European Commission

Joint Research Centre

DigComp 2.2

The Digital Competence Framework for Citizens

With new examples of knowledge, skills and attitudes

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DigComp 2.2 – The Digital Competence Framework for Citizens

The Digital Competence Framework for Citizen (DigComp) provides a common understanding of what digital competence is. The present publication has two main parts: The integrated DigComp 2.2 framework provides more than 250 new examples of knowledge, skills and attitudes that help citizens engage confidently, critically and safely with digital technologies, and new and emerging ones such as systems driven by artificial intelligence (AI). The framework is also made available following the digital accessibility guidelines, as creating accessible digital resources is an important priority today. The second part of the publication gives a snapshot of the existing reference material for DigComp consolidating previously released publications and references.

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PREFACE

For more than a decade, the Digital Competence Framework for Citizens (DigComp) has provided a common understanding, across the EU and beyond, of what digital competence is, and therefore provided a basis for framing digital skills policy. There is already a high awareness of DigComp as the EU-wide framework for developing and measuring digital competence.

Going forward, DigComp can also play a central role in achieving our ambitious EU objectives with regard to the digital upskilling of the whole population and in developing a European Digital Skills Certificate. In the Digital Compass for Europe's digital decade, the EU has set the ambitious policy targets of reaching a minimum of 80% of the population with basic digital skills and having 20 million ICT specialists by 2030. The first of these targets is also taken up by the European Pillar of Social Rights Action Plan.

Since its adoption, DigComp has provided a scientifically solid and technology-neutral basis for a common understanding of digital skills and framing policy. However, things move fast in the digital sphere and a lot has happened since the framework was last updated in 2017. More specifically, emerging technologies, such as Artificial Intelligence, Virtual and Augmented reality, robotisation, the Internet of Things, datafication or new phenomena such as misinformation and disinformation, have led to new and increased digital literacy requirements on the part of the citizen. There is also an increasing need to address the green and sustainability aspects of interacting with digital technologies. The present update, therefore takes account of the knowledge skills and attitudes needed by citizens in the face of these developments.

Importantly also, the DigComp 2.2 update process has involved consulting a very broad number of stakeholders, including through the dedicated Community of Practice that was set up for this purpose. In addition, there was an open validation process both on-line and through interactive workshops with major international players such as ILO, UNESCO, UNICEF and the World Bank. This broad stakeholder involvement and buy-in is vital to achieving the continued recognition and success of the Digital Competence Framework.

With this update, our aim is to keep DigComp relevant for learning, working and participating in society, as well as for EU policy-making and the European Digital Strategy, including initiatives such as the Skills Agenda, the Digital Education Action Plan, the Digital Decade and Compass, and the Pillar of Social rights and its action plan.

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EXECUTIVE SUMMARY

Policy context

Digital skills for work and for life are at the top of the European Policy Agenda. The EU digital skills strategy and related policy initiatives have the objective of enhancing digital skills and competences for the digital transformation. The **European Skills Agenda**, of 1 July 2020, supports digital skills for all, including by supporting the objectives of the **Digital Education Action Plan**, which has the objectives of i) enhancing digital skills and competences for the digital transformation while ii) fostering the development of a high-performing digital education system. The Digital Compass and the European Pillar of Social Rights Action Plan set the ambitious policy targets of reaching a minimum of 80% of the population with basic digital skills and having 20 million ICT specialists by 2030.

The DigComp 2.2 update

The Digital Competence Framework for Citizens, also known as DigComp, provides a common language to identify and describe the key areas of digital competence. It is an EU-wide tool to improve citizens' digital competence, help policy-makers formulate policies that support digital competence building, and plan education and training initiatives to improve the digital competence of specific target groups.

This report presents version 2.2 of the Digital Competence Framework for Citizens. It consists of an update of the examples of knowledge, skills and attitudes. Additionally, the publication also brings together the key reference documents on DigComp to support its implementation.

DigComp implementations

From 2013 up until now, DigComp has been used for multiple purposes, particularly in the context of employment, education and training, and lifelong learning.

Additionally, DigComp has been put into practice at EU level to construct the Digital Skills Indicator (DSI), which is used for setting policy-targets and to monitor the Digital Economy and Society (DESI). Another example is incorporated into the Europass CV enabling jobseekers to evaluate their own digital competence and include the evaluation in their Curriculum Vitaes.

Related and future JRC work

The JRC work on reference frameworks for individuals' competence development includes the Entrepreneurship Competence Framework (EntreComp); Personal, Social and Learning to Learn competence framework (LifeComp) and GreenComp for sustainable development. Additionally, the European Framework for the Digital Competence of Educators (DigCompEdu) supports digital competence building in a professional context, whereas the European Framework for Digitally-Competent Educational Organisations (DigCompOrg) supports capacity building within an educational organisation.

Quick guide

This publication has two main parts. Section 2 presents the integrated DigComp 2.2 framework highlighting the new examples of knowledge, skills and attitudes. These examples illustrate new focus areas with the aim to help citizens engage confidently, critically and safely with everyday digital technologies, but also with new and emerging technologies such as systems driven by artificial intelligence (AI).

A set of around 10 to 15 examples is given per competence to motivate education and training providers to update their curriculum and course material to face today's challenges, these examples do not aim to be an exhaustive list of what the competence entails. The annexes include a **fully accessible version** of the integrated framework.

Sections 3 and 4 gather the key reference documents on DigComp. They include tools for self-reflection and monitoring digital competence development, and references to guides and reports that help implement DigComp in different contexts such as at work or at international level. Importantly, a snapshot of translations and national adaptations of DigComp is given including references to ESCO classification.

1. INTRODUCTION

This new publication introduces the 2.2 update to the Digital Competence Framework for Citizens. It also acts as a complete reference material to the DigComp framework consolidating previously released publications and user guides.

Digital competence is one of the Key Competences for Lifelong Learning. It was first defined in 2006, and after an update of the Council Recommendation in 2018, it reads as follows:

> "Digital competence involves the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), intellectual property related questions, problem solving and critical thinking." (Council Recommendation on Key Competences for Lifelong Learning, 22 May 2018, ST 9009 2018 INIT).

The competences are a combination of knowledge, skills and attitudes, in other words, they are composed of concepts and facts (i.e. knowledge), descriptions of skills (e.g. the ability to carry out processes) and attitudes (e.g. a disposition, a mindset to act) (see **BOX 1**). Key competences are developed throughout life.

The work on operationalising digital competence following the 2006 Council Recommendation, started in 2010. In 2013, the first DigComp reference framework came out defining digital competence as a combination of 21 competences grouped in five main areas (**FIG. 1**). Since 2016, the five areas are Information and data literacy; Communication and collaboration; Digital content creation; Safety; and Problem solv-ing (**FIG. 3**). Further methodological details are described in **ANNEX 1.**

BOX 1. Dimension 4 of the DigComp framework outlines examples of knowledge, skills and attitudes in a non-exhaustive manner

KNOWLEDGE

It 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 DigComp 2.2, **knowledge examples** follow the wording of: ***Aware of***..., ***Knows about***..., ***Understands that...***, etc.

SKILLS

They are 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).

→ In DigComp 2.2, **skills examples** follow the wording of: ***Knows how to do***..., ***Able to do***..., ***Searches***..., etc.

ATTITUDES

They are conceived as the motivators of performance, the basis for continued competent performance. They include values, aspirations and priorities.

→ In DigComp 2.2, **attitude examples** follow the wording of: ***Open to***..., ***Curious about***..., ***Weighs the benefits and risks*** ..., etc.

Reference frameworks such as the DigComp framework create an agreed vision of what is needed in terms of competences to overcome the challenges that arise from digitisation in almost all aspects of modern lives. Their aim is to create a common understanding using an agreed vocabulary which can then be consistently applied in all tasks from policy formulation and target setting to instructional planning, assessment and monitoring. Ultimately, it is up to the users, institutions, intermediaries or initiative developers to adapt the reference framework to their needs when tailoring interventions (e.g. curriculum development) to fit the specific needs of target groups. To read more about the use of DigComp, see **SECTION 3**.

WHAT IS NEW IN THE UPDATE?

The 2.2 update focuses on "**Examples of the knowledge, skills and attitudes applicable to each competence**" (Dimension 4). For each of the 21 competences, 10-15 statements are given to illustrate timely and updated examples that highlight contemporary themes. As such, the update does not alter descriptors of the conceptual reference model (**FIG. 1**) and it does not change how proficiency levels are outlined (Dimension 3). Also, use cases presented in Dimension 5 remain the same. The integrated DigComp framework 2.2 is available in **SECTION 2**.

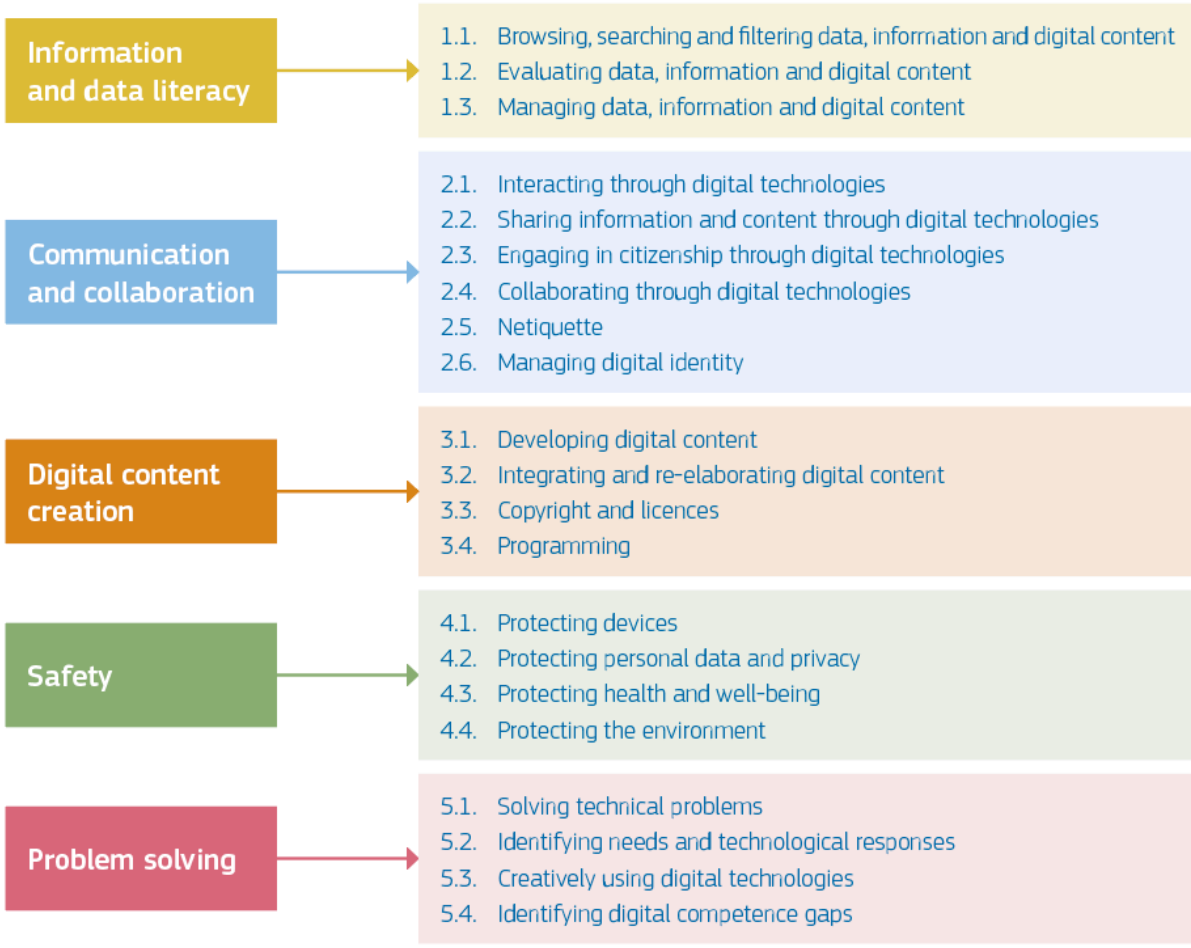


FIG.1 The DigComp conceptual reference model

More than 250 examples highlight new and emerging themes that have arisen since the last update. The new examples will become useful, for example, for those who are responsible for curriculum planning and updating, and for those developing DigComp training syllabus or course content. They can use these examples to address themes that are relevant in today's society, some of which are the following:

- **misinformation** and **disinformation** in social media and news sites (e.g. fact-checking information and its sources, fake news, deep fakes) linked with information and media literacy
- the trend of **datafication of internet services and apps** (e.g. focus on how personal data is exploited)
- **citizens interacting with AI systems** (including data-related skills, data protection and privacy, but also ethical considerations)
- **emerging technologies** such as Internet of Things (IoT)
- **environmental sustainability concerns** (e.g. resources consumed by ICT)
- new and emerging contexts (e.g. remote work and hybrid work)

As the term "example" itself already explains, these new statements do not represent an exhaustive list of what the competence itself entails. Therefore, it is important to emphasise that the new DigComp examples of knowledge, skills and attitudes should not be taken as a set of learning outcomes that are expected from all citizens. However, it is possible to use them as a basis to develop explicit descriptions of learning objectives, content, learning experiences and their assessment, although this requires more instructional planning and implementation.

Secondly, the examples are not developed on proficiency levels. Even if one can observe some heterogeneity and differences in their complexity (some examples of this might focus on a very rudimentary level of new knowledge whereas others can illustrate more complex tasks), this does not mean that they are an instrument to gauge progress. For each competence, Dimension 3 outlines 8 levels of proficiency.

Lastly, the new examples of knowledge, skills and attitudes are not offered as an assessment instrument or as a tool for self-reflection on one's own competence development. For a validated self-reflection instrument, see more in **SECTION 3.1**.

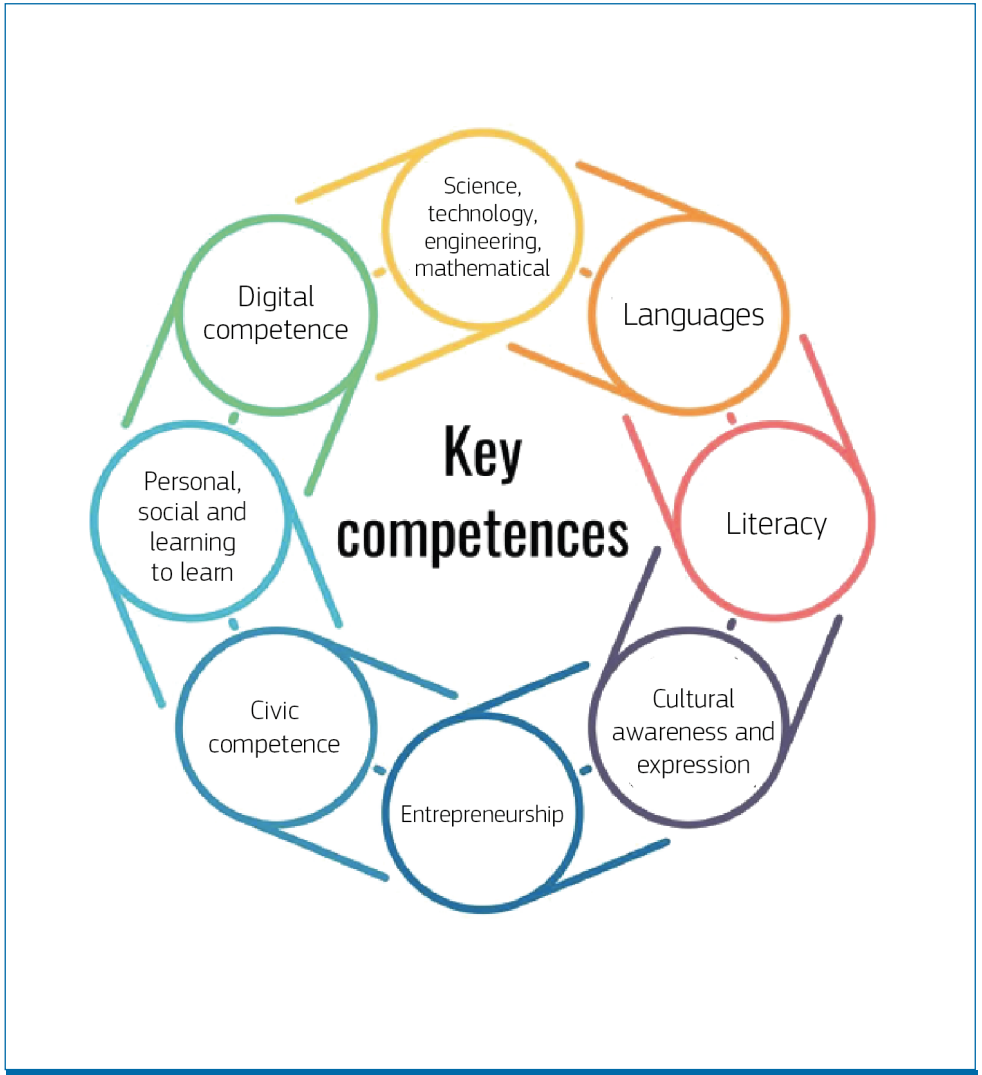


FIG.2 Digital competence is part of the Key Competence Framework for Lifelong Learning and interlinked with other competences

INTERCONNECTIONS BETWEEN THE KEY COMPETENCES

The recommendation on Key Competences for Lifelong Learning identifies key competences that are essential to citizens for personal fulfilment, a healthy and sustainable lifestyle, employability, active citizenship and social inclusion (**FIG. 2**).

All Key competences are complementary and interconnected to each other. In other words, competences essential to one domain will support competence development in another. This is also the case between Digital competence and other Key competences. Some important interconnections are highlighted below, although they are non-exhaustive, their intention is to bring more focus on how this complementary nature might be encountered in digital environments.

For example, aspects of **Literacy competence** are needed when reading on paper or on screen. According to the Key Competences for Lifelong Learning recommendation, Literacy competence includes, for example, "*the abilities to distinguish and use different types of sources, to search for, collect and process information*". These skills are called upon when evaluating online content and its sources, a competence that forms an integral part of Information literacy in today's media-rich environment (DigComp competence 1.2).

On the other hand, one the DigComp competence defines engaging in citizenship through digital technologies (DigComp competence 2.3). The **Citizenship competence** itself is defined in Key Competences as "*the ability to act as responsible citizens and to fully participate in civic and social life*". The new examples attempt to illustrate this interconnection by highlighting knowledge, skills and attitudes that are complementary for both themes.

Moreover, the Citizenship competence also links with **media literacy** outlining "*the ability to access, have a critical understanding of, and interact with both traditional and new forms of media and understand the role and functions of media in democratic societies*". Therefore, it can be said that Media literacy, which is a new theme added to the definition of digital competence in 2018, lies at the interconnection between **Citizenship and Digital competences**. To read more about complementarity between DigComp, and Media and Information Literacy, see **SECTION 4.1**.

References to **Personal, social and learning to learn competence** are also many in the DigComp update, for example in the domain of managing one's own learning and career (DigComp competence 5.4) and supporting one's physical and emotional well-being (DigComp competence 4.3).

Entrepreneurship competence aims to create value in today's world. Pairing it with Digital competence, and in particular with creatively using digital technologies (DigComp competence 5.3), can help transform ideas into value for oneself and others. Netiquette (DigComp competence 2.5), on the other hand, draws upon the Key competence of **Cultural awareness and expression**, but also on the competence of **multilingualism** (the coexistence of different languages at the social or individual level) and plurilingualism (the dynamic and developing linguistic repertoire of an individual user/ learner) distinguished in the Common European Framework of Reference for Languages.

The new examples presented in this update intend to bring more focus on how these interconnections might be encountered in digital environments (the interconnections highlighted above are non-exhaustive). More about other EU frameworks for Key competences is found in **SECTION 4.2**.

2. THE DIGITAL COMPETENCE FRAMEWORK FOR CITIZENS

In DigComp, 5 competence areas outline what the digital competence entails. They are the following: Information and data literacy; Communication and collaboration; Digital content creation; Safety; and Problem solving.

The first 3 areas deal with competences that can be traced back to specific activities and uses. On the other hand, areas 4 and 5 (Safety and Problem solving) are "transversal" as they apply to any type of activity carried out through digital means. Elements of Problem solving, in particular, are present in all competences, but a specific area was defined to highlight the importance of this aspect for the appropriation of technology and digital practices.

Information and data literacy

To articulate information needs, to locate and retrieve digital data, information and content.

To judge the relevance of the source and its content.

To store, manage, and organise digital data, information and content.

Communication and collaboration

To interact, communicate and collaborate through digital technologies while being aware of cultural and generational diversity.

To participate in society through public and private digital services and participatory citizenship.

To manage one's digital presence, identity and reputation.

Digital content creation

To create and edit digital content.

To improve and integrate information and content into an existing body of knowledge while understanding how copyright and licences are to be applied.

To know how to give understandable instructions for a computer system.

Safety

To protect devices, content, personal data and privacy in digital environments.

To protect physical and psychological health, and to be aware of digital technologies for social well-being and social inclusion.

To be aware of the environmental impact of digital technologies and their use.

Problem solving

To identify needs and problems, and to resolve conceptual problems and problem situations in digital environments.

To use digital tools to innovate processes and products.

To keep up-to-date with the digital evolution.

FIG.3 DigComp areas (Dimension 1)

THE INTEGRATED DIGCOMP 2.2 FRAMEWORK

This section presents the DigComp 2.2 update in detail. In this graphical layout, one competence with all its five Dimensions is presented spanning across two page faces.

How to read it?

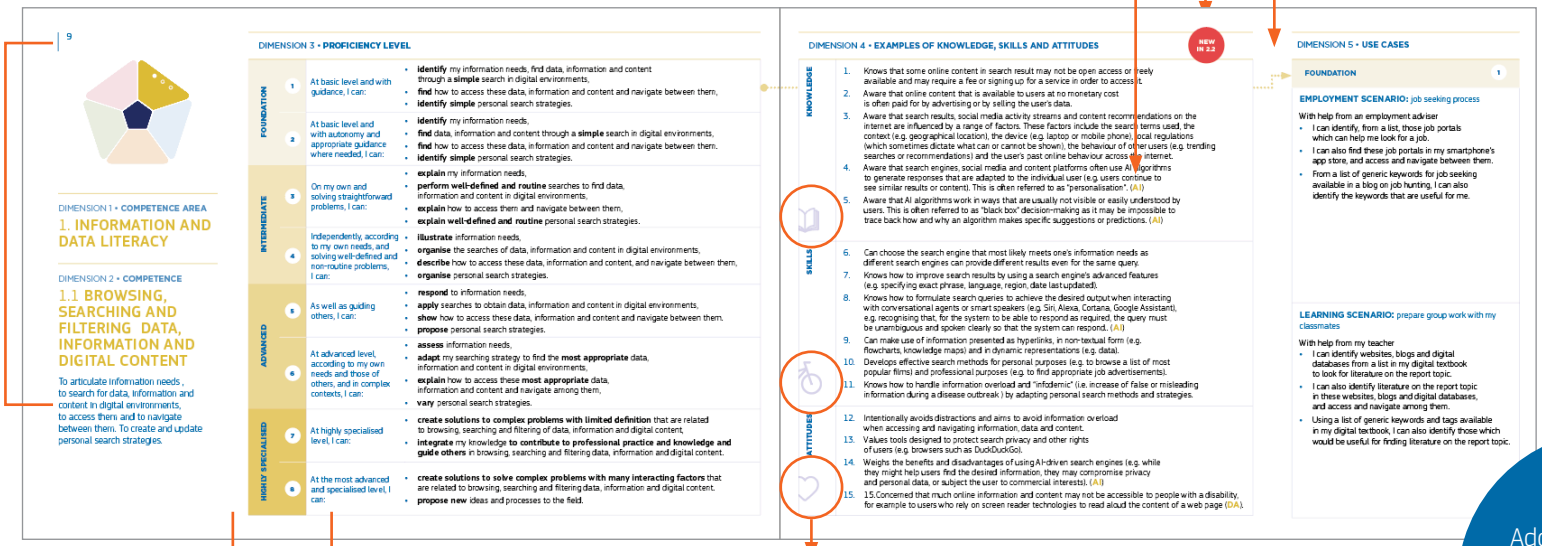
A number of **graphical representations** are used to increase readability., they are explained below.

A small **red dot** is used to introduce the new Dimension 4. It helps the reader quickly spot the new updated part.

Artificial intelligence, **Remote Working** and **Digital Accessibility** examples are highlighted with (**AI**), (**RW**), (**DA**).

For Dimension 5, a **dashed arrow** depicts the **link between the use case and its proficiency level**, as only one example per level and competence is given. In general, Dimension 5 uses a "cascade" strategy: 1.2 has an example for level 1, competence 1.3 for level 2, competence 2.1 for level 3, etc.

Each competence area (Dimension 1) has its own **colour**, which is used to display all competences within the area (Dimension 2).



Shades of the same colour are used for proficiency levels (Dimension 3).

Graphic symbols are used to group the examples of knowledge, skills and attitudes: a **book** for knowledge, a **bicycle** for skills and a **heart** for attitude.

Additionally, a fully accessible version for screen reader is available in **ANNEX 4**.

DIMENSION 1 • **COMPETENCE AREA**

1. INFORMATION AND DATA LITERACY

DIMENSION 2 • **COMPETENCE**

1.1 BROWSING, SEARCHING AND FILTERING DATA, INFORMATION AND DIGITAL CONTENT

To articulate information needs , to search for data, information and content in digital environments, to access them and to navigate between them. To create and update personal search strategies.

DIMENSION 3 • **PROFICIENCY LEVEL**

FOUNDATION	1	At basic level and with guidance, I can:	• **identify** my information needs, find data, information and content through a **simple** search in digital environments, • **find** how to access these data, information and content and navigate between them, • **identify simple** personal search strategies.
	2	At basic level and with autonomy and appropriate guidance where needed, I can:	• **identify** my information needs, • **find** data, information and content through a **simple** search in digital environments, • **find** how to access these data, information and content and navigate between them. • **identify simple** personal search strategies.
INTERMEDIATE	3	On my own and solving straightforward problems, I can:	• **explain** my information needs, • **perform well-defined and routine** searches to find data, information and content in digital environments, • **explain** how to access them and navigate between them, • **explain well-defined and routine** personal search strategies.
	4	Independently, according to my own needs, and solving well-defined and non-routine problems, I can:	• **illustrate** information needs, • **organise** the searches of data, information and content in digital environments, • **describe** how to access these data, information and content, and navigate between them, • **organise** personal search strategies.
ADVANCED	5	As well as guiding others, I can:	• **respond** to information needs, • **apply** searches to obtain data, information and content in digital environments, • **show** how to access these data, information and content and navigate between them. • **propose** personal search strategies.
	6	At advanced level, according to my own needs and those of others, and in complex contexts, I can:	• **assess** information needs, • **adapt** my searching strategy to find the **most appropriate** data, information and content in digital environments, • **explain** how to access these **most appropriate** data, information and content and navigate among them, • **vary** personal search strategies.
HIGHLY SPECIALISED	7	At highly specialised level, I can:	• **create solutions to complex problems with limited definition** that are related to browsing, searching and filtering of data, information and digital content, • **integrate** my knowledge **to contribute to professional practice and knowledge and guide others** in browsing, searching and filtering data, information and digital content.
	8	At the most advanced and specialised level, I can:	• **create solutions to solve complex problems with many interacting factors** that are related to browsing, searching and filtering data, information and digital content. • **propose new** ideas and processes to the field.

DIMENSION 4 • **EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES**

NEW IN 2.2

KNOWLEDGE

1. Knows that some online content in search result may not be open access or freely available and may require a fee or signing up for a service in order to access it.
2. Aware that online content that is available to users at no monetary cost is often paid for by advertising or by selling the user's data.
3. Aware that search results, social media activity streams and content recommendations on the internet are influenced by a range of factors. These factors include the search terms used, the context (e.g. geographical location), the device (e.g. laptop or mobile phone), local regulations (which sometimes dictate what can or cannot be shown), the behaviour of other users (e.g. trending searches or recommendations) and the user's past online behaviour across the internet.
4. Aware that search engines, social media and content platforms often use AI algorithms to generate responses that are adapted to the individual user (e.g. users continue to see similar results or content). This is often referred to as "personalisation". (**AI**)
5. Aware that AI algorithms work in ways that are usually not visible or easily understood by users. This is often referred to as "black box" decision-making as it may be impossible to trace back how and why an algorithm makes specific suggestions or predictions. (**AI**)

SKILLS

6. Can choose the search engine that most likely meets one's information needs as different search engines can provide different results even for the same query.
7. Knows how to improve search results by using a search engine's advanced features (e.g. specifying exact phrase, language, region, date last updated).
8. Knows how to formulate search queries to achieve the desired output when interacting with conversational agents or smart speakers (e.g. Siri, Alexa, Cortana, Google Assistant), e.g. recognising that, for the system to be able to respond as required, the query must be unambiguous and spoken clearly so that the system can respond. (**AI**)
9. Can make use of information presented as hyperlinks, in non-textual form (e.g. flowcharts, knowledge maps) and in dynamic representations (e.g. data).
10. Develops effective search methods for personal purposes (e.g. to browse a list of most popular films) and professional purposes (e.g. to find appropriate job advertisements).
11. Knows how to handle information overload and "infodemic" (i.e. increase of false or misleading information during a disease outbreak) by adapting personal search methods and strategies.

ATTITUDES

12. Intentionally avoids distractions and aims to avoid information overload when accessing and navigating information, data and content.
13. Values tools designed to protect search privacy and other rights of users (e.g. browsers such as DuckDuckGo).
14. Weighs the benefits and disadvantages of using AI-driven search engines (e.g. while they might help users find the desired information, they may compromise privacy and personal data, or subject the user to commercial interests). (**AI**)
15. Concerned that much online information and content may not be accessible to people with a disability, for example to users who rely on screen reader technologies to read aloud the content of a web page. (**DA**)

DIMENSION 5 • **USE CASES**

FOUNDATION 1

EMPLOYMENT SCENARIO: job seeking process

With help from an employment adviser

- I can identify, from a list, those job portals which can help me look for a job.
- I can also find these job portals in my smartphone's app store, and access and navigate between them.
- From a list of generic keywords for job seeking available in a blog on job hunting, I can also identify the keywords that are useful for me.

LEARNING SCENARIO: prepare group work with my classmates

With help from my teacher

- I can identify websites, blogs and digital databases from a list in my digital textbook to look for literature on the report topic.
- I can also identify literature on the report topic in these websites, blogs and digital databases, and access and navigate among them.
- Using a list of generic keywords and tags available in my digital textbook, I can also identify those which would be useful for finding literature on the report topic.

DIMENSION 1 • **COMPETENCE AREA**

1. INFORMATION AND DATA LITERACY

DIMENSION 2 • **COMPETENCE**

1.2 EVALUATING DATA, INFORMATION AND DIGITAL CONTENT

To analyse, compare and critically evaluate the credibility and reliability of sources of data, information and digital content. To analyse, interpret and critically evaluate the data, information and digital content.

DIMENSION 3 • **PROFICIENCY LEVEL**

FOUNDATION	1	At basic level and with guidance, I can:	• **detect** the credibility and reliability of common sources of data, information and their digital content.
	2	At basic level and with autonomy and appropriate guidance where needed, I can:	• **detect** the credibility and reliability of common sources of data, information and their digital content.
INTERMEDIATE	3	On my own and solving straightforward problems, I can:	• **perform** the analysis, comparison and evaluation of the credibility and reliability of **well-defined** sources of data, information and digital content. • **perform** the analysis, interpretation and evaluation of **well-defined** data, information and digital content
	4	Independently, according to my own needs, and solving well-defined and non-routine problems, I can:	• **perform** the analysis, comparison and evaluation of sources of data, information and digital content. • **perform** the analysis, interpretation and evaluation of data, information and digital content.
ADVANCED	5	As well as guiding others, I can:	• **carry out** an evaluation of the credibility and reliability of **different** sources of data, information and digital content. • **carry out** an evaluation of **different** data, information and digital content.
	6	At advanced level, according to my own needs and those of others, and in complex contexts, I can:	• critically **assess** the credibility and reliability of sources of data, information and digital content. • critically **assess** data, information and digital content.
HIGHLY SPECIALISED	7	At highly specialised level, I can:	• **create solutions to complex problems with limited definition** that are related to analysing and evaluating credible and reliable sources of data, information and content in digital environments. • **integrate** my knowledge **to contribute to professional practices and knowledge** and to **guide others** in the analysis and evaluation of the credibility and reliability of data, information and digital content and their sources.
	8	At the most advanced and specialised level, I can:	• **create solutions to solve complex problems with many interacting factors** that are related to analysing and evaluating credible and reliable sources of data, information and content in digital environments. • **propose new** ideas and processes to the field.

DIMENSION 4 • **EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES**

NEW IN 2.2

KNOWLEDGE

16. Aware that online environments contain all types of information and content including misinformation and disinformation, and even if a topic is widely reported it does not necessarily mean it is accurate.
17. Understands the difference between disinformation (false information with the intent to deceive people) and misinformation (false information regardless of intent to deceive or mislead people).
18. Knows the importance of identifying who is behind information found on the internet (e.g. on social media) and verifying it by checking multiple sources, to help recognise and understand point of view or bias behind particular information and data sources
19. Aware of potential information biases caused by various factors (e.g. data, algorithms, editorial choices, censorship, one's own personal limitations).
20. Knows that the term "deep-fakes" refers to AI-generated images, videos or audio recordings of events or persons that did not really happen (e.g. speeches by politicians, celebrity faces on pornographic imagery). They may be impossible to distinguish from the real thing. (**AI**)
21. Aware that AI algorithms might not be configured to provide only the information that the user wants; they might also embody a commercial or political message (e.g. to encourage users to stay on the site, to watch or buy something particular, to share specific opinions). This can also have negative consequences (e.g. reproducing stereotypes, sharing misinformation). (**AI**)
22. Aware that the data, on which AI depends, may include biases. If so, these biases can become automated and worsened by the use of AI. For example, search results about occupation may include stereotypes about male or female jobs (e.g. male bus drivers, female sales persons). (**AI**)

SKILLS

23. Carefully considers the top/first search results in both text-based and audio searches, as they may reflect commercial and other interests rather than be the most appropriate results for the query.
24. Knows how to differentiate sponsored content from other content online (e.g. recognising advertisements and marketing messages on social media or search engines) even if it is not marked as sponsored.
25. Knows how to analyse and critically evaluate search results and social media activity streams, to identify their origins, to distinguish fact-reporting from opinion, and to determine whether outputs are truthful or have other limitations (e.g. economic, political, religious interests).
26. Knows how to find the author or the source of the information, to verify whether it is credible (e.g. an expert or authority in a relevant discipline).
27. Able to recognise that some AI algorithms may reinforce existing views in digital environments by creating "echo chambers" or "filter bubbles" (e.g. if a social media stream favours a particular political ideology, additional recommendations can reinforce that ideology without exposing it to opposing arguments). (**AI**)

ATTITUDES

28. Inclined to ask critical questions in order to evaluate the quality of online information, and concerned about purposes behind spreading and amplifying disinformation.
29. Willing to fact-check a piece of information and assess its accuracy, reliability and authority, while preferring primary sources over secondary sources of information where possible.
30. Carefully considers the possible outcome before clicking a link. Some links (e.g. compelling titles) could be "clickbait" that takes the user to sponsored or unwanted content (e.g. pornography).

DIMENSION 5 • **USE CASES**

FOUNDATION 1

EMPLOYMENT SCENARIO: job seeking process

With help from an employment adviser

- I can identify in a list of job portals and apps a friend has found in an employment office's blog, those that are commonly used because they have credible and reliable job offers.

LEARNING SCENARIO: prepare group work with my classmates

With help from my teacher

- I can identify, from a list in my textbook of blogs and digital databases containing available literature, those that are commonly used because they are credible and reliable.

DIMENSION 1 • **COMPETENCE AREA**

1. INFORMATION AND DATA LITERACY

DIMENSION 2 • **COMPETENCE**

1.3 MANAGING DATA, INFORMATION AND DIGITAL CONTENT

To organise, store and retrieve data, information, and content in digital environments. To organise and process them in a structured environment.

DIMENSION 3 • **PROFICIENCY LEVEL**

FOUNDATION	1	At basic level and with guidance, I can:	• **identify** how to organise, store and retrieve data, information and content in a **simple way** in digital environments. • **recognise** where to organise them in a **simple way** in a structured environment.
	2	At basic level and with autonomy and appropriate guidance where needed, I can:	• **identify** how to organise, store and retrieve data, information and content in a **simple way** in digital environments. • **recognise** where to organise them in a **simple way** in a structured environment.
INTERMEDIATE	3	On my own and solving straightforward problems, I can:	• **select** data, information and content in order to organise, store and retrieve them in a **routine way** in digital environments. • **organise** them in a **routine way** in a structured environment.
	4	Independently, according to my own needs, and solving well-defined and non-routine problems, I can:	• **organise** information, data and content to be easily stored and retrieved. • **organise** information, data and content in a structured environment.
ADVANCED	5	As well as guiding others, I can:	• **manipulate** information, data and content for their easier organisation, storage and retrieval. • **carry out** their organisation and processing in a structured environment.
	6	At advanced level, according to my own needs and those of others, and in complex contexts, I can:	• **adapt** the management of information, data and content for **the most appropriate** easy retrieval and storage. • **adapt** them to be organised and processed in **the most appropriate** structured environment.
HIGHLY SPECIALISED	7	At highly specialised level, I can:	• **create solutions to complex problems with limited definition** that are related to managing data, information, and content for their organisation, storage and retrieval in a structured digital environment. • **integrate** my knowledge **to contribute to professional practices and knowledge and to guide others** in managing data, information and digital content in a structured digital environment.
	8	At the most advanced and specialised level, I can:	• **create solutions to solve complex problems with many interacting factors** that are related to managing data, information, and content for their organisation, storage and retrieval in a structured digital environment. • **propose new** ideas and processes to the field.

DIMENSION 4 • **EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES**

NEW IN 2.2

KNOWLEDGE

31. Aware that many applications on the internet and mobile phones collect and process data (personal data, behavioural data and contextual data) that the user can access or retrieve, for example, to monitor their activities online (e.g. clicks in social media, searches on Google) and offline (e.g. daily steps, bus rides on public transport).
32. Aware that for data (e.g. numbers, text, images, sounds) to be processed by a program, they have to be first properly digitised (i.e. digitally encoded).
33. Knows that data collected and processed, for example by online systems, can be used to recognise patterns (e.g. repetitions) in new data (i.e. other images, sounds, mouse clicks, online behaviours) to further optimise and personalise online services (e.g. advertisements).
34. Aware that sensors used in many digital technologies and applications (e.g. facial tracking cameras, virtual assistants, wearable technologies, mobile phones, smart devices) generate large amounts of data, including personal data, that can be used to train an AI system. (**AI**)
35. Knows that open data repositories exist where anyone can get data to support some problem solving activities (e.g. citizens can use open data to generate thematic maps or other digital content).

SKILLS

36. Knows how to collect digital data using basic tools such as online forms, and present them in an accessible way (e.g. using headers in tables).
37. Can apply basic statistical procedures to data in a structured environment (e.g. spreadsheet) to produce graphs and other visualisations (e.g. histograms, bar charts, pie charts).
38. Knows how to interact with dynamic data visualisation and can manipulate dynamic graphs of interest (e.g. as provided by Eurostat, government websites).
39. Can differentiate between different types of storage locations (local devices, local network, cloud) that are the most appropriate to use (e.g. data on the cloud is available anytime and from anywhere, but has implications for access time).
40. Can use data tools (e.g. databases, data mining, analysis software) designed to manage and organise complex information, to support decision-making and solving problems.

ATTITUDES

41. Considers transparency when manipulating and presenting data to ensure reliability, and spots data that are expressed with underlying motives (e.g. unethical, profit, manipulation) or in misleading ways.
42. Watchful of accuracy when evaluating sophisticated representations of data (e.g. tables or visualisations as they could be used to mislead one's judgement by trying to give a false sense of objectivity.

DIMENSION 5 • **USE CASES**

FOUNDATION 2

EMPLOYMENT SCENARIO: job seeking process

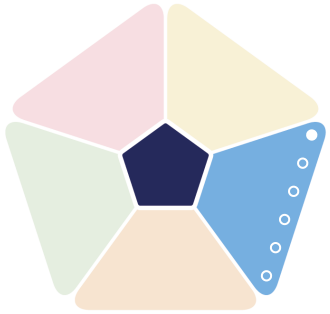
At home with my sister who I ask whenever I need

- I can identify how and where to organise and keep track of job ads in a job app (e.g. www.indeed.com) of my smartphone in order to retrieve them when I need them along my job seeking.

LEARNING SCENARIO: prepare group work with my classmates

In the classroom with my teacher who I can consult whenever I need

- I can identify an app in my tablet to organise and store links to those websites, blogs and digital databases related with a specific topic of literature and use it to retrieve them when needed for my report.



DIMENSION 1 • **COMPETENCE AREA**

2. COMMUNICATION AND COLLABORATION

DIMENSION 2 • **COMPETENCE**

2.1 INTERACTING THROUGH DIGITAL TECHNOLOGIES

To interact through a variety of digital technologies and to understand appropriate digital communication means for a given context.

DIMENSION 3 • **PROFICIENCY LEVEL**

FOUNDATION	1	At basic level and with guidance, I can:	• **select simple** digital technologies to interact, and • **identify** appropriate **simple** communication means for a given context.
	2	At basic level and with autonomy and appropriate guidance where needed, I can:	• **select simple** digital technologies to interact, and • **identify** appropriate **simple** communication means for a given context.
INTERMEDIATE	3	On my own and solving straightforward problems, I can:	• **perform well-defined and routine** interactions with digital technologies, and • **select well-defined and routine** appropriate digital communication means for a given context.
	4	Independently, according to my own needs, and solving well-defined and non-routine problems, I can:	• **select** a variety of digital technologies to interact, and • **select** a variety of appropriate digital communication means for a given context.
ADVANCED	5	As well as guiding others, I can:	• **use** a variety of digital technologies in order to interact, • **show** others **the most appropriate** digital communication means for a given context
	6	At advanced level, according to my own needs and those of others, and in complex contexts, I can:	• **adapt** a variety of digital technologies for **the most appropriate** interaction, and • **adapt the most appropriate** communication means for a given context.
HIGHLY SPECIALISED	7	At highly specialised level, I can:	• **create solutions to complex problems with limited definition** that are related to interacting through digital technologies and digital communication means. • **integrate** my knowledge **to contribute to professional practices and knowledge and to guide others** in the interaction through digital technologies.
	8	At the most advanced and specialised level, I can:	• **create solutions to solve complex problems with many interacting factors** that are related to interacting through digital technologies and digital communication means • **propose new** ideas and processes to the field.

DIMENSION 4 • **EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES**

NEW IN 2.2

KNOWLEDGE

43. Knows that many communication services (e.g. instant messaging) and social media are free of charge because they are partly paid for by advertising and monetising user data.
44. Aware that many communication services and digital environments (e.g. social media) use mechanisms such as nudging, gamification and manipulation to influence user behaviour.
45. Aware which communication tools and services (e.g. phone, email, video conference, social network, podcast) are appropriate in specific circumstances (e.g. synchronous, asynchronous), depending on the audience, context and purpose of the communication. Aware that some tools and services also provide an accessibility statement. (**DA**)
46. Aware of the need to formulate messages in digital environments so that they are easily understandable by the targeted audience or the recipient.

SKILLS

47. Knows how to use a variety of videoconferencing features (e.g. moderating a session, recording audio and video).
48. Able to achieve effective communication in asynchronous (non-simultaneous) mode using digital tools (e.g. for reporting and briefing, sharing ideas, giving feedback and advice, scheduling meetings, communicating milestones). (**RW**)
49. Knows how to use digital tools for informal communication with colleagues in order to develop and maintain social relations (e.g. to reproduce conversations such as those during face-to-face coffee breaks). (**RW**)
50. Knows how to identify signs that indicate whether one is communicating with a human or an AI-based conversational agent (e.g. when using text- or voice-based chatbots). (**AI**)
51. Able to interact and give feedback to the AI system (e.g. by giving user ratings, likes, tags to online content) to influence what it next recommends (e.g. to get more recommendations on similar movies that the user previously liked). (**AI**)
52. Considers the need to balance asynchronous and synchronous communication activities (e.g. to minimise video conferencing fatigue, to respect co-workers time and preferred working hours).

ATTITUDES

53. Willing to listen to others and to engage in online conversations with confidence, clarity and reciprocity, both in personal and social contexts.
54. Open to AI systems supporting humans to make informed decisions in accordance with their goals (e.g. users actively deciding whether to act upon a recommendation or not). (**AI**)
55. Willing to adapt an appropriate communication strategy depending on the situation and digital tool: verbal strategies (written, oral language), non-verbal strategies (body language, facial expressions, tone of voice), visuals strategies (signs, icons, illustrations) or mixed strategies.

DIMENSION 5 • **USE CASES**

INTERMEDIATE 3

EMPLOYMENT SCENARIO: organise an event

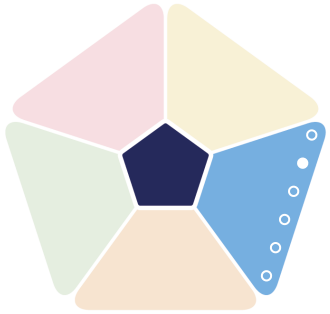
By myself:

- I can interact with participants and other colleagues using my corporate email account app on my smartphone in order to organise an event for my company.
- I can also select options available in my email suite to organise the event, such as sending calendar invitations.
- I can fix problems, e.g. an incorrect email address.

LEARNING SCENARIO: prepare group work with my classmates

By myself:

- I can use a commonly-used chat on my smartphone (e.g. Facebook messenger or WhatsApp) to talk to my classmates and organise group work.
- I can choose other digital communication means on the classroom tablet (e.g. my classroom forum) that could be useful to talk about the details of organising group work.
- I can fix problems such as adding or deleting members to the chat group.



DIMENSION 1 • **COMPETENCE AREA**

2. COMMUNICATION AND COLLABORATION

DIMENSION 2 • **COMPETENCE**

2.2 SHARING THROUGH DIGITAL TECHNOLOGIES

To share data, information and digital content with others through appropriate digital technologies. To act as an intermediary, to know about referencing and attribution practices.

DIMENSION 3 • **PROFICIENCY LEVEL**

FOUNDATION	1	At basic level and with guidance, I can:	• **recognise simple** appropriate digital technologies to share data, information and digital content. • **identify simple** referencing and attribution practices.
	2	At basic level and with autonomy and appropriate guidance where needed, I can:	• **recognise simple** appropriate digital technologies to share data, information and digital content. • **identify simple** referencing and attribution practices.
INTERMEDIATE	3	On my own and solving straightforward problems, I can:	• **select well-defined and routine** appropriate digital technologies to share data, information and digital content. • **explain** how to act as an intermediary for sharing information and content through **well-defined** and **routine** digital technologies, • **illustrate well-defined and routine** referencing and attribution practices.
	4	Independently, according to my own needs, and solving well-defined and non-routine problems, I can:	• **manipulate** appropriate digital technologies to share data, information and digital content. • **explain** how to act as an intermediary for sharing information and content through digital technologies, • **illustrate** referencing and attribution practices.
ADVANCED	5	As well as guiding others, I can:	• **share** data, information and digital content through a **variety of** appropriate digital tools, • **show** others how to act as an intermediary for sharing information and content through digital technologies. • **apply a variety of** referencing and attribution practices.
	6	At advanced level, according to my own needs and those of others, and in complex contexts, I can:	• **assess the most appropriate** digital technologies to share information and content. • **adapt** my intermediation role, • **vary** the use of the **more appropriate** referencing and attribution practices.
HIGHLY SPECIALISED	7	At highly specialised level, I can:	• **create solutions to complex problems with limited definition** that are related to sharing through digital technologies. • **integrate my knowledge to contribute to professional practices and knowledge and guide others** in sharing through digital technologies.
	8	At the most advanced and specialised level, I can:	• **create solutions to solve complex problems with many interacting factors** that are related to sharing through digital technologies. • **propose new** ideas and processes to the field.

DIMENSION 4 • **EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES**

NEW IN 2.2

KNOWLEDGE

56. Aware that everything that one shares publicly online (e.g. images, videos, sounds) can be used to train AI systems. For example, commercial software companies who develop AI facial recognition systems can use personal images shared online (e.g. family photographs) to train and improve the software's capability to automatically recognise those persons in other images, which might not be desirable (e.g. might be a breach of privacy). (**AI**)
57. Knows the role and responsibilities of the online facilitator to structure and guide a discussion group (e.g. how to act as an intermediary when sharing information and digital content in digital environments).

SKILLS

58. Knows how to share digital content (e.g. pictures) across multiple devices (e.g. from smartphones to cloud services).
59. Knows how to share and show information from one's own device (e.g. show graphs from a laptop) to support a message being conveyed during a real time online session (e.g. video conference). (**RW**)
60. Able to select and restrict with whom the content is shared (e.g. giving access only to friends on social media, allowing only co-workers to read and comment on a text).
61. Knows how to curate content on content sharing platforms so as to add value for oneself and others (e.g. shares music playlists, shares comments on online services).
62. Knows how to acknowledge the original source and authors of shared content.
63. Knows how to flag or report disinformation and misinformation to fact-checking organisations and to social media platforms in order to stop it spreading.

ATTITUDES

64. Willing to share expertise on the internet, for example through intervening in online forums, contributing to Wikipedia or through creating Open Educational Resources.
65. Open towards sharing digital content that might be interesting and useful to others.
66. Inclined not to share digital resources if not able to cite their author or source in an appropriate manner.

DIMENSION 5 • **USE CASES**

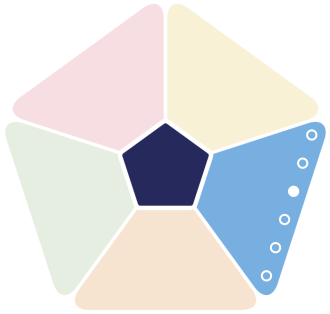
INTERMEDIATE 4

EMPLOYMENT SCENARIO: organise an event

- I can use my company's digital storage system to share the event's agenda with the list of participants I created on my PC.
- I can show my colleagues on their smartphones how to access and share the agenda using my organisation's digital storage system.
- I can show my boss examples on her tablet of the digital sources I use to design the event's agenda.
- I can respond to any issue while I am doing these activities, such as unexpected problems with sharing the agenda with the participants.

LEARNING SCENARIO: prepare group work with my classmates

- I can use a cloud-based storage system (e.g. Dropbox, Google Drive) to share material with other members of my group.
- I can explain to other members of my group, using the class laptop, how I share the material in the digital storage system.
- I can show my teacher, on her tablet, the digital sources I use to prepare the material for group work.
- While I am doing these activities, I can solve any issue that may arise such as solving problems to do with storage or sharing material with other members of my group.



DIMENSION 1 • **COMPETENCE AREA**

2. COMMUNICATION AND COLLABORATION

DIMENSION 2 • **COMPETENCE**

2.3 ENGAGING CITIZENSHIP THROUGH DIGITAL TECHNOLOGIES

To participate in society through the use of public and private digital services. To seek opportunities for self-empowerment and for participatory citizenship through appropriate digital technologies.

DIMENSION 3 • **PROFICIENCY LEVEL**

FOUNDATION	1	At basic level and with guidance, I can:	• **identify simple** digital services in order to participate in society. • **recognise simple** appropriate digital technologies to empower myself and to participate in society as a citizen.
	2	At basic level and with autonomy and appropriate guidance where needed, I can:	• **identify simple** digital services in order to participate in society. • **recognise simple** appropriate digital technologies to empower myself and to participate in society as a citizen.
INTERMEDIATE	3	On my own and solving straightforward problems, I can:	• **select well-defined and routine** digital services in order to participate in society. • **indicate well-defined and routine** appropriate digital technologies to empower myself and to participate in society as a citizen.
	4	Independently, according to my own needs, and solving well-defined and non-routine problems, I can:	• **select** digital services in order to participate in society. • **discuss** appropriate digital technologies to empower myself and to participate in society as a citizen.
ADVANCED	5	As well as guiding others, I can:	• **propose differen**t digital services to participate in society. • **use** appropriate digital technologies to empower myself and to participate in society as a citizen.
	6	At advanced level, according to my own needs and those of others, and in complex contexts, I can:	• **vary** the use of the **most appropriate** digital services in order to participate in society. • **vary** the use of the **most appropriate** digital technologies to empower myself and to participate in society as a citizen.
HIGHLY SPECIALISED	7	At highly specialised level, I can:	• **create solutions to complex problems with limited definition** that are related to engaging in citizenship through digital technologies. • **integrate my knowledge to contribute to professional practices and knowledge and guide others** in engaging in citizenship through digital technologies.
	8	At the most advanced and specialised level, I can:	• **create solutions to solve complex problems with many interacting factors** that are related to engaging in citizenship through digital technologies. • **propose new** ideas and processes to the field.

DIMENSION 4 • **EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES**

NEW IN 2.2

KNOWLEDGE

67. Knows about different types of digital services on the internet: public ones (e.g. services to consult tax information or make an appointment in the health care centre), community-based services (e.g. knowledge repositories such as Wikipedia, map services such as Open Street Map, environmental monitoring services such as Sensor Community) and private services (e.g. e-commerce, online banking).
68. Knows that a secure electronic identification, (e.g. identity cards which contain digital certificates), enables citizens to increase safety when using online services provided by the government or by the private sector.
69. Knows that all EU citizens have the right to not be subject to fully automated decision-making (e.g. if an automatic system refuses a credit application, the customer has the right to ask for the decision to be reviewed by a person). (**AI**)
70. Recognises that while the application of AI systems in many domains is usually uncontroversial (e.g. AI that helps avert climate change), AI that directly interacts with humans and takes decisions about their life can often be controversial (e.g. CV-sorting software for recruitment procedures, scoring of exams that may determine access to education). (**AI**)
71. Knows that AI per se is neither good nor bad. What determines whether the outcomes of an AI system are positive or negative for society are how the AI system is designed and used, by whom and for what purposes. (**AI**)
72. Aware of civil society platforms on the internet that offer opportunities for citizens to participate in actions targeting global developments to reach sustainability goals on local, regional, national, European and international level.
73. Aware of the role of traditional (e.g. newspapers, television) and new forms of media (e.g. social media, the internet) in democratic societies.

SKILLS

74. Knows how to acquire certificates from a certification authority (CA) for the purpose of a secure electronic identification.
75. Knows how to monitor public spending of local and national government (e.g. through open data on the government's website and open data portals).
76. Knows how to identify areas where AI can bring benefits to various aspects of everyday life. For example, in healthcare, AI might contribute to early diagnosis, while in agriculture, it might be used to detect pest infestations. (**AI**)
77. Knows how to engage with others through digital technologies for the sustainable development of society (e.g. create opportunities for joint action across communities, sectors and regions with different interests in sustainability challenges) with an awareness of technology´s potential for both inclusion/participation and exclusion.

ATTITUDES

78. Open to change one's own administrative routines and adopt digital procedures when dealing with government and public services.
79. Readiness to contemplate ethical questions related to AI systems (e.g. in which contexts, such as sentencing criminals, should AI recommendations not be used without human intervention)? (**AI**)
80. Considers responsible and constructive attitudes on the internet as they are the foundation for human rights, together with values such as respect for human dignity, freedom, democracy and equality.
81. Proactive about using the internet and digital technologies to seek opportunities for constructive participation in democratic decision-making and civic activities (e.g. by participating in consultations organised by municipality, policy-makers, NGOs; signing a petition using a digital platform).

DIMENSION 5 • **USE CASES**

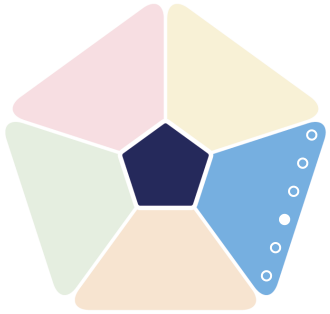
ADVANCED 5

EMPLOYMENT SCENARIO: organise an event

- I can propose and use different media strategies (e.g. Survey on FaceBook, Hashtags on Instagram and Twitter) to empower the citizens of my city to participate in defining the main topics of an event on the use of sugar in food production.
- I can inform my colleagues about these strategies and show them how to use a particular one to empower citizens to participate.

LEARNING SCENARIO: prepare group work with my classmates

- I can propose and use different micro-blogs (e.g. Twitter), blogs and wikis, for a public consultation regarding social inclusion of migrants in my neighbourhood to collect proposals on the topic of the group work.
- I can inform my classmates about these digital platforms and guide them on how to use a particular one to empower citizenship participation in their neighbourhood.



DIMENSION 1 • **COMPETENCE AREA**

2. COMMUNICATION AND COLLABORATION

DIMENSION 2 • **COMPETENCE**

2.4 COLLABORATING THROUGH DIGITAL TECHNOLOGIES

To use digital tools and technologies for collaborative processes, and for co-construction and co-creation of data, resources and knowledge.

DIMENSION 3 • **PROFICIENCY LEVEL**

FOUNDATION	1	At basic level and with guidance, I can:	• **choose simple** digital tools and technologies for collaborative processes.
	2	At basic level and with autonomy and appropriate guidance where needed, I can:	• **choose simple** digital tools and technologies for collaborative processes.
INTERMEDIATE	3	On my own and solving straightforward problems, I can:	• **select well-defined and routine** digital tools and technologies for collaborative processes.
	4	Independently, according to my own needs, and solving well-defined and non-routine problems, I can:	• **select** digital tools and technologies for collaborative processes.
ADVANCED	5	As well as guiding others, I can:	• **propose different** digital tools and technologies for collaborative processes.
	6	At advanced level, according to my own needs and those of others, and in complex contexts, I can:	• **vary** the use of the **most appropriate** digital tools and technologies for collaborative processes. • **choose** the **most appropriate** digital tools and technologies for co-constructing and co-creating data, resources and knowledge.
HIGHLY SPECIALISED	7	At highly specialised level, I can:	• **vary** the use of the **most appropriate** digital tools and technologies for collaborative processes. • **choose** the **most appropriate** digital tools and technologies for co-constructing and co-creating data, resources and knowledge.
	8	At the most advanced and specialised level, I can:	• **create solutions to solve complex problems with many interacting factors** that are related to using collaborative processes and co-construction and co-creation of data, resources and knowledge through digital tools and technologies. • **propose new** ideas and processes to the field.

DIMENSION 4 • **EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES**

NEW IN 2.2

KNOWLEDGE

82. Aware of the advantages of using digital tools and technologies for remote collaborative processes (e.g. reduced commuting time, join specialised skills together regardless of location).
83. Understands that in order to co-create digital content with other people, good social skills (e.g. clear communication, ability to clarify misunderstandings) are important to compensate for the limitations of online communication .

SKILLS

84. Knows how to use digital tools in a collaborative context to plan and share tasks and responsibilities within a group of friends, a family or a sport or work team (e.g. digital calendar, planners for trips and leisure activities).
85. Knows how to use digital tools to facilitate and improve collaborative processes, for example through shared visual boards and digital canvases (e.g. Mural, Miro, Padlet).
86. Knows how to engage collaboratively in a wiki (e.g. negotiate opening a new entry on a subject that is missing from Wikipedia to increase public knowledge).
87. Knows how to use digital tools and technologies in a remote working context for idea generation and co-creation of digital content (e.g. shared mind maps and whiteboards, polling tools). (**RW**)
88. Knows how to evaluate the advantages and disadvantages of digital applications for making collaboration effective (e.g. the use of online spaces for co-creation, shared project management tools).

ATTITUDES

89. Encourages everyone to express their own opinions constructively when collaborating in digital environments.
90. Acts in trustworthy ways to achieve group goals when engaging in co-construction of resources or knowledge.
91. Inclined to use appropriate digital tools for fostering collaboration between the members of a team while, at the same time, ensuring digital accessibility. (**DA**)

DIMENSION 5 • **USE CASES**

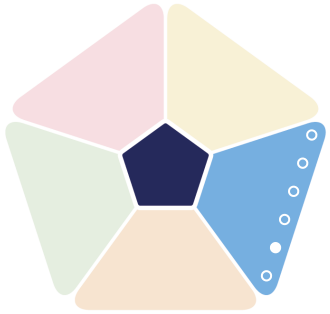
ADVANCED 6

EMPLOYMENT SCENARIO: organise an event

- I can use the most appropriate digital tools at work (e.g. Dropbox, Google Drive, wiki) to create with my colleagues a leaflet and a blog on the event.
- I can also differentiate between appropriate and inappropriate digital tools for collaborative processes. The latter are those tools that do not address the purpose and scope of the task - e.g. two people editing text simultaneously using a wiki is impractical.
- I can overcome unexpected situations that can arise in the digital environment when co-creating the leaflet and the blog (e.g. controlling access to edit documents or a colleague cannot save changes to the material).

LEARNING SCENARIO: prepare group work with my classmates

- can use the most appropriate digital resources in order to create a video related to the work on my tablet with my classmates. I can also differentiate between appropriate and inappropriate digital resources to create this video and work in a digital environment together with classmates.
- I can overcome unexpected situations that arise on the digital environment when co-creating data and content and making a video on group work. (e.g. a file is not updating the changes made by the members, a member doesn't know how to upload a file in the digital tool).



DIMENSION 1 • **COMPETENCE AREA**

2. COMMUNICATION AND COLLABORATION

DIMENSION 2 • **COMPETENCE**

2.5 NETIQUETTE

To be aware of behavioural norms and know-how while using digital technologies and interacting in digital environments. To adapt communication strategies to the specific audience and to be aware of cultural and generational diversity in digital environments.

DIMENSION 3 • **PROFICIENCY LEVEL**

FOUNDATION	1	At basic level and with guidance, I can:	• **differentiate simple** behavioural norms and know-how while using digital technologies and interacting in digital environments. • **choose simple** communication modes and strategies adapted to an audience and • **differentiate simple** cultural and generational diversity aspects to consider in digital environments.
	2	At basic level and with autonomy and appropriate guidance where needed, I can:	• **differentiate simple** behavioural norms and know-how while using digital technologies and interacting in digital environments. • **choose simple** communication modes and strategies adapted to an audience and • **differentiate simple** cultural and generational diversity aspects to consider in digital environments.
INTERMEDIATE	3	On my own and solving straightforward problems, I can:	• **clarify well-defined and routine** behavioural norms and know-how while using digital technologies and interacting in digital environments. • **express well-defined and routine** communication strategies adapted to an audience. • **describe well-defined and routine** cultural and generational diversity aspects to consider in digital environments.
	4	Independently, according to my own needs, and solving well-defined and non-routine problems, I can:	• **discuss** behavioural norms and know-how while using digital technologies and interacting in digital environments. • **discuss** communication strategies adapted to an audience and • **discuss** cultural and generational diversity aspects to consider in digital environments.
ADVANCED	5	As well as guiding others, I can:	• **apply different** behavioural norms and know-how while using digital technologies and interacting in digital environments. • **apply different** communication strategies in digital environments adapted to an audience and • **apply different** cultural and generational diversity aspects to consider in digital environments.
	6	At advanced level, according to my own needs and those of others, and in complex contexts, I can:	• **adapt** the **most appropriate** behavioural norms and know-how while using digital technologies and interacting in digital environments. • **adapt** the **most appropriate** communication strategies in digital environments to an audience. • **apply different** cultural and generational diversity aspects in digital environments.
HIGHLY SPECIALISED	7	At highly specialised level, I can:	• **create solutions to complex problems with limited definition** that are related to digital etiquettes respectful of different audiences and cultural and generational diversity. • **integrate** my knowledge **to contribute to professional practice and knowledge and guide others** in digital etiquette
	8	At the most advanced and specialised level, I can:	• **create solutions to solve complex problems with many interacting factors** that are related to digital etiquettes respectful to different audiences and cultural and generational diversity. • **propose new** ideas and processes to the field.

DIMENSION 4 • **EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES**

NEW IN 2.2

KNOWLEDGE

92. Aware of the meaning of non-verbal messages (e.g. smiley faces, emojis) used in digital environments (e.g. social media, instant messaging) and knowing that their use can culturally differ between countries and communities.
93. Aware of the existence of some expected rules about one's behaviour when using digital technologies (e.g. using audio headsets instead of loudspeakers when taking calls in public places or listening to music).
94. Understands that inappropriate behaviours in digital environments (e.g. drunken, being overly intimate and other sexually explicit behaviour) can damage social and personal aspects of lives over a long term.
95. Aware that adapting one's behaviour in digital environments depends on one's relationship with other participants (e.g. friends, co-workers, managers) and the purpose in which the communication takes place (e.g. to instruct, inform, persuade, order, entertain, inquire, socialise).
96. Aware of accessibility requirements when communicating in digital environments so that communication is inclusive and accessible for all users (e.g. for people with disabilities, older people, those with low literacy, speakers of another language). (**DA**)

SKILLS

97. Knows how to stop receiving unwanted disturbing messages or emails.
98. Able to manage one's feelings when talking with other people on the internet.
99. Knows how to recognise hostile or derogatory messages or activities online that attack certain individuals or groups of individuals (e.g. hate speech).
100. Can manage interactions and conversations in different socio-cultural contexts and domain-specific situations.

ATTITUDES

101. Believes that it is necessary to define and share rules within digital communities (e.g. explain codes of conduct for creating, sharing or posting content).
102. Inclined to adopt an empathic perspective in communication (e.g. being responsive to another person's emotions and experiences, negotiating disagreements to build and sustain fair and respectful relationships).
103. Open to and respectful of the views of people on the internet with different cultural affiliations, backgrounds, beliefs, values, opinions or personal circumstances; open to the perspectives of others even if they differ from one's own.

DIMENSION 5 • **USE CASES**

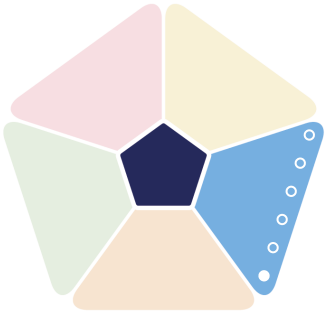
HIGHLY SPECIALISED 7

EMPLOYMENT SCENARIO: organise an event

- While organising an event for my organisation, I can solve problems that arise while writing and communicating in digital environments, (e.g. inappropriate comments about my organisation in a social network).
- I can create rules from this practice for my current and future colleagues to implement and use as a guide.

LEARNING SCENARIO: prepare group work with my classmates

- I can solve problems of etiquette that arise with my classmates while using a digital collaborative platform (blog, wiki, etc.) for group work (e.g. classmates criticising each other).
- I can create rules for appropriate behaviour while working online as a group which can be used and shared in the school's digital learning environment. I can also guide my classmates as to what constitutes appropriate digital behaviour while working with others on a digital platform.



DIMENSION 1 • **COMPETENCE AREA**

2. COMMUNICATION AND COLLABORATION

DIMENSION 2 • **COMPETENCE**

2.6 MANAGING DIGITAL IDENTITY

To create, and manage one or multiple digital identities, to be able to protect one's own reputation, to deal with the data that one produces through several digital tools, environments and services.

DIMENSION 3 • **PROFICIENCY LEVEL**

FOUNDATION	1	At basic level and with guidance, I can:	• **identify** a digital identity, • **describe simple** ways to protect my reputation online, • **recognise simple** data I produce through digital tools, environments or services.
	2	At basic level and with autonomy and appropriate guidance where needed, I can:	• **identify** a digital identity, • **describe simple** ways to protect my reputation online, • **recognise simple** data I produce through digital tools, environments or services.
INTERMEDIATE	3	On my own and solving straightforward problems, I can:	• **discriminate** a range of well-defined and routine digital identities, • **explain well-defined and routine** ways to protect my reputation online, • **describe well-defined** data I **routinely** produce through digital tools, environments or services.
	4	Independently, according to my own needs, and solving well-defined and non-routine problems, I can:	• **display** a **variety** of specific digital identities, • **discuss specific** ways to protect my reputation online, • **manipulate** data I produce through digital tools, environments or services.
ADVANCED	5	As well as guiding others, I can:	• **use** a **variety** of digital identities, • **apply different** ways to protect my reputation online, • **use** data I produce through several digital tools environment and services.
	6	At advanced level, according to my own needs and those of others, and in complex contexts, I can:	• **discriminate** multiple digital identities, • **explain** the more appropriate ways to protect one's own reputation, • **change** the data produced through several tools, environments and services.
HIGHLY SPECIALISED	7	At highly specialised level, I can:	• **create solutions to complex problems with limited definition** that are related to managing digital identities and protection of people's online reputation. • **integrate** my knowledge **to contribute to professional practice** and knowledge and **guide others** in managing digital identity.
	8	At the most advanced and specialised level, I can:	• **create solutions to solve complex problems with many interacting factors** that are related to managing digital identities and protection of people's online reputation. • **propose new** ideas and processes to the field.

DIMENSION 4 • **EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES**

NEW IN 2.2

KNOWLEDGE

104. Aware that digital identity refers to (1) the method of authenticating a user on a website or an online service, and also to (2) a set of data identifying a user by means of tracing their digital activities, actions and contributions on the internet or digital devices (e.g. pages viewed, purchase history), personal data (e.g. name, username, profile data such as age, gender, hobbies) and context data (e.g. geographical location).
105. Aware that AI systems collect and process multiple types of user data (e.g. personal data, behavioural data and contextual data) to create user profiles which are then used, for example, to predict what the user might want to see or do next (e.g. offer advertisements, recommendations, services). (**AI**)
106. Knows that in the EU, one has the right to ask a website's or search engine's administrators to access personal data held about you (right of access), to update or correct them (right of rectification), or remove them (right of erasure, also known as the Right To Be Forgotten).
107. Aware that there are ways to limit and manage the tracking of one's activities on the internet, such as software features (e.g. private browsing, deletion of cookies) and privacy-enhancing tools and product/service features (e.g. custom consent for cookies, opting out of personalised ads).

SKILLS

108. Knows how to create and manage profiles in digital environments for personal purposes (e.g. civic participation, e-commerce, social media use) and professional purposes (e.g. create a profile on an online employment platform).
109. Knows how to adopt information and communication practices in order to build a positive online identity (e.g. by adopting healthy, safe and ethical behaviours, such as avoiding stereotypes and consumerism).
110. Able to conduct an individual or family name search in order to inspect one's own digital footprint in online environments (e.g. to detect any potentially troubling posts or images, to exercise one's legal rights).
111. Able to verify and modify what type of metadata (e.g. location, time) is included in pictures being shared in order to protect privacy.
112. Knows what strategies to use in order to control, manage or delete data that is collected/curated by online systems (e.g. keeping track of services used, listing online accounts, deleting accounts that are not in use).
113. Knows how to modify user configurations (e.g. in apps, software, digital platforms) to enable, prevent or moderate the AI system tracking, collecting or analysing data (e.g. not allowing the mobile phone to track the user's location). (**AI**)

ATTITUDES

114. Considers the benefits (e.g. fast authentication process, user preferences) and risks (e.g. having identities stolen, personal data exploited by third parties) when managing one or multiple digital identities across digital systems, apps and services.
115. Inclined to check and select website cookies to be installed (e.g. accepting only technical cookies) when the website provides users with this option.
116. Careful about t keeping one's own and others' personal information private (e.g. vacations or birthday photos; religious or political comments).
117. Identifies both the positive and negative implications of the use of all data (collection, encoding and processing), but especially personal data, by AI-driven digital technologies such as apps and online services. (**AI**)

DIMENSION 5 • **USE CASES**

HIGHLY SPECIALISED 8

EMPLOYMENT SCENARIO: organise an event

- I can propose to my boss a new social media procedure that avoids actions which could harm our company's digital reputation (e.g. spam) when promoting the company's events.

LEARNING SCENARIO: prepare group work with my classmates

- I can propose a new procedure to my school that avoids the publication of digital content (texts, pictures, videos), that can harm the students' reputation.

DIMENSION 1 • **COMPETENCE AREA**

3. DIGITAL CONTENT CREATION

DIMENSION 2 • **COMPETENCE**

3.1 DEVELOPING DIGITAL CONTENT

To create and edit digital content in different formats, to express oneself through digital means.

DIMENSION 3 • **PROFICIENCY LEVEL**

FOUNDATION	1	At basic level and with guidance, I can:	• **identify** ways to create and edit simple content in **simple** formats, • **choose** how I express myself through the creation of **simple** digital means.
	2	At basic level and with autonomy and appropriate guidance where needed, I can:	• **identify** ways to create and edit **simple** content in simple formats, • **choose** how I express myself through the creation of **simple** digital means.
INTERMEDIATE	3	On my own and solving straightforward problems, I can:	• **indicate** ways to create and edit **well-defined and routine** content in **well-defined and routine** formats, • **express** myself through the creation of **well-defined and routine** digital means.
	4	Independently, according to my own needs, and solving well-defined and non-routine problems, I can:	• **indicate** ways to create and edit content in different formats, • **express** myself through the creation of digital means.
ADVANCED	5	As well as guiding others, I can:	• **apply** ways to create and edit content in different formats, • **show** ways to express myself through the creation of digital means.
	6	At advanced level, according to my own needs and those of others, and in complex contexts, I can:	• **change** content using the **most appropriate** formats, • **adapt** the expression of myself through the creation of the **most appropriate** digital means.
HIGHLY SPECIALISED	7	At highly specialised level, I can:	• **create solutions to complex problems with limited definition** that are related to content creation and edition in different formats, and self-expression through digital means. • **integrate my knowledge to contribute to professional practice and knowledge and guide others i**n developing content.
	8	At the most advanced and specialised level, I can:	• **create solutions to solve complex problems with many interacting factors** that are related to content creation and edition in different formats, and self-expression through digital means. • **propose new** ideas and processes to the field.

DIMENSION 4 • **EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES**

NEW IN 2.2

KNOWLEDGE

118. Knows that digital content exists in a digital form and that there are many different types of digital content (e.g. audio, image, text, video, applications) that are stored in various digital file formats.
119. Knows that AI systems can be used to automatically create digital content (e.g. texts, news, essays, tweets, music, images) using existing digital content as its source. Such content may be difficult to distinguish from human creations. (**AI**)
120. Aware that "digital accessibility" means ensuring that everyone, including people with disabilities, can use and navigate the internet. Digital accessibility includes accessible websites, digital files and documents, and other web-based applications (e.g. for online banking, accessing public services, and messaging and video-calling services). (**DA**)
121. Aware that virtual reality (VR) and augmented reality (AR) allow new ways to explore simulated environments and interactions within the digital and physical worlds.

SKILLS

122. Can use tools and techniques to create accessible digital content (e.g. add ALT text to images, tables and graphs; create a proper and well-labelled document structure; use accessible fonts, colours, links) following official standards and guidelines (e.g. WCAG 2.1 and EN 301 549). (**DA**)
123. Knows how to select the appropriate format for digital content according to its purpose (e.g. saving a document in an editable format vs one that cannot be modified but is easily printed).
124. Knows how to create digital content to support one's own ideas and opinions (e.g. to produce data representations such as interactive visualisations using basic datasets such as open government data).
125. Knows how to create digital content on open platforms (e.g. create and modify text in a wiki environment).
126. Knows how to use Internet of Things (IoT) and mobile devices to create digital content (e.g. use embedded cameras and microphones to produce photos or videos).

ATTITUDES

127. Inclined to combine various types of digital content and data to better express facts or opinions for personal and professional use.
128. Open to explore alternative pathways to find solutions to produce digital content.
129. Inclined to follow official standards and guidelines (e.g. WCAG 2.1 and EN 301 549) to test the accessibility of a website, digital files, documents, e-mails or other web-based applications that one has created. (**DA**)

DIMENSION 5 • **USE CASES**

FOUNDATION 1

EMPLOYMENT SCENARIO: develop a short course (tutorial) to train the staff on a new procedure to be applied in the organisation

With the help of a colleague (who has advanced digital competence and who I can consult whenever I need) and having as support a tutorial video with the steps on how to do it:

- I can find out how to add new dialogues and images onto a brief support video already created on the intranet to illustrate the new organisational procedures.

LEARNING SCENARIO: prepare a presentation on a certain topic that I will make to my classmates

Helped by my teacher:

- I can find out how to create a digital animated presentation, using a video tutorial from YouTube provided by my teacher to help me to present my work to my classmates.
- I can also identify other digital means from an article in my textbook that can help me to present the work as an animated digital presentation to my classmates on the interactive digital whiteboard.

DIMENSION 1 • **COMPETENCE AREA**

3. DIGITAL CONTENT CREATION

DIMENSION 2 • **COMPETENCE**

3.2 INTEGRATING AND RE-ELABORATING DIGITAL CONTENT

To modify, refine and integrate new information and content into an existing body of knowledge and resources to create new, original and relevant content and knowledge.

DIMENSION 3 • **PROFICIENCY LEVEL**

FOUNDATION	1	At basic level and with guidance, I can:	• **select** ways to modify, refine, improve and integrate **simple** items of new content and information to create new and original ones.
	2	At basic level and with autonomy and appropriate guidance where needed, I can:	• **select** ways to modify, refine, improve and integrate **simple** items of new content and information to create new and original ones.
INTERMEDIATE	3	On my own and solving straightforward problems, I can:	• **explain** ways to modify, refine, improve and integrate **well-defined** items of new content and information to create new and original ones.
	4	Independently, according to my own needs, and solving well-defined and non-routine problems, I can:	• **discuss** ways to modify, refine, improve and integrate new content and information to create new and original ones.
ADVANCED	5	As well as guiding others, I can:	• **operate** with new **different** items of content and information, modifying, refining, improving and integrating them in order to create new and original ones.
	6	At advanced level, according to my own needs and those of others, and in complex contexts, I can:	• **assess** the **most appropriate** ways to modify, refine, improve and integrate specific new items of content and information to create new and original ones.
HIGHLY SPECIALISED	7	At highly specialised level, I can:	• **create solutions to complex problems with limited definition** that are related to modifying, refining, improving and integrating new content and information into existing knowledge to create new and original ones. • **integrate** my knowledge **to contribute to professional practice and knowledge and guide others** in integrating and re-elaborating content.
	8	At the most advanced and specialised level, I can:	• **create solutions to solve complex problems with many interacting factors** that are related to modifying, refining, improving and integrating new content and information into existing knowledge to create new and original ones. • **propose new** ideas and processes to the field.

DIMENSION 4 • **EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES**

NEW IN 2.2

KNOWLEDGE

130. Aware that it is possible to integrate hardware (e.g. sensors, cables, motors) and software structures to develop programmable robots and other non-digital artefacts (e.g. Lego Mindstorms, Micro:bit, Raspberry Pi, EV3, Arduino, ROS).

SKILLS

131. Can create infographics and posters combining information, statistical content and visuals using available apps or software.
132. Knows how to use tools and applications (e.g. add-ons, plug-ins, extensions) to enhance digital accessibility of digital content (e.g. adding captions in video players to a recorded presentation). (**DA**)
133. Knows how to integrate digital technologies, hardware and sensor data to create a new (digital or non-digital) artefact (e.g. makerspace and digital fabrication activities).
134. Knows how to incorporate AI edited/manipulated digital content in one's own work (e.g. incorporate AI generated melodies in one's own musical composition). This use of AI can be controversial as it raises questions about the role of AI in artworks, and for example, who should be credited. (**AI**)

ATTITUDES

135. Open to creating something new from existing digital content using iterative design processes (e.g. create, test, analyse and refine ideas).
136. Inclined to help others to improve their digital content (e.g. through providing useful feedback).
137. Inclined to use available tools to verify whether images or videos have been modified (e.g. by deep-fake techniques).

DIMENSION 5 • **USE CASES**

FOUNDATION 2

EMPLOYMENT SCENARIO: develop a short course (tutorial) to train the staff on a new procedure to be applied in the organisation

With the help of a colleague (who has advanced digital competence and who I can consult whenever I need) and having as support a tutorial video with the steps on how to do it

- I can find out how to add new dialogues and images onto a brief support video already created on the intranet to illustrate the new organisational procedures.

LEARNING SCENARIO: prepare a presentation on a certain topic that I will make to my classmates

At home with my mother (who I can consult whenever I need) and the help of a list (stored on my tablet provided by my teacher with the steps on how to do it)

- I can identify how to update a digital animated presentation I have created to present my work to my classmates, adding text, images and visual effects to be shown in the classroom using the interactive digital whiteboard.

DIMENSION 1 • **COMPETENCE AREA**

3. DIGITAL CONTENT CREATION

DIMENSION 2 • **COMPETENCE**

3.3 COPYRIGHT AND LICENCES

To understand how copyright and licences apply to digital information and content.

DIMENSION 3 • **PROFICIENCY LEVEL**

FOUNDATION	1	At basic level and with guidance, I can:	• **identify simple** rules of copyright and licenses that apply to data, digital information and content.
	2	At basic level and with autonomy and appropriate guidance where needed, I can:	• **identify simple** rules of copyright and licenses that apply to data, digital information and content.
INTERMEDIATE	3	On my own and solving straightforward problems, I can:	• **indicate well-defined and routine** rules of copyright and licenses that apply to data, digital information and content.
	4	Independently, according to my own needs, and solving well-defined and non-routine problems, I can:	• **discuss** rules of copyright and licenses that apply to digital information and content.
ADVANCED	5	As well as guiding others, I can:	• **apply different** rules of copyright and licenses that apply to data, digital information and content.
	6	At advanced level, according to my own needs and those of others, and in complex contexts, I can:	• **choose the most appropriate** rules that apply copyright and licences to data, digital information and content.
HIGHLY SPECIALISED	7	At highly specialised level, I can:	• **create solutions to complex problems with limited definition** that are related to applying copyright and licenses to data, digital information and content. • **integrate** my knowledge to contribute to professional practice and knowledge and guide others in applying copyright and licenses.
	8	At the most advanced and specialised level, I can:	• **create solutions to solve complex problems with many interacting factors** that are related to applying copyright and licenses to data, digital information and content. • **propose new** ideas and processes to the field.

DIMENSION 4 • **EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES**

NEW IN 2.2

KNOWLEDGE

138. Knows that digital content, goods and services might be protected under intellectual property (IP) rights (e.g. copyright, trademarks, designs, patents).
139. Aware that the creation of digital content (e.g. pictures, texts, music) when original is considered protected by copyright as soon as it exists (automatic protection).
140. Aware that certain copyright exceptions exist (e.g. use for the purpose of illustration for teaching, for caricature, parody, pastiche, for quotation, private uses).
141. Knows different models of licensing software (e.g. proprietary, free and open-source software) and that some types of licences need to be renewed once the licence period expires.
142. Aware of the legal limitations of using and sharing digital content (e.g. music, movies, books) and the possible consequences of illegal actions (e.g. sharing copyrighted content with others can give rise to legal sanctions).
143. Aware that mechanisms and methods to block or limit access to digital content exist (e.g. passwords, geo-blocking, Technical Protection Measures, TPM).

SKILLS

144. Able to identify and select digital content for downloading or uploading legally (e.g. public domain databases and tools, open licences).
145. Knows how to use and share digital content legally (e.g. checks the terms and conditions and licensing schemes available, such as the various types of Creative Commons) and knows how to assess whether limitations and copyright exceptions apply.
146. Able to identify when uses of copyright-protected digital content fall under the scope of a copyright exception so that no prior consent is needed (e.g. teachers and students in the EU can use copyright protected content for the purpose of illustration for teaching).
147. Able to check and understand the right to use and/or re-use digital content created by a third party (e.g. knows about collective licencing schemes and contacts the relevant collective management organisations , understands the various Creative Commons licences).
148. Can choose the most suitable strategy, including the licensing, for the purpose of sharing and protecting one's own original creation (e.g. by registering it in an optional copyright deposit system; choosing open licences such as Creative Commons).

ATTITUDES

149. Respectful of rights affecting others (e.g. ownership, contract terms), only using legal sources for downloading digital content (e.g. movies, music, books) and when relevant, opting for open-source software.
150. Open to consider whether open licences or other licence schemes are more suitable when producing and publishing digital content and resources.

DIMENSION 5 • **USE CASES**

INTERMEDIATE 3

EMPLOYMENT SCENARIO: develop a short course (tutorial) to train the staff on a new procedure to be applied in the organisation

By myself:

- I can tell a colleague which image banks I usually use to find images that I can download free of charge for a brief tutorial video on a new procedure for my organisation's staff.
- I can deal with problems such as identifying the symbol that indicates whether an image is licensed with a certain type of Creative Commons licence and therefore can be reused without the author's permission.

LEARNING SCENARIO: prepare a presentation on a certain topic that I will make to my classmates

By myself:

- I can explain to a friend which image banks I usually use to find images that I can download completely free of charge to create a digital animation to present my work to my classmates.
- I can fix problems such as identifying the symbol that indicate that an image is copyrighted and therefore cannot be used without the author's permission.

DIMENSION 1 • **COMPETENCE AREA**

3. DIGITAL CONTENT CREATION

DIMENSION 2 • **COMPETENCE**

3.4 PROGRAMMING

To plan and develop a sequence of understandable instructions for a computing system to solve a given problem or to perform a specific task.

DIMENSION 3 • **PROFICIENCY LEVEL**

FOUNDATION	1	At basic level and with guidance, I can:	• **list simple** instructions for a computing system to solve a simple problem or perform a simple task.
	2	At basic level and with autonomy and appropriate guidance where needed, I can:	• **list simple** instructions for a computing system to solve a simple problem or perform a simple task.
INTERMEDIATE	3	On my own and solving straightforward problems, I can:	• **list well-defined and routine** instructions for a computing system to solve routine problems or perform routine tasks.
	4	Independently, according to my own needs, and solving well-defined and non-routine problems, I can:	• **list** instructions for a computing system to solve a given problem or perform a specific task.
ADVANCED	5	As well as guiding others, I can:	• **operate** with instructions for a computing system to solve a different problem or perform different tasks.
	6	At advanced level, according to my own needs and those of others, and in complex contexts, I can:	• **determine the most appropriate** instructions for a computing system to solve a given problem and perform specific tasks.
HIGHLY SPECIALISED	7	At highly specialised level, I can:	• **create solutions to complex problems with limited definition** that are related to planning and developing instructions for a computing system and performing a task using a computing system. • **integrate my knowledge to contribute to professional practice and knowledge and guide others** in programming.
	8	At the most advanced and specialised level, I can:	• **create solutions to solve complex problems with many interacting factors** that are related to planning and developing instructions for a computing system and performing a task using a computing system. • **propose new** ideas and processes to the field.

DIMENSION 4 • **EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES**

NEW IN 2.2

KNOWLEDGE

151. Knows that computer programs are made of instructions, written according to strict rules in a programming language.
152. Knows that programming languages provide structures that allow program instructions to be executed in sequence, repeatedly, or only under certain conditions, and to group them to define new instructions.
153. Knows that programs are executed by computing devices/systems, that are able to automatically interpret and execute instructions.
154. Knows that programs produce output data depending on input data, and that different inputs usually yield different outputs (e.g. a calculator will provide output 8 to the 3+5 input and output 15 to the 7+8 input).
155. Knows that, to produce its output, a program stores and manipulates data in the computer system that executes it, and that it sometimes behaves unexpectedly (e.g. faulty behaviour, malfunction, data leakage).
156. Knows that a program's blueprint is based on an algorithm, i.e. a step-wise method to produce an output from an input.
157. Knows that algorithms, and consequently programs, are designed to help solve real life problems; input data models the known information about the problem, while output data provides information relevant to the problem's solution. There are different algorithms, and consequently programs, solving the same problem.
158. Knows that any program requires time and space (hardware resources) to compute its output, depending on the input's size and/or problem's complexity.
159. Knows that there are problems that cannot be solved exactly by any known algorithm in reasonable time, thus, in practice they are frequently dealt with by approximate solutions (e.g. DNA sequencing, data clustering, weather forecasting).

SKILLS

160. Knows how to combine a set of program blocks (e.g. as in the visual programming tool Scratch), in order to solve a problem.
161. Knows how to detect issues in a sequence of instructions, and make changes to resolve them (e.g. to find an error in the program and correct it; to detect the reason why the execution time or output of the program is not as expected).
162. Able to identify input and output data in some simple programs.
163. Given a program, being able to recognise the execution order of instructions, and how information is processed.

ATTITUDES

164. Willing to accept that algorithms, and hence programs, may not be perfect in solving the problem that they aim to address.
165. Considers ethics (including but not limited to human agency and oversight, transparency, non-discrimination, accessibility, and biases and fairness) as one of the core pillars when developing or deploying AI systems. (**AI**)

DIMENSION 5 • **USE CASES**

INTERMEDIATE 4

EMPLOYMENT SCENARIO: develop a short course (tutorial) to train the staff on a new procedure to be applied in the organisation

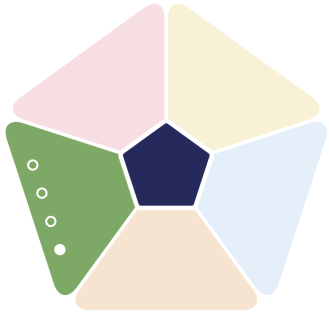
- Using a programming language (e.g. Ruby, Python), I can provide instructions to develop an educational game to introduce the new procedure to be applied in the organisation.
- I can resolve issues such as debugging the programme to fix problems with my code.

LEARNING SCENARIO: prepare a presentation on a certain topic that I will make to my classmates

- Using a simple graphical programming interface (e.g. Scratch Jr), I can develop a smartphone app that presents my work to my classmates.
- If a problem appears, I know how to debug the programme and I can fix easy problems in my code.

The examples under this competence are abbreviated from Programming for All: Understanding the Nature of Programs (Brodnik et al., 2021). The document offers a more complete list of knowledge, skills and attitude statements that are accompanied with examples from everyday life.

For example, when reading example no: 157, the interested reader can go to the document and find more information about "programs" under the section "A.2 Programs are made of instructions" (p.14), or to understand more about data models, the reader should direct to the knowledge statement "K3.4" on p.18.



DIMENSION 1 • **COMPETENCE AREA**

4. SAFETY

DIMENSION 2 • **COMPETENCE**

4.1 PROTECTING DEVICES

To protect devices and digital content, and to understand risks and threats in digital environments.

To know about safety and security measures and to have a due regard to reliability and privacy.

DIMENSION 3 • **PROFICIENCY LEVEL**

FOUNDATION	1	At basic level and with guidance, I can:	• **identify simple** ways to protect my devices and digital content, and • differentiate simple risks and threats in digital environments. • choose simple safety and security measures, and • **identify simple** ways to have due regard to reliability and privacy.
	2	At basic level and with autonomy and appropriate guidance where needed, I can:	• **identify simple** ways to protect my devices and digital content, and • differentiate simple risks and threats in digital environments. • follow simple safety and security measures. • **identify simple** ways to have due regard to reliability and privacy.
INTERMEDIATE	3	On my own and solving straightforward problems, I can:	• **indicate well-defined and routine** ways to protect my devices and digital content, and • differentiate well-defined and routine risks and threats in digital environments, and • **select well-defined and routine** safety and security measures. • **indicate well-defined and routine** ways to have due regard to reliability and privacy
	4	Independently, according to my own needs, and solving well-defined and non-routine problems, I can:	• **organise** ways to protect my devices and digital content, and • **differentiate** risks and threats in digital environments. • **select** safety and security measures. • **explain** ways to have due regard to reliability and privacy.
ADVANCED	5	As well as guiding others, I can:	• **apply different** ways to protect devices and digital content, and • **differentiate a variety** of risks and threats in digital environments. • **apply** safety and security measures. • **employ different** ways to have due regard to reliability and privacy.
	6	At advanced level, according to my own needs and those of others, and in complex contexts, I can:	• **choose the most appropriate** protection for devices and digital content, and • **discriminate** risks and threats in digital environments. • **choose the most appropriate** safety and security measures. • **assess the most appropriate** ways to have due regard to reliability and privacy.
HIGHLY SPECIALISED	7	At highly specialised level, I can:	• **create solutions to complex problems with limited definition** that are related to protecting devices and digital content, managing risks and threats, applying safety and security measures, and reliability and privacy in digital environments. • **integrate my knowledge to contribute to professional practice and knowledge and guide others** in protecting devices.
	8	At the most advanced and specialised level, I can:	• **create solutions to solve complex problems with many interacting factors** that are related to protecting devices and digital content, managing risks and threats, applying safety and security measures, and reliability and privacy in digital environments. • **propose new** ideas and processes to the field.

DIMENSION 4 • **EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES**

NEW IN 2.2

KNOWLEDGE

166. Knows that using different strong passwords for different online services is a way to mitigate the negative effects of an account being compromised (e.g. hacked).
167. Knows about measures to protect devices (e.g. password, fingerprints, encryption) and prevent others (e.g. a thief, commercial organisation, government agency) from having access to all data.
168. Knows about the importance of keeping the operating system and applications (e.g. browser) up-to-date, in order to fix security vulnerabilities and protect against malicious software (i.e. malware).
169. Knows that a firewall blocks certain kinds of network traffic, aiming to prevent different security risks (e.g. remote logins).
170. Aware of different types of risks in digital environments, such as identity theft (e.g. someone committing fraud or other crimes using another person's personal data), scams (e.g. financial scams where victims are tricked into sending money), malware attacks (e.g. ransomware).

SKILLS

171. Knows how to adopt a proper cyber-hygiene strategy regarding passwords (e.g. selecting strong ones difficult to guess) and managing them securely (e.g. using a password manager).
172. Knows how to install and activate protection software and services (e.g. antivirus, anti-malware, firewall) to keep digital content and personal data safer.
173. Knows how to activate two-factor authentication when available (e.g. using one-time passwords, OTP, or codes along with access credentials).
174. Knows how to check the type of personal data an app accesses on one's mobile phone and, based on that, decides whether to install it and configures the appropriate settings.
175. Able to encrypt sensitive data stored on a personal device or in a cloud storage service.
176. Can respond appropriately to a security breach (i.e. an incident that results in unauthorised access to digital data, applications, networks or devices, the leaking of personal data such as logins or passwords).

ATTITUDES

177. Vigilant not to leave computers or mobile devices unattended in public places (e.g. shared workplaces, restaurants, trains, car backseat).
178. Weighs the benefits and risks of using biometric identification techniques (e.g. fingerprint, face images) as they can affect safety in unintended ways. If biometric information is leaked or hacked, it becomes compromised and can lead to identity fraud.
179. Keen to consider some self-protective behaviours such as not using open Wi-fi networks to make financial transactions or online banking.

DIMENSION 5 • **USE CASES**

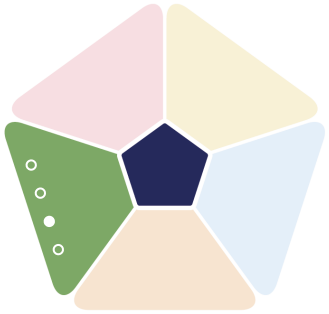
ADVANCED 5

EMPLOYMENT SCENARIO: use of a Twitter account to share information on my organization

- I can protect the corporate Twitter account using different methods (e.g. a strong password, control the recent logins) and show new colleagues how to do it.
- I can detect risks like receiving tweets and messages from followers with false profiles or phishing attempts.
- I can apply measures to avoid them (e.g. control the privacy settings).
- I can also help my colleagues to detect risks and threats while using Twitter.

LEARNING SCENARIO: use of the school's digital learning platform to share information on interested topics

- I can protect information, data and content on my school's digital learning platform (e.g. a strong password, control the recent logins).
- I can detect different risks and threats when accessing school's digital platform and apply measures to avoid them (e.g. how to virus-check attachments before downloading).
- I can also help my classmates to detect risks and threat while using the digital learning platform on their tablets (e.g. controlling who can access the files).



DIMENSION 1 • **COMPETENCE AREA**

4. SAFETY

DIMENSION 2 • **COMPETENCE**

4.2 PROTECTING PERSONAL DATA AND PRIVACY

To protect personal data and privacy in digital environments.

To understand how to use and share personally identifiable information while being able to protect oneself and others from damages.

To understand that digital services use a "Privacy policy" to inform how personal data is used.

DIMENSION 3 • **PROFICIENCY LEVEL**

FOUNDATION	1	At basic level and with guidance, I can:	• **select simple** ways to protect my personal data and privacy in digital environments, • **identify simple** ways to use and share personally identifiable information while protecting myself and others from damages. • **identify simple** privacy policy statements of how personal data is used in digital services.
	2	At basic level and with autonomy and appropriate guidance where needed, I can:	• **select simple** ways to protect my personal data and privacy in digital environments, • **identify simple** ways to use and share personally identifiable information while protecting myself and others from damages. • **identify simple** privacy policy statements of how personal data is used in digital services.
INTERMEDIATE	3	On my own and solving straightforward problems, I can:	• **explain well-defined and routine** ways to protect my personal data and privacy in digital environments, and • **explain well-defined and routine** ways to use and share personally identifiable information while protecting myself and others from damages. • **indicate well-defined and routine** privacy policy statements of how personal data is used in digital services.
	4	Independently, according to my own needs, and solving well-defined and non-routine problems, I can:	• **discuss** ways to protect my personal data and privacy in digital environments, and • **discuss** ways to use and share personally identifiable information while protecting myself and others from damages. • **indicate** privacy policy statements of how personal data is used in digital services.
ADVANCED	5	As well as guiding others, I can:	• **apply different** ways to protect my personal data and privacy in digital environments, • **apply different** specific ways to share my data while protecting myself and others from dangers. • **explain** privacy policy statements of how personal data is used in digital services.
	6	At advanced level, according to my own needs and those of others, and in complex contexts, I can:	• **choose the more appropriate ways** to protect personal data and privacy in digital environments, and • **evaluate the most appropriate ways** of using and sharing personally identifiable information while protecting myself and others from damages. • **evaluate the appropriateness** of privacy policy statements on how personal data are used.
HIGHLY SPECIALISED	7	At highly specialised level, I can:	• **create solutions to complex problems with limited definition** that are related to protecting personal data and privacy in digital environments, using and sharing personally identifiable information protecting self and others from dangers, and privacy policies to use my personal data. • **integrate my knowledge to contribute to professional practice and knowledge and guide others** in protecting personal data and privacy
	8	At the most advanced and specialised level, I can:	• **create solutions to solve complex problems with many interacting factors** that are related to protecting personal data and privacy in digital environments, using and sharing personally identifiable information protecting self and others from dangers, and privacy policies to use my personal data. • **propose new** ideas and processes to the field.

DIMENSION 4 • **EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES**

NEW IN 2.2

KNOWLEDGE

180. Aware that secure electronic identification is a key feature designed to enable safer sharing of personal data with third parties when conducting public sector and private transactions.
181. Knows that the "privacy policy" of an app or service should explain what personal data it collects (e.g. name, brand of device, geolocation of the user), and whether data are shared with third parties.
182. Knows that the processing of personal data is subject to local regulations such as the EU's General Data Protection Regulation (GDPR) (e.g. voice interactions with a virtual assistant are personal data in terms of the GDPR and can expose users to certain data protection, privacy and security risks). (**AI**)

SKILLS

183. Knows how to identify suspicious e-mail messages that try to obtain sensitive information (e.g. personal data, banking identification) or might contain malware. Knows that these emails are often designed to trick people who do not check carefully and who are thus more susceptible to fraud, by containing deliberate errors that prevent vigilant people clicking on them.
184. Knows how to apply basic security measures in online payments (e.g. never sending a scan of credit cards or giving the pin code of a debit/payment/credit card).
185. Knows how to use electronic identification for services provided by public authorities or public services (e.g. filling-in your tax form, applying for social benefits, requesting certificates) and by the business sector, such as banks and transport services.
186. Knows how to use digital certificates acquired from certifying authorities (e.g. digital certificates for authentication and digital signing stored on national identity cards).

ATTITUDES

187. Weighs the benefits and risks before allowing third parties to process personal data (e.g. recognises that a voice assistant on a smartphone, that is used to give commands to a robot vacuum cleaner, could give third parties - companies, governments, cybercriminals - access to the data). (**AI**)
188. Confident in carrying out online transactions after taking appropriate safety and security measures.

DIMENSION 5 • **USE CASES**

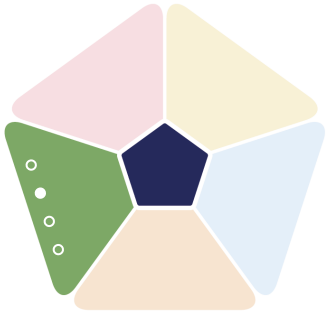
ADVANCED 6

EMPLOYMENT SCENARIO: use of a Twitter account to share information on my organization

- I can select the most appropriate way to protect the personal data of my colleagues (e.g. address, phone number) when sharing digital content (e.g. a picture) on the corporate Twitter account.
- I can distinguish between appropriate and inappropriate digital content to share it on the corporate Twitter account, so that my privacy and that of my colleagues are not damaged.
- I can assess whether personal data are used on the Corporate Twitter appropriately according to the European Data Protection Law and Right to be Forgotten.
- I can deal with complex situations that can arise with personal data in my organisation while on Twitter, such as removing pictures or names to protect personal information in accordance with the European Data Protection Law and Right to be Forgotten.

LEARNING SCENARIO: use of the school's digital learning platform to share information on interested topics

- I can select the most appropriate way to protect my personal data (e.g. address, phone number), before sharing it on the school's digital platform.
- I can distinguish between appropriate and inappropriate digital content to share it on my school's digital platform, so that my privacy and that of my classmates are not damaged.
- I can assess whether the way my personal data are used on the digital platform is appropriate and acceptable as regards my rights and privacy.
- I can overcome complex situations that can arise with my personal data and those of my classmates while on the digital education platform, such as personal data is not used in accordance to the "Privacy policy" of the platform.



DIMENSION 1 • **COMPETENCE AREA**

4. SAFETY

DIMENSION 2 • **COMPETENCE**

4.3 PROTECTING HEALTH AND WELL-BEING

To be able to avoid health-risks and threats to physical and psychological well-being while using digital technologies.

To be able to protect oneself and others from possible dangers in digital environments (e.g. cyber bullying).

To be aware of digital technologies for social well-being and social inclusion.

DIMENSION 3 • **PROFICIENCY LEVEL**

FOUNDATION	1	At basic level and with guidance, I can:	• **differentiate simple** ways to avoid health risks and threats to physical and psychological well-being while using digital technologies. • **select simple** ways to protect myself from possible dangers in digital environments. • **identify simple** digital technologies for social well-being and social inclusion.
	2	At basic level and with autonomy and appropriate guidance where needed, I can:	• **differentiate simple** ways to avoid health risks and threats to physical and psychological well-being while using digital technologies. • **select simple** ways to protect myself from possible dangers in digital environments. • **identify simple** digital technologies for social well-being and social inclusion.
INTERMEDIATE	3	On my own and solving straightforward problems, I can:	• **explain well-defined and routine** ways to how to avoid health risks and threats to physical and psychological well-being while using digital technologies. • **select well-defined and routine** ways to protect myself from dangers in digital environments. • **indicate well-defined and routine** digital technologies for social well-being and social inclusion.
	4	Independently, according to my own needs, and solving well-defined and non-routine problems, I can:	• **explain** ways to how to avoid threats to my physical and psychological health related with the use of technology. • **select** ways to protect self and others from dangers in digital environments. • **discuss** on digital technologies for social well-being and social inclusion.
ADVANCED	5	As well as guiding others, I can:	• **show different** ways to avoid health -risks and threats to physical and psychological well-being while using digital technologies. • **apply different** ways to protect myself and others from dangers in digital environments. • **show different** digital technologies for social well-being and social inclusion.
	6	At advanced level, according to my own needs and those of others, and in complex contexts, I can:	• **discriminate the most appropriate** ways to avoid health risks and threats to physical and psychological well-being while using digital technologies. • **adapt the most appropriate** ways to protect myself and others from dangers in digital environments. • **vary** the use of digital technologies for social well-being and social inclusion.
HIGHLY SPECIALISED	7	At highly specialised level, I can:	• **create solutions to complex problems with limited definition** that are related to avoiding health -risks and threats to well-being while using digital technologies, to protect self and others from dangers in digital environments, and to the use of digital technologies for social well-being and social inclusion. • **integrate my knowledge to contribute to professional practice and knowledge and guide others** in protecting health.
	8	At the most advanced and specialised level, I can:	• **create solutions to solve complex problems with many interacting factors** that are related to avoiding health risks and threats to well-being while using digital technologies, to protect self and others from dangers in digital environments, and to the use of digital technologies for social well-being and social inclusion. • **propose new** ideas and processes to the field.

DIMENSION 4 • **EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES**

NEW IN 2.2

KNOWLEDGE

189. Aware of the importance of balancing the use of digital technologies with non-use as an option, as many different factors in digital life can impact on personal health, wellbeing and life satisfaction.
190. Knows signs of digital addictions (e.g. loss of control, withdrawal symptoms, dysfunctional mood regulation) and that digital addiction can cause psychological and physical harm.
191. Aware that for many digital health applications, there are no official licensing procedures as is the case in mainstream medicine.
192. Aware that some applications on digital devices (e.g. smartphones) can support the adoption of healthy behaviours by monitoring and alerting the user about health conditions (e.g. physical, emotional, psychological). However, some actions or images proposed by such applications could also have negative impacts on physical or mental health (e.g. viewing 'idealised' body images can cause anxiety).
193. Understands that cyberbullying is bullying with the use of digital technologies (i.e. a repeated behaviour aimed at scaring, angering or shaming those who are targeted).
194. Knows that the "online disinhibition effect" is the lack of restraint one feels when communicating online in comparison to communicating in-person. This can lead to an increased tendency towards online flaming (e.g. offensive language, posting insults online) and inappropriate behaviours.
195. Aware that vulnerable groups (e.g. children, those with lower social skills and lack of in-person social support) are at a higher risk of victimisation in digital environments (e.g. cyber bullying, grooming).
196. Aware that digital tools can create new opportunities for participation in society for vulnerable groups (e.g. older people, people with special needs). However, digital tools can also contribute to isolation or the exclusion of those who do not use them.

SKILLS

197. Knows how to apply, for oneself and others, a variety of digital usage monitoring and limitation strategies (e.g. rules and agreements on screen-free times, delayed availability of devices for children, installing time limitation and filter software).
198. Knows how to recognise embedded user experience techniques (e.g. clickbait, gamification, nudging) designed to manipulate and/or to weaken one's ability to be in control of decisions (e.g. make users to spend more time on online activities, encourage consumerism).
199. Can apply and follow protection strategies to fight online victimisation (e.g. block receiving further messages from sender(s), not reacting/responding, forwarding or saving messages as evidence for legal procedures, deleting negative messages to avoid repeated viewing).

ATTITUDES

200. Inclined to focus on physical and mental wellbeing, and avoid the negative impacts of digital media (e.g. overuse, addiction, compulsive behaviour).
201. Assumes responsibility for protecting personal and collective health and safety when evaluating the effects of medical and medical-like products and services online, as the internet is awash with false and potentially dangerous information about health.
202. Wary of the reliability of recommendations (e.g. are they by a reputable source) and their intentions (e.g. do they really help the user vs encourage to use the device more to be exposed to advertising).

DIMENSION 5 • **USE CASES**

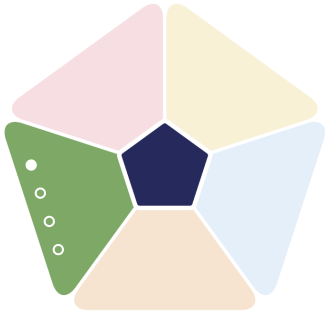
HIGHLY SPECIALISED 7

EMPLOYMENT SCENARIO: use of a Twitter account to share information on my organization

- I can create a digital campaign of possible health dangers of using Twitter
- for professional reasons (e.g. bullying, addictions, physical well-being) which can be shared and used by other colleagues and professionals on their smartphones or tablets.

LEARNING SCENARIO: use of the school's digital learning platform to share information on interested topics

- I can create a blog on cyberbullying and social exclusion for my school's digital learning platform, which helps my classmates to recognise and face up to violence in digital environments.



DIMENSION 1 • **COMPETENCE AREA**

4. SAFETY

DIMENSION 2 • **COMPETENCE**

4.4 PROTECTING THE ENVIRONMENT

To be aware of the environmental impact of digital technologies and their use.

DIMENSION 3 • **PROFICIENCY LEVEL**

FOUNDATION	1	At basic level and with guidance, I can:	• **recognise simple** environmental impacts of digital technologies and their use.
	2	At basic level and with autonomy and appropriate guidance where needed, I can:	• **recognise simple** environmental impacts of digital technologies and their use.
INTERMEDIATE	3	On my own and solving straightforward problems, I can:	• **indicate well-defined and routine** environmental impacts of digital technologies and their use.
	4	Independently, according to my own needs, and solving well-defined and non-routine problems, I can:	• **discuss** ways to protect the environment from the impact of digital technologies and their use.
ADVANCED	5	As well as guiding others, I can:	• **show different** ways to protect the environment from the impact of digital technologies and their use.
	6	At advanced level, according to my own needs and those of others, and in complex contexts, I can:	• **choose the most appropriate** solutions to protect the environment from the impact of digital technologies and their use.
HIGHLY SPECIALISED	7	At highly specialised level, I can:	• **create solutions to complex problems with limited definition** that are related to protecting the environment from the impact of digital technologies and their use. • **integrate my knowledge to contribute to professional practice and knowledge and guide other**s in protecting the environment.
	8	At the most advanced and specialised level, I can:	• **create solutions to solve complex problems with many interacting factors** that are related to protecting the environment from the impact of digital technologies and their use. • **propose new** ideas and processes to the field.

DIMENSION 4 • **EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES**

NEW IN 2.2

KNOWLEDGE

203. Aware of the environmental impact of everyday digital practices (e.g. video streaming that rely on data transfer), and that the impact is composed of energy use and carbon emissions from devices, network infrastructure and data centres.
204. Aware of the environmental impact of the manufacturing of digital devices and batteries (e.g. pollution and toxic by-products, consumption of energy) and that at the end of their life, such devices must be appropriately disposed of to minimise their environmental impact and to enable reuse of rare and expensive components and natural resources.
205. Aware that some components of electronic and digital devices can be replaced to extend their life or performance, however, some might be purposefully designed to stop functioning correctly after a certain period (planned obsolescence).
206. Knows 'green' behaviours to follow when buying digital devices, e.g. choose products with less energy consumption during use and stand-by, less polluting (products easier to dismantle and recycle) and less toxic (limited use of substances harmful to the environment and health).
207. Knows that e-commerce practices such as purchasing and delivery of physical goods have an impact on the environment (e.g. carbon footprint of transport, generation of waste).
208. Aware that digital technologies (including AI-driven ones) can contribute to energy efficiency, for example through monitoring the need for heating at home and optimising its management.
209. Aware that certain activities (e.g. training AI and producing cryptocurrencies like Bitcoin) are resource intensive processes in terms of data and computing power. Therefore, energy consumption can be high which can also have a high environmental impact. (**AI**)

SKILLS

210. Knows how to apply efficient low-tech strategies for protecting the environment, e.g. shutting down devices and switching off Wi-fi, not printing out documents, repair and replace component to avoid the unnecessary replacement of digital devices.
211. Knows how to reduce the energy consumption of devices and services used, e.g. change the quality settings of video streaming services, using Wi-fi rather than data connectivity when at home, closing apps, optimising email attachments).
212. Knows how to use digital tools to improve the environmental and social impact of one's consumer behaviour (e.g. by looking for local produce, by searching for collective deals and car-pooling options for transportation).

ATTITUDES

213. Seeks out ways in which digital technologies could help live and consume in a way which respects the sustainability of human society and the natural environment.
214. Seeks out information regarding the environmental impact of technology to influence one's behaviour and that of others (e.g. friends and family) to be more eco-responsible in their digital practices.
215. Considers product's overall impact on the planet when choosing digital means over physical products, e.g. reading a book online does not need paper and thus transport costs are low, however, one should consider digital devices including toxic component and needed energy to be charged.
216. Considers the ethical consequences of AI systems throughout their life-cycle: they include both the environmental impact (environmental consequences of the production of digital devices and services) and societal impact, e.g. platformisation of work and algorithmic management that may repress workers' privacy or rights; the use of low-cost labour for labelling images to train AI systems. (**AI**)

DIMENSION 5 • **USE CASES**

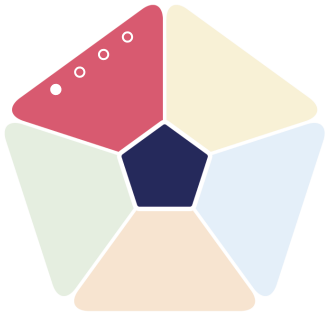
HIGHLY SPECIALISED 8

EMPLOYMENT SCENARIO: use of a Twitter account to share information on my organization

- I can create an illustrated video which answers questions on the sustainable use of digital devices in organisations of my sector, to be shared on Twitter, and to be used by staff and by other professionals in the sector.

LEARNING SCENARIO: use of the school's digital learning platform to share information on interested topics

- I can create a new eBook to answer questions on the sustainable use of digital devices at school and home, and share it on my school's digital learning platform in order to be used by other schoolmates and their families.



DIMENSION 1 • COMPETENCE AREA

5. PROBLEM SOLVING

DIMENSION 2 • COMPETENCE

5.1 SOLVING TECHNICAL PROBLEMS

To identify technical problems when operating devices and using digital environments, and to solve them (from trouble-shooting to solving more complex problems).

DIMENSION 3 • **PROFICIENCY LEVEL**

FOUNDATION	1	At basic level and with guidance, I can:	• **identify simple** technical problems when operating devices and using digital environments. • **identify simple** solutions to solve them.
	2	At basic level and with autonomy and appropriate guidance where needed, I can:	• **identify simple** technical problems when operating devices and using digital environments. • **identify simple** solutions to solve them.
INTERMEDIATE	3	On my own and solving straightforward problems, I can:	• **indicate well-defined and routine** technical problems when operating devices and using digital environments. • **select well-defined and routine** solutions to them.
	4	Independently, according to my own needs, and solving well-defined and non-routine problems, I can:	• **differentiate** technical problems when operating devices and using digital environments. • **select** solutions to them.
ADVANCED	5	As well as guiding others, I can:	• **assess** technical problems when using digital environments and operating digital devices. • **apply different** solutions to them.
	6	At advanced level, according to my own needs and those of others, and in complex contexts, I can:	• **appraise** technical problems when operating devices and using digital environments, • **resolve** them with the **most appropriate** solutions.
HIGHLY SPECIALISED	7	At highly specialised level, I can:	• **create solutions to complex problems with limited definition** that are related to technical problems when operating devices and using digital environments. • **integrate my knowledge to contribute to professional practice and knowledge and to guide others** in solving technical problems.
	8	At the most advanced and specialised level, I can:	• **create solutions to solve complex problems with many interacting factors** that are related to technical problems when operating devices and using digital environments. • **propose new** ideas and processes to the field.

DIMENSION 4 • **EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES**

NEW IN 2.2

KNOWLEDGE

217. Knows the main functions of the most common digital devices (e.g. computer, tablet, smartphone).
218. Knows some reasons why a digital device may fail to connect online (e.g. wrong Wi-fi password, airplane mode on).
219. Knows that computing power or storage capacity can be improved to overcome fast obsolescence of hardware (e.g. by contracting power or storage as a service).
220. Aware that the most frequent sources of problems in Internet of Thing (IoT) and mobile devices, and in their applications, are related to connectivity/network availability, battery/power, limited processing power.
221. Aware that AI is a product of human intelligence and decision-making (i.e. humans choose, clean and encode the data, they design the algorithms, train the models, and curate and apply human values to the outputs) and therefore does not exist independently of humans. (**AI**)

SKILLS

222. Knows how to identify and solve a camera and/or a microphone issue when in an online meeting.
223. Knows how to verify and troubleshoot problems related to interconnected IoT devices and their services.
224. Takes a step-by-step approach to identify the root of a technical problem (e.g. hardware vs software) and explores various solutions when facing a technical malfunction.
225. Knows how to find solutions on the internet when facing a technical problem

ATTITUDES

226. Takes an active and curiosity driven approach to explore how digital technologies operate.

DIMENSION 5 • **USE CASES**

FOUNDATION 1

EMPLOYMENT SCENARIO: use of a digital learning platform to improve my career opportunities

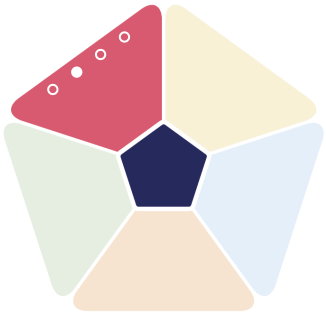
Helped by a colleague from the IT department:

- I can create an illustrated video which answers questions on the sustainable use of digital devices in organisations of my sector, to be shared on Twitter, and to be used by staff and by other professionals in the sector.

LEARNING SCENARIO: use of a digital learning platform to improve my math skills

Helped by a friend:

- I can create a new eBook to answer questions on the sustainable use of digital devices at school and home, and share it on my school's digital learning platform in order to be used by other schoolmates and their families.



DIMENSION 1 • COMPETENCE AREA

5. PROBLEