10.1177/1461444809349577
- Brouwer, P. (1997). Hold on a Minute Here: What Happened to Critical Thinking in the Information Age? *Journal of Educational Technology Systems*, 25(2), 189-197.
- Campbell, B. (1990). What is literacy? Acquiring and using literacy skills. *Aplis*, 3(3), 149.
- Catts, R., & Lau, J. (2008). Towards Information Literacy Indicators. . Paris: UNESCO.
- Celot, P., & Perez Tonero, J. M. (2009). Study on Assessment Criteria for Media Literacy levels. Final report.
- Chou, C., Chan, P. S., & Wu, H. C. (2007). Using a two-tier test to assess students' understanding and alternative conceptions of cyber copyright laws. *British Journal of Educational Technology*, 38(6), 072-1084.
- Cobo Romani, J. C. (2009). Strategies to Promote the Development of E-competencies: ESRCfunded Centre on Skills, Knowledge and Organisational Performance Cardiff and Oxford Universities.
- Cody, M. J., Dunn, D., Hoppin, S., & Wendt, P. (1999). Silver surfers: Training and evaluating Internet use among older adult learners. *Communication Education*, 48(4), 269-286.
- Committee on Information Technology Literacy. (1999). *Being fluent with information technology*. Washington, DC: National Academy Press.
- ComScore. (2011). 2010 Europe Digital Year in Review.
- ConsumerReports.org. (2011). Online exposure - Social networks, mobile phones, and scams can threaten your security. *Consumer Reports*, (June 2011). Retrieved from <http://www.consumerreports.org/cro/magazine-archive/2011/june/electronics-computers/state-of-the-net/online-exposure/index.htm>
- Council of the European Union. (2010). 2010 joint progress report of the Council and the Commission on the implementation of the 'Education and Training 2010 work programme'. *Official Journal of the European Union*, C117/111.
- Deere, G. (2006). *The power of blogs in Europe*. Ipsos MORI. Retrieved from <http://www.ipsos-mori.com/polls/2006/blogging.shtml>
- DiMaggio, P., Hargittai, E., Celeste, C., & Shafer, S. (2004). Digital inequality: From unequal access to differentiated use. In K. Neckerman (Ed.), *Social Inequality* (pp. 355-400). New York: Russell Sage Foundation.
- Dupuis, E. A. (1997). The information literacy challenge: addressing the changing needs of our students through our programs. *Internet Reference Services Quarterly*, 2(2/3), 93-111.
- Erstad, O. (2008). Chapter eight: Trajectories of Remixing. In C. Lankshear & M. Knobel (Eds.), *Digital Literacies: Concepts, Policies & Practices* (pp. 177-202). New York ; Oxford: Peter Lang.
- Eshet-Alkalai, Y. (2004). Digital Literacy. A Conceptual Framework for Survival Skills in the Digital Era. *Journal of Educational Multimedia & Hypermedia*, 13(1), 93-106.
- European Commission. (2007a). E-skills for the 21st century: fostering competitiveness, growth and jobs COM(2007) 496 final.

- European Commission. (2007b). A European approach to media literacy in the digital environment *COM(2007) 833 final*.
- European Commission. (2008a). Digital Literacy Report: a review for the i2010 eInclusion Initiative *European Commission staff working document*.
- European Commission. (2008b). New Skills for New Jobs. Anticipating and matching labour market and skills needs *COM(2008) 868/3*.
- European Commission. (2010a). A Digital Agenda for Europe *COM(2010)245 final*.
- European Commission. (2010b). Europe 2020: A strategy for smart, sustainable and inclusive growth *COM (2010) 2020*.
- European Parliament and the Council. (2006). Recommendation of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning. *Official Journal of the European Union*, L394/310.
- European Parliament and the Council. (2008a). Decision of the European Parliament and of the Council of 16 December 2008 concerning the European Year of Creativity and Innovation (2009). *Official Journal of the European Union*, L348/115.
- European Parliament and the Council. (2008b). Recommendation of the European Parliament and of the Council on the establishment of the European Qualifications Framework for lifelong learning. *Official Journal of the European Union*, C111/111.
- European Parliament and the Council. (2010). Directive 2010/13/EU of the European Parliament and of the Council of 10 March 2010 on the coordination of certain provisions laid down by law, regulation or administrative action in Member States concerning the provision of audiovisual media services (Audiovisual Media Services Directive). *Official Journal of the European Union*, L95/91-L95/24.
- Expert Group on New Skills for New Jobs. (2010). New Skills for New Jobs: Action Now. A report by the Expert Group on New Skills for New Jobs prepared for the European Commission.
- Fox, S., & Jones, S. (2009). The Social Life of Health Information: Pew Internet & American Life Project.
- Gee, J. P. (2007). *Good video games + good learning : collected essays on video games, learning, and literacy*. New York: P. Lang.
- Get Safe Online. (2007). Social networkers and wireless networks users provide "rich pickings" for criminals. Dudley: Get Safe Online.
- Gilster, P. (1997). *Digital literacy*. New York ; Chichester: John Wiley.
- Hargittai, E. (2005). Survey measures of web-oriented digital literacy. *Social Science Computer Review*, 23(3), 371-379. doi: 10.1177/0894439305275911
- Hargittai, E. (2009). An Update on Survey Measures of Web-Oriented Digital Literacy *Social Science Computer Review*, 27(1), 130-137.
- Hargittai, E. (2010). Digital Na(t)ives? Variation in Internet Skills and Uses among Members of the "Net Generation". *Sociological Inquiry*, 80(1), 92-113. doi: 10.1111/j.1475-682X.2009.00317.x
- Horton, F. W., Jr. (1983). Information literacy vs. computer literacy. *Bulletin of the American Society for Information Science*, 9(4), 14-16.
- Hunter, B. (1983). *My students use computers : learning activities for computer literacy*. Reston: Reston Publishing.
- Ilomäki, L., Kantosalo, A., & Lakkala, M. (2010). *What is digital competence*. LINKED project. Retrieved from http://linked-project.wikispaces.com/file/view/Digital_competence_LONG+12.10.2010.docx
- Jenkins, H., K., C., Purushotma, R., Robison, A. J., & Weigel, M. (2006). Confronting the Challenges of Participatory Culture: Media Education for the 21st Century: MacArthur. The John D. and Catherine T. MacArthur Foundation.
- Lankshear, C., & Knobel, M. (2008a). *Digital literacies : concepts, policies and practices*. New York ; Oxford: Peter Lang.
- Lankshear, C., & Knobel, M. (2008b). Introduction: Digital Literacies-Concepts, Policies and Practices. In C. Lankshear & M. Knobel (Eds.), *Digital Literacies: Concepts, Policies & Practices* (pp. 1-16).
- Lenhart, A., & Fox, S. (2006). A portrait of the internet's new storytellers. *Pew/Internet*. Retrieved from http://www.pewinternet.org/PPF/r/186/report_display.asp
- Lindmark, S. (2008). Web 2.0. Techno-economic analysis and assessment of EU position. Seville: European Commission - Joint Research Centre - Institute for Prospective Technological Studies.

