DIGCOMP: a Framework for Developing and Understanding Digital Competence in Europe

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The paper describes the digital competence framework developed by EC JRC IPTS on behalf of DG Education and Culture with the overall aim to contribute to the better understanding and development of digital competence in Europe. Digital competence is one of the eight key competences for lifelong learning and is essential for participation in our increasingly digitalised society. It is therefore necessary to understand and define what digital competence is and consists of. The paper discusses various aspects of digital competence firstly differentiating it from other similar or overlapping concepts, then discussing the implication of the historic evolution of the term, finally detailing the digital competence framework in its constituting parts. The proposed digital competence framework consists of 21 competences divided in 5 areas. For each competence three proficiency levels are foreseen. Current and possible applications of the framework are discussed.

1. Introduction

Information and communication technologies (ICT) brought many changes and challenges in everyday life (Silverstone & Haddon, 1996) and education is one of the fields where impact can be observed. New forms of teaching and learning are emerging (Redecker at al., 2011), new formats of educational resources have appeared and being used by teachers and students (e.g. digital resources, open educational resources, educational platforms). Concepts as lifelong learning, information society, knowledge society all emphasize the importance of ICT as a motor for greater social inclusion, quality of life and competitiveness in the labour market and economic growth.

The use of ICT in teaching and learning has become one of the key components in educational policies of developed countries and is increasingly becoming an object of scientific research. The concept of digital competence occupies a strong position in European policy documents, actions and initiatives (examples include: Digital Agenda, Communication on rethinking education, Opening up education, Grand coalition for digital jobs).

Already in 2008 ICT cluster set up under the Education and Training 2010 Work Programme released the following message: "*Lifelong learning strategies need to answer to the growing need for advanced digital competence for all jobs and for all learners. Learning digital skills not only need to be addressed as a separate subject but also embedded within teaching in all subjects. Building digital competence by embedding and learning ICT should start as early as possible, i.e. in primary education. This includes learning to use digital tools critically, confidently and creatively, with attention paid to security, safety, and privacy. Teachers need to be equipped with the digital competence themselves, in order to support this process.*" (EC ICT cluster, 2008)

Digital competence is a universal and basic need for all citizens for working, living and learning in the knowledge society. In many European countries, digital competence is now considered to be of great strategic significance in both the public and private lives of citizens (EU Skills Panorama, 2012). As discussed by Ala-Mutka (2011), digital competence benefits many aspects of our life e.g. social, health, economic, civic, cultural, societal.

It is doubtless that we live an e-permeated society (Martin & Grudziecki, 2006), where 'being digital' (Negroponte, 1995) equals to being functioning (Gilster, 1997) and integrated. Digital competence is nowadays conceived as an essential requirement for life (Bawden, 2008), or even as a survival skill (Eshet-Alkalai, 2004). Notwithstanding this central role, literature and surveys warn against the inadequate digital literacy levels of both the younger (Newman, 2008) and the older population (European Comission, 2010a). Digital competence is a transversal key competence which 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, to ensure their active participation in society and the economy.

The concept of digital competence is a multi-faceted moving target, covering many areas and literacies and rapidly evolving as new technologies appear. It is moreover at the convergence of multiple fields. Being digitally competent today implies the ability to understand media, to search for information and be critical about what is retrieved, and to be able to communicate with others using a variety of digital tools and applications. All these abilities belong to different disciplines and traditions. Analysing the repertoire of competences related to digital literacy requires an understanding of all these underlying conceptualisations.

2. Scanning the horizon: digital competence among related terms

Establishing what digital competence is (and is not) is easier done than said. The concept is a highly debated one, at least in the academic and policy arenas: while some speak about digital competence (Krumsvik, 2008), others refer to digital literacy (Bowden, 2001; Eshet-Alkalai, 2004), or prefer the notion of e-skills, or again strongly argue for computer *literacy* (Oliver & Towers, 2000; Reed, Doty, & May, 2005). There are those who defend the fact that digital competence is part of media literacy, and those who on the contrary believe that media literacy

belongs to the wider domain of digital competence (Bawden, 2001; Buckingham, 2003; Hartley, McWilliam, Burgess, & Banks, 2008; Knobel & Lankshear, 2010; Livingstone, 2003). All these positions create a proliferation of terms that can sometimes hardly be differentiated. In the following lines we will provide a brief overview of some selected terms that are associated with digital competence and summarise how they are conceived in academic and EU policy contexts.

Digital Literacy

In the European Commission working paper (European Commission, 2008) digital literacy was defined as "*the skills required to achieve digital competence. It is underpinned by basic skills in ICT and 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 definition indicates that digital literacy comprises of basic ICT skills, which lead to digital competence. However, in the academic field, digital literacy is used as a synonym for digital competence. Moreover, Anglo-Saxon scholars tend to prefer term 'digital literacy'.

e–Skills

E-skills is used by DG Enterprise and industry[1] and focuses mainly on skills at the workplace.

There is a differentiation between three groups of users:

a) **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.

b) **ICT user skills** these 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 specialised tools supporting business functions within industry.

At the general level, they cover "digital literacy": the skills required for the confident and critical use of ICT for work, leisure, learning and communication.

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1 http://ec.europa.eu/enterprise/sectors/ict/e-skills/index_en.htm

c) **e-Business skills (also called e-leadership skills)** These 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.

One of the outcomes of this policy line is the **eCompetence** framework (EC 2010b), which is a reference framework for ICT practitioners and ICT business contexts.

In the academic context, the term 'e-skills' is manly used when referring to the above-mentioned policy activities.

Media literacy

By European Commission, Media literacy is considered an important overall skill in everyday life and at every age. At the end of 2007, the Commission adopted a communication on media literacy - A European approach to media literacy in the digital environment.

Media literacy is defined as: "*…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.*" (EC, 2007).

There is a long academic tradition on studies in media literacy. Media education is typically concerned with a critical evaluation of what we read, hear and see through the media, with the analyses of audiences and the construction of media messages, and the understanding of the purpose of these messages (Buckingham, 2003). Its closeness with semiotics and social studies kept media literacy away from the more technical, tool-related ICT literacy. Even nowadays, university courses and school curricula keep a distinctive split between these two disciplines (Sefton-Green, et al., 2009).

Digital competence

European Parliament and the Council (2006), based on the Communication of DG Education and Culture, have approached digital skills and competences[2] from the lifelong learning point of view, defining Digital Competence as one of the 8 Key Competences :

2 See website http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:394:0010:0018:EN:PDF

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.

In the academic context, digital competence is manly used by Scandinavian scholars (Krumsvik, 2008).

3. Unrolling a recent past: Digital competence yesterday and today

Leaving the theoretical and semantic debates aside, digital competence (or literacy, or other related competences and literacies) could be defined tautologically as the ability to use digital technologies. If we assume this definition as an obvious and consensual one, we should nevertheless recognise that the digitalisation of society implies changes in the connotation of the expression 'digital technology'. Twenty years ago, digital technology was often understood as a synonym for 'computers', whereas nowadays it embraces media, mobile phones, leisure tools as television sets and video game consoles. In 1997, Glister's influential definition of 'digital literacy' speaks about the ability to use computers. In more recent times, the upsurge of concepts as 'multimodality' (Kress, 2003, Walsh, 2009) underlines how digital competence covers a plethora of tools, modes of transmission/communication, and semiotic resources. Furthermore, the term 'technology' does not only refer to a wider set of devices and modes than it did for our parents, it moreover implies a number of adapted, new, and fast-changing practices: we do things in a different way than before, and we do things we did not use to do. Examples include buying products online (thus facing risks related to personal information and security or to bogus products) and tagging information (thus requiring an ability to organise and retrieve the information we come across).

Some considerations on the meaning of 'literacy' and 'competence' are probably due. The notion of literacy (the ability to read and write) refers to a basic life skill and is traditionally associated with books and printed matter. It also denotes a decoding and encoding process. Certainly, the ability to read and write in today's society includes digital texts. Moreover, there is a strong encoding and decoding (if not of straight coding) component in several digital tasks. Nevertheless, as

technologies are not just computers, digital literacy/competence is not only about coding, even if understood as 'deciphering'. Although 'literacy' is often used nowadays as an umbrella word to indicate a wide fan of abilities, it should not be forgotten that the term brings a core meaning that deviates from the matter. Instead, 'competence' refers to the categorisation of a discipline in a series of intertwined knowledge, skills and attitudes, the three learning domains envisaged by Bloom (1956). Therefore, a discussion on competence rather than literacy brings the focus on the constituting elements of the term, while taking it away from a highly contextualised notion as 'literacy'. In particular, it underlines the fact that having the 'know how' (i.e. skills, i.e. the ability to do something pragmatically) is not enough. A very basic example: are you able to format a word text? You certainly are, on your computer with your default programme. You know you have to click on a certain icon, choose an option from a scroll-down menu, you perfectly know the path you have to follow (even if probably without a computer in front of you, you will not remember it by heart). But then, one day you find yourself having to use a different computer (or a mobile phone or other device to accomplish the same task), or maybe the technology company updated the software to a higher version, and in doing so you find yourself faced with a different graphic, different menus, different paths. At this point the ability to format becomes as useless as the lack of it. What one needs in this situation is the ability to understand how a programme works, what it can do for you, and how you can find your way around it (or whom to ask eventually). It can be argued that what is foremost needed today are the right attitudes – for instance, adaptability – rather than the right skills.

As we were arguing before, we have witnessed a paradigmatic change on the use and adoption of technologies. However, in our opinion this change is not reflected in the way we conceive the competences that are needed in the digital domain. Until the 80s, technologies were the tools of a minority of professionals. From the 90s, with the shift from programming languages to graphical user interfaces, technologies became more available to society. At the same time, there was a change in the type of knowledge that was needed to use them, as it was no more necessary to be able to programme and code but to operate specific applications. Technological shifts and the spill-over effects on the related competence change they entail can be seen as a spiral of unknown end. Technologies keep becoming user-friendlier, and therefore more pervasive, and therefore more needed than ever before. Technological changes bring about renewed sets of competences, as in the case of Web2.0 uptake,

its implications on citizen's privacy, and the need to know how to protect one's privacy. The upsurge of new tools and practices reshape digital competence, which has been recognised from earlier on (Glister, 1997) as a 'mind set' enabling the user to adapt to new requirements set by the evolving technologies. However, there is a tendency to promote, develop, and assess a certain notion of digital competence that does not necessarily take into account the evolving nature of technologies and their adoption. In 2004, the Department of Education of Ireland reported that many approaches to digital competence did not take into account higher order thinking skills, which are so fundamental, for instance, when judging the validity of the information on the Internet. A more recent analysis suggests that while approaches tend to include critical and thinking competences, the main focus still remains on operational, application-oriented skills. If 50 years ago technologies were for a specialised few, and the shift from professional courses to mass certification schemes was made, now there is a need to make a new shift to promote and grasp the 'reflective' side (Erstad, 2010) that is needed for taking advantage of the current technology use.

In a nutshell, educating people in becoming digitally included and competent has to shift away from the consolidated tradition of teaching them how specific software works (thus fomenting operational skills) and to move towards educating for competence, thus fomenting skills together with knowledge and attitudes. This implies the need to be critical and reflective on what we do with technologies, aware of the possibilities and the risks that technologies offer, and ready to move along technological changes in order to keep up-to-date with the latest developments. It is with this aim and along this philosophy that the DIGCOMP framework has been created.

4. The DIGCOMP study method and structure

In order to create a consensus at the European level about the components of Digital Competence, the DIGCOMP study was launched by JRC-IPTS IS Unit under an Administrative Agreement with DG Education and Culture with the aim to contribute to better understanding of digital competence and to develop Digital Competence framework in Europe. The aim of the project was to identify exhaustive but conceptual descriptors of Digital Competence.

In the context of this work, digital competence is to be understood as the set of knowledge, attitudes and skills needed to take an active part in digital environments and to reap the benefits of technologies for everyday life. It is a basic competence for lifelong learning and can be considered as a continuum, ranging from partial digital inclusion to mastery at professional level. The digital competence of individuals depends on each person's needs, interests, and context, and has therefore to be adapted to those. Digital competence depends as well on technological availability and users' adoption practices, therefore its detailed definition is likely to change over time. As a consequence, being digitally competent means to be able and willing to keep abreast with new technological developments and practices.

The DIGCOMP framework can serve as an umbrella or meta-framework where other current existing frameworks, initiatives, curricula and certifications can find themselves. Therefore, even if the framework is exhaustive in collecting all the possible competences that are needed nowadays to be fluent in a digital environment, it allows for these competences to be applied in different ways and degrees so that, on the one hand, current curricula can be tracked onto the framework and so that, on the other hand, curricula or initiative developer can have the freedom to interpret the given competence and apply it according to their own context.

The project was being carried out between January 2011 and December 2012, following a structured process: conceptual mapping, case study analyses, online consultation, experts' workshop and stakeholders' consultation. After a first data collection phase, aimed at collecting competences as building blocks from different sources (academic literature and policy documents, existing frameworks, opinions of experts in the field), a draft framework was proposed and submitted to a number of experts for reiterative feedback and consultation. Over 150 stakeholders actively contributed to the building or refinement of the final output. The framework was presented at different stages of development at about 10 different conferences and seminars. Feedback from questions and comments of participants to these events were taken into account.

The structure of the DIGCOMP has been taken and elaborated from the eCompetence framework for ICT professionals (eCF).[3]

The decision is based on two arguments:

- the eCF uses clear structure that has received extensive stakeholders support;

- the use of the same shell will allow both projects to be cross-referenced.

Another framework that was used as a good example for the elaboration of the DIGCOMP proposal was the Common European Framework of Reference for Languages (CEFR). The CEFR provides a self-assessment grid built on three proficiency levels (each of them is then split into two sub-levels). The CEFR self-assessment grid is also supported by a more extensive toolkit that sets the standards for the evaluation of learning outcomes of foreign languages. The structure of the CEFR can be seen in particular in the phrasing of the proficiency levels.

5. The DIGCOMP framework

The DIGCOMP framework consists of five areas of digital competence and 21 competences. Competences are detailed in three proficiency levels. The framework is presented in a tabular form. It is a matrix which consists of different dimensions and that can be presented in several ways. In the original framework (Ferrari, 2013), for every competence there are examples of knowledge, skills and attitudes and also examples on how the competence can be applied for two different purposes (namely: learning and employment).

Figure 1 shows an example of a competence table. The reader is referred to the DIGCOMP final report for consulting the complete framework.

Five areas of digital competence were identified and can be summarised as follows:

1. **Information:** to identify, to locate, to retrieve, to store, to organise and analyse digital information, judging its relevance and purpose.
2. **Communication:** to communicate in digital environments, to share resources through online tools, to link with others and to collaborate through digital tools, to interact with and to participate in communities and networks, cross-cultural awareness.
3. **Content-creation:** to create and edit new content (from word processing to images and video); to integrate and re-elaborate previous knowledge and content; to produce creative expressions, media outputs and programming; to deal with and apply intellectual property rights and licences.

Dimension 1	Information		
Name of area			
Dimension 2	**1.2 Evaluating information**		
Competence title and description	To gather, process, understand and critically evaluate information		
Dimension 3	A - Foundation	B- Intermediate	C- Advanced
Proficiency levels	I know that not all online information is reliable.	I can compare different information sources.	I am critical about the information I find and I can cross-check and assess its validity and credibility.
Dimension 4			
Knowledge examples	Can analyse retrieved information Evaluates media content Judges the validity of content found on the internet or the media, evaluates and interprets information Understands the reliability of different sources Understands online and offline information sources Understands that information sources need to be cross-checked Can transform information into knowledge Understands power forces in the online world		
Skills examples	Is able to deal with information pushed at the user Assesses the usefulness, timeliness, accuracy and integrity of the information Can compare, contrast, and integrate information from different sources Distinguishes reliable information from unreliable sources		
Attitude examples	Recognises that not all information can be found on the Internet Is critical about information found Is aware that despite globalisation certain countries are more represented on the Internet Is aware that search engine mechanism and algorithms are not necessarily neutral in displaying the information		
Dimension 5 Application to purpose			
Learning	I have found some information from different sources about society in the 1500s, but I'm not sure how to judge its value.	I have found a range of different sources about society in the 1500s, and I've looked for the origins of the material as a way to judge their value.	I have found a range of different sources about society in the 1500s, I've looked for the sources they originate from, I've removed some because the academic nature of the sources is not clear, and I've checked details across the sources to see how valid they may be.
Employment	I have been asked to look at sales of certain products, but I'm not sure how reliable the figures that I've obtained are.	I have been asked to look at sales of certain products, and I've checked the sources of figures that I've obtained so I have an idea of how reliable they may be.	I have been asked to look at sales of certain products, I've checked the sources of figures that I've obtained so I have an idea of how reliable they may be. I've taken out those that appear to be unreliable, and I will check with colleagues or experts about the likely validity of those that appear to be more consistent.

Figure 1: Example of matrix of one of the competences (Source: Ferrari, 2013)

4. **Safety:** personal protection, data protection, digital identity protection, security measures, safe and sustainable use.

5. **Problem-solving:** to identify digital needs and resources, to make informed decisions on most appropriate digital tools according to the purpose or need, to solve conceptual problems through digital means, to creatively use technologies, to solve technical problems, to update own and other's competence.

It should be noted, that all five areas are of equal importance, nevertheless *information, communication* and *content creation* are rather linear while *safety* and *problem solving* are more transversal. This means that while areas 1 to 3 deal with competences that can be re-traced in terms of specific activities and uses, areas 4 and 5 apply to any type of activity that is carried out through digital means. Although each area has its own specificity, there are several overlapping points and cross-references to other areas. For instance, the creation of content implies at some point competences related to communication – when sharing the knowledge and content that has been produced.

For each of the above listed competence areas, a series of related competences were identified. Competences in each area vary in number from a minimum of 3 to a maximum of 6. Competences in the framework are numbered, however the progression does not refer to a different degree of attainment. The first competence in each area is the one that includes more technical aspects: in these specific competences, the knowledge, skills and attitudes have operational processes as a dominant component. However, technical and operational skills are also embedded in each competence.

Further we present the framework more in detail. For the scope of this paper, each area is presented separately and briefly discussed. In order not to exceed the scope of the paper, only areas, competences and levels are presented.

1. Information

The area information comprises three competences: 1.1) Browsing, searching & filtering information, 1.2) Evaluating Information, 1.3) Storing and retrieving information.

'Information' is certainly at the core of digital competence, and has been so since the beginning: Glister's definition (1997) is in fact centred on information. However, the way we deal with digital information is no more the same: nowadays, for instance, searching for information is as important as being able to filter it.

As already mentioned, some competences are more technical and linear, while other are more transversal and interrelated. While browsing, searching and storing information are more technical competences, evaluating information is more transversal and includes higher level of understanding and critical thinking. According to CRAAP test, there are 5 criteria, to evaluate information: Currency (the timeliness of the information), relevance (the importance of the information found), Authority (the source of the information), Accuracy (the reliability, truthfulness, and correctness of the informational content) and Purpose (The reason the information exists).
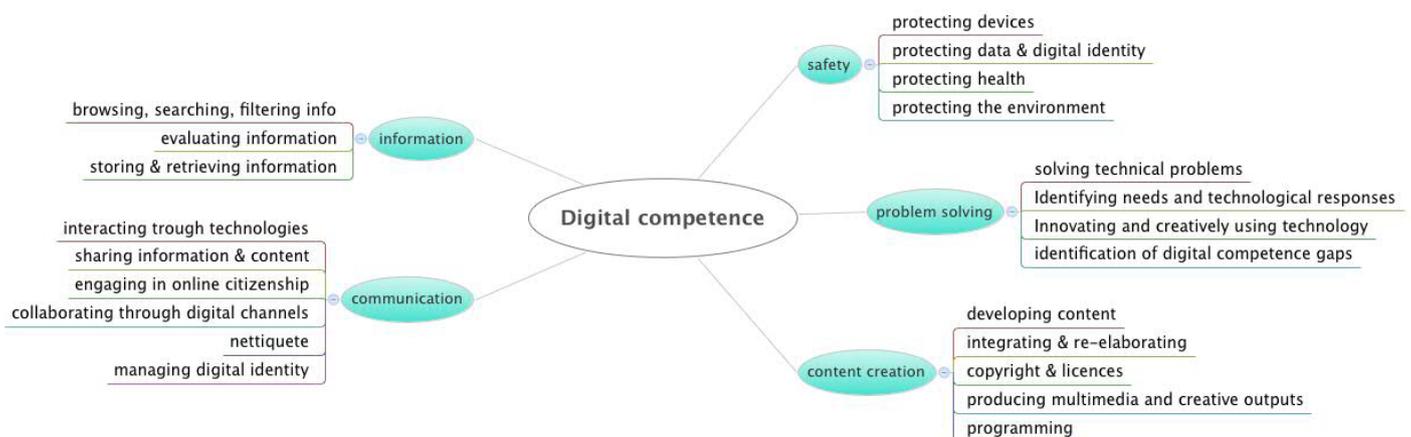
Picture 2: Graphical presentation of digital competence areas and identified competences

Table 1: Area 1 - Information

Area	1 Information		
Competence title and description	**1.1 Browsing, searching & filtering information**		
	To access and search for online information, to find relevant information, to select resources effectively, to create personal information strategies		
	A - Foundation	B - Intermediate	C - Advanced
Proficiency levels	I can do some online searches through search engines. I know that different search engines can provide different results.	I can browse the internet for information and I can search for information online. I can select the appropriate information I find.	I can use a wide range of search techniques when searching for information and browsing on the Internet. I can filter and monitor the information I receive. I know whom to follow in online information sharing places (e.g. micro-blogging).
Competence title and description	**1.2 Evaluating Information**		
	To gather, process, understand and critically evaluate information		
Competence title and description	A - Foundation	B - Intermediate	C - Advanced
	I know that not all online information can be trusted.	I can compare different information sources.	I am critical about the information I find and I cross-check and assess its validity and credibility.
Competence title and description	**1.3 Storing and retrieving information**		
	To manipulate and store information and content for easier retrieval, to organise information and data		
	A - Foundation	B - Intermediate	C - Advanced
Proficiency levels	I know how to save files and content (e.g. texts, pictures, music, videos, and web pages). I know how to go back to the content I saved.	I know how to save, store or tag files, content and information and I have my own storing strategy. I can retrieve and manage the information and content I save or stored.	I apply different methods and tools to organise files, content, and information. I can deploy a set of strategies for retrieving the content I or others have organised and stored.

2. Communication:

The area comprises six competences: 2.1) Interacting through technologies, 2.2) Sharing information and content, 2.3) Engaging in online citizenship, 2.4) Collaborating through digital channels, 2.5) Netiquette, 2.6) Managing digital identity.

This area is certainly the one more associated to Web 2.0 practices, social media and participatory web. The listed competences are of equal importance despite numbering and the fact that some are more technical in nature. It can be argued that competences 2.1 and 2.3 are very similar, however, 2.1 emphasises the technical skills and knowledge (being familiar with different possibilities, e.g knowing which applications allow VoIP and screen sharing at the same time), while 2.3 supposes collaborative skills.

Table 2: Area 2 - Communication

Area	2 Communication		
Competence title and description	**2.1 Interacting through technologies**		
	To interact through a variety of digital devices and applications, to understand how digital communication is distributed, displayed and managed, to understand appropriate ways of communicating through digital means, to refer to different communication formats, to adapt communication modes and strategies to the specific audience		
Proficiency levels	A - Foundation	B - Intermediate	C - Advanced
	I can communicate with others using technologies (e.g. mobile phone, or VoIP, or chat, or email).	I can use several digital tools to communicate with others (e.g. mobile phone, VoIP, chat, email).	I am engaged in the use of a wide range of tools for online communication (emails, chats, SMS, instant messaging, blogs, micro-blogs, SNS). I can adopt digital modes and ways of communication that best fit the purpose. I can tailor the format and ways of communication to my audience. I can manage the different types of communication I receive.
Competence title and description	**2.2 Sharing information and content**		
	To communicate with others the location and content of information found, to be willing and able to share knowledge, content and resources, to act as an intermediary, to be proactive in the spreading of news, content and resources, to know about citation practices and to integrate new information into an existing body of knowledge		
Competence title and description	A - Foundation	B - Intermediate	C - Advanced
	I know how to share files and content with others through simple technological means (e.g. sending attachments to emails, uploading pictures on the internet, etc.)	I know how to participate in social networking sites and online communities, where I pass on or share knowledge, content and information.	I can actively share information, content and resources with others through online communities, networks and collaboration platforms.
Competence title and description	**2.3 Engaging in online citizenship**		
	To participate in society through online engagement, seeks opportunities for self-development and empowerment in using technologies and digital environments, is aware of the potential of technologies for citizen participation		
Proficiency levels	A - Foundation	B - Intermediate	C - Advanced
	I know that technology can be used to interact with services (e.g.: government, hospital or medical centres, bank).	I can use online services (e.g.: government, hospital or medical centres, bank, eGoverment services, etc).	I am actively participating in online spaces. I know how to get actively engaged in online participation and I can use several online services.
Competence title and description	**2.5 Netiquette**		
	To have the knowledge and know-how of behavioural norms in online/virtual interactions, to be aware of cultural diversity aspects, to be able to protect self and others from possible online dangers (e.g. cyberbullying), to develop active strategies to discover bed behaviour		
Proficiency levels	A - Foundation	B- Intermediate	C- Advanced
	I know some basic principles for communicating with others through digital means	I know the principles of online etiquette and I am able to apply them in my own context	I can apply the various aspects of online etiquette to different digital communication spaces and contexts.
Competence title and description	**2.6 Managing digital identity**		
	To create, adapt and manage one or multiple digital identities, to be able protect one's e-reputation, to deal with the data that one produces through several accounts and applications		
Proficiency levels	A - Foundation	B- Intermediate	C- Advanced
	I am aware of the benefits and risks related to digital identity	I can shape my online digital identity and keep track of my digital footprint	I can manage several digital identities according to the context and purpose, I can monitor the information and data I produce through my online interaction, I know how to protect my digital reputation

3. Content creation:

There are five competences in this area: 3.1) Developing content, 3.2) Integrating and re-elaborating, 3.3) Copyright and Licences, 3.4) Producing multimedia and creative outputs, 3.5) Programming

This competence area is fairly technical and linear. It is about being able to deal with different software, application and ability to code, nevertheless creative outputs presuppose collaboration, which can be also found in communication area, as well creating knowledge with technologies can also be part of the problem solving area.

Copyright and licences is a competence which emphasises attitudes and knowledge and is as well related to other competences.

Table 3: Area 3 – Content creation

Area	3 Content creation		
Competence title and description	**3.1 Developing content**		
	To create content in different formats, to edit and improve content that s/he has created or that others have created		
Proficiency levels	A - Foundation	B - Intermediate	C - Advanced
	I can produce simple digital content (e.g. text, or tables, or images, or audio, etc.).	I can produce digital content different formats (e.g. text, tables, images, audio, etc.).	I can produce digital content in different formats, platforms and environments. I have expertise in the production of content using various multi-media application tools.
Competence title and description	**3.2 Integrating and re-elaborating**		
	To modify, refine and mash-up existing resources to create new, original and relevant content and knowledge.		
Competence title and description	A - Foundation	B - Intermediate	C - Advanced
	I can make basic changes to the content that others have produced.	I can edit, refine and modify the content I or others have produced.	I can mash-up existing items of content to create new ones.
Competence title and description	**3.3 Copyright and Licences**		
	To understand how copyright and licences apply to information and content		
Proficiency levels	A - Foundation	B - Intermediate	C - Advanced
	I know that some of the content I use can be covered by copyright.	I have an intuitive knowledge of the differences about copyright, copyleft and creative commons and can apply some licences to the content I create.	I know how different types of licences apply to the information and resources I use and create.
Competence title and description	**3.4 Producing multimedia and creative outputs**		
	To improve and innovate with ICT, to actively participate in collaborative digital and multimedia production, to express him/herself creatively through digital media and technologies, to create knowledge with the support of technologies		
Proficiency levels	A - Foundation	B- Intermediate	C- Advanced
	I can use some simple technology to create multi-media original outputs.	I can use a variety of digital tools for creating multimedia outputs.	I can produce original and creative digital and media output.
Competence title and description	**3.5 Programming**		
	To program applications, software, devices, to understand the principles of programming, to understand what is behind a program		
Proficiency levels	A - Foundation	B- Intermediate	C- Advanced
	I can modify some simple function of software and applications.	I can use some basic tools to program. I understand the different parts of a computer or device.	I can code and program in several languages, I understand the systems and functions that are behind programs.

4. Safety

There are four competences: 4.1) Protecting devices, 4.2) Protecting data and digital identity, 4.3) Protecting Health, 4.4) Protecting the environment.

Safety is an area, which is very transversal and interrelated to other competences. Some of the competences are already embedded into other areas (e.g. managing digital identity and netiquette) but all of the competences form safety area can be applied to almost all activities in digital environment.

It is also very much the "awareness" competence area – today it is important that people are aware of what kinds of threats exist on-line.

Table 4: Area 4 - Safety

Area	4 Safety		
Competence title and description	**4.1 Protecting devices**		
	To protect own devices and to understand online risks and threats, to know about safety and security measures		
Proficiency levels	A - Foundation	B - Intermediate	C - Advanced
	I can use basic steps to protect my devices (for instance: using anti-viruses, passwords, etc.).	I know how to protect my digital devices.	I frequently update my security strategies.
Competence title and description	**4.2 Protecting data and digital identity**		
	To understand common terms of service, active protection of own data, understanding other people privacy, to protect self from online fraud and threats and cyber bulling		
Competence title and description	A - Foundation	B - Intermediate	C - Advanced
	I know that I can only share certain types of information about myself or others in online environments.	I can protect my own online privacy and that of others. I have a general understanding of privacy issues and I have an intuitive knowledge of how my data is collected and used.	I often change the default privacy settings of online services to enhance my privacy protection. I have an informed and wide understanding of privacy issues and I know how my data is collected and used.
Competence title and description	**4.3 Protecting Health**		
	To avoid health-risks related with the use of technology in terms of threats to physical and psychological well-being		
Proficiency levels	A - Foundation	B - Intermediate	C - Advanced
	I know how to avoid cyberbulling. I know that technology can affect my health if misused.	I know how to protect myself and others from cyberbulling and I understand the health risks associated with the use of technologies (from ergonomics aspects to addiction to technologies).	I am aware of the correct use of technologies to avoid health problems. I know how to find a good balance between online and off-line worlds.
Competence title and description	**4.4 Protecting the environment**		
	To be aware of the impact of ICT on the environment		
Proficiency levels	A - Foundation	B- Intermediate	C- Advanced
	I can take basic measures to save energy.	I understand the positive and negative aspects of the use of technology on the environment.	I have an informed stance on the impact of technologies on everyday life, online consumption, and the environment.

5. Problem solving

The area comprises four competences: 5.1) Solving technical problems, 5.2) Identifying needs and technological responses, 5.3) Innovating and creatively using technology, 5.4) Identification of digital competence gaps.

"Problem solving" is the most transversal competence area and the one where the need to bring a 'reflective' attitude is most evident. In the framework it is a stand-alone area, although elements of problem solving can be found in all competences. For instance, the competence area "Information" (area 1) includes the competence "evaluating information", which is part of cognitive dimension in problem solving. Communication and content creation include several elements of problem solving (namely: interacting, collaborating, developing content, integrating and re-elaborating, programming…). Despite including problem solving elements in relevant competence areas, it was seen necessary to have a dedicated stand-alone area about problem solving, as for the relevance this aspect has on the appropriation of technologies and digital practices. It can be noted that some of the competences listed in areas 1 to 4 can also be mapped into area 5.

Table 5: Area 5 – Problem solving

Area	5 Problem solving		
Competence title and description	**5.1 Solving technical problems**		
	To identify possible problems and solve them (from trouble-shooting to solving more complex problems) with the help of digital means.		
Proficiency levels	A - Foundation	B - Intermediate	C - Advanced
	I can ask for targeted support and assistance when technologies do not work or when using a new device, program or application.	I can solve easy problems that arise when technologies do not work.	I can solve a wide-range of problems that arise from the use of technology.
Competence title and description	**5.2 Identifying needs and technological responses**		
	To assess own needs in terms of resources, tools and competence development, to match needs with possible solutions, adapting tools to personal needs, to critically evaluate possible solutions and digital tools		
Competence title and description	A - Foundation	B - Intermediate	C - Advanced
	I know that I can only share certain types of information about myself or others in online environments.	I can protect my own online privacy and that of others. I have a general understanding of privacy issues and I have an intuitive knowledge of how my data is collected and used.	I often change the default privacy settings of online services to enhance my privacy protection. I have an informed and wide understanding of privacy issues and I know how my data is collected and used.
Competence title and description	**5.3 Innovating and creatively using technology**		
	To innovate with technology, to actively participate in collaborative digital and multimedia production, to express oneself creatively through digital media and technologies, to create knowledge and solve conceptual problems with the support of digital tools		
Proficiency levels	A - Foundation	B - Intermediate	C - Advanced
	I know that technologies and digital tools can be used for creative purposes and I can make some creative use of technologies.	I can use technologies for creative outputs and I can use technologies to solve problems (i.e. visualizing a problem). I collaborate with others in the creation of innovative and creative outputs, but I don't take the initiative.	I can solve conceptual problems taking advantage of technologies and digital tools, I can contribute to the knowledge creation through technological means, I can take part in innovative actions through the use of technologies. I proactively collaborate with others to produce creative and innovative outputs.
Competence title and description	**5.4 Identification of digital competence gaps**		
	To understand where own competence needs to be improved or updated, to support others in the development of their digital competence, to keep up-to-date with new developments.		
Proficiency levels	A - Foundation	B- Intermediate	C- Advanced
	I am aware of my limits when using technologies.	I know how to learn to do something new with technologies.	I frequently update my digital competence needs.

6. Conclusions

The DIGCOMP framework, developed by EC JRC-IPTS, contributes to the ongoing discussion on the understanding and development of digital competence for all. The framework provides detailed descriptions of all the competences that are necessary to be proficient in digital environments and describes them in terms of knowledge, skills, and attitudes.

The framework as such has already been used as support to policy in the following instances:

- It was endorsed by the EAC Thematic Working Group on ICT and Education which represents the Member States' Ministries of Education, as a guideline for curricula development and teacher professional development.

- It was adopted as an input to Action 62 of the Digital Agenda on proposing EU-wide indictors of digital competence.

- It has also been accepted as a framework for data collection on e-skills in Eurostat's household survey on ICT usage by individuals in their 2015 study.

- An action in Opening Up Education: Innovative teaching and learning for all through new technologies and open educational resources confirms that the Commission will, in cooperation with stakeholders and Member States, test the digital competence framework with a view to supporting full implementation of the framework and the future development of an EU self-assessment tool for digital competences. (EC, 2013)

Nevertheless it should be noted, that the framework should not be fixed - with quick changes in digital world, there is a need for regular revisions and updates of the framework. Moreover, although this framework benefited from the opinions and feedback of a variety of stakeholders, up to now its applicability has not been tested yet. It is therefore likely that, once applied in real educational context, the different areas or descriptor will be subject to change.

It is foreseen to continue along this research line with the development of digital competence indicators which would enable monitoring and assessment of levels of digital competence of citizens.

Complete document can be downloaded at: http://ftp.jrc.es/EURdoc/JRC83167.pdf

The views expressed in this article are purely those of the authors and they should not be regarded as the official position of the European Commission.

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