- Livingstone, S., Van Couvering, E., & Thumim, N. (2005). Adult Media Literacy. A review of the research literature: Department of Media and Communications. London School of Economics and Political Science.
- Martin, A. (2006). Literacies for the Digital Age. In A. Martin & D. Madigan (Eds.), *Digital Literacies for Learning* (pp. 3-25). London: Facet.
- Martin, A. (2008). CHAPTER SEVEN: Digital Literacy and the "Digital Society". [Book Chapter]. *Digital Literacies: Concepts, Policies & Practices*, 151-176.
- Martin, A., & Grudziecki, J. (2006). DigEuLit: Concepts and Tools for Digital Literacy Development. *ITALICS: Innovations in Teaching & Learning in Information & Computer Sciences*, 5(4), 246-264.
- OECD. (2010a). *Are the New Millennium Learners Making the Grade? Technology use and educational performance in PISA*. Paris: OECD.
- OECD. (2010b). *PISA 2009 Results: Executive Summary*: OECD.
- OECD. (2010c). *PISA 2009 Results: What Students Know and Can Do. Students performance in reading, mathematics and science*. (Vol. 1). Paris: OECD.
- Osimo, D. (2008). Web 2.0 in Government: Why and How? : Institute for Prospective Technological Studies, Joint Research Centre, European Commission.
- Palfrey, J., Sacco, D. T., boyd, d., DeBonis, L., & Tatlock, J. (2008). Enhancing Child safety & Online Technologies. Final report of the Internet Safety Technical Task Force. Cambridge (MA), The Berkman Center for Internet & Society at Harvard University: Internet Safety Technical Task Force to the Multi-State Working Group on Social Networking of State Attorneys General of the United States.
- Perez Tornero, J. M., & Varis, T. (2010). *Media literacy and new humanism*: UNESCO Institute for Information Technologies in Education.
- Proofpoint, I. (2007). Outbound Email and Content Security in Today's Enterprise.
- Redecker, C., Ala-Mutka, K., Bacigalupo, M., Ferrari, A., & Punie, Y. (2009). Learning 2.0: The impact of Web2.0 Innovations on Education and Training in Europe. Final Report. Seville: European Commission - Joint Research Center -Institute for Prospective Technological Studies.
- Redecker, C., Hache, A., & Centeno, C. (2010). Using Information and Communication Technologies to Promote Education and Employment Opportunities for Immigrants and Ethnic Minorities: Institute for Prospective Technological Studies, Joint Research Centre, European Commission.
- Sanacore, J., & Palumbo, A. (2009). Understanding the Fourth-Grade Slump: Our Point of View. *The Educational Forum*, 73, 67-74.
- Sefton-Green, J., Nixon, H., & Erstad, O. (2009). Reviewing Approaches and Perspectives on "Digital Literacy". *Pedagogies: An International Journal*, 4, 107-125.
- Thoman, E., & Jolls, T. (2003). [Literacy for the 21st Century. An Overview & Orientation Guide To Media Literacy Education].
- van Deursen, A. J. A. M. (2010). *Internet Skills. Vital assets in an information society*. University of Twente. Retrieved from <http://doc.utwente.nl/75133/>
- van Deursen, A. J. A. M., & van Dijk, J. A. G. M. (2009). Using the Internet: Skill related problems in users' online behavior. *Interacting with Computers*, 21(5/6), 393-402.
- van Deursen, A. J. A. M., van Dijk, J. A. G. M., & Peters, O. (2011). Rethinking Internet skills: The contribution of gender, age, education, Internet experience, and hours online to medium- and content-related Internet skills. *Poetics*, 39(2), 125-144. doi: 10.1016/j.poetic.2011.02.001
- Voogt, J., & Pareja Roblin, N. (2010). *21st Century Skills discussion paper*. Retrieved from http://onderzoek.kennisnet.nl/attachments/session=cloud_mmbase+2185119/White_Paper_21stCS_Final_ENG_def2.pdf

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Technical Note

Abstract

Technologies are increasingly being used in society and the economy, and this is transforming ways of working, studying, communicating, accessing information and spending leisure time, among others. Attention must be paid to ensuring that everyone has digital competence as it provides important benefits while its lack can lead to various risks to children, young people, workers, elderly, groups at risk of exclusion and all citizens in general. It is not always clear however what is meant with digital competence. Therefore, the IS Unit at JRC-IPTS has launched a project to develop guidelines for supporting digital competence development in Europe on the request of DG Education and Culture.

This report reviews needs for digital competence, different concepts used to describe and understand it, and related policy approaches and measurements. Based on these, it suggests a conceptual model with the following main areas: 1) Instrumental knowledge and skills for tool and media usage; 2) Advanced skills and knowledge for communication and collaboration, information management, learning and problem-solving, and meaningful participation; 3) Attitudes to strategic skills usage in intercultural, critical, creative, responsible and autonomous ways. Instrumental knowledge and skills are a precondition for developing or using more advanced skills. The objective of the conceptual model is to highlight the various knowledge, skill and attitude areas that should be considered when developing digital competence. The proposed structure allows flexibility and the concept to be tailored to different target groups of digital competence learners and users.

The work developed in this report will contribute to the IPTS DIGCOMP project, where it will also be developed further. The reader is encouraged to follow the project's progress and results at the project website: <http://is.jrc.ec.europa.eu/pages/EAP/DIGCOMP.html>

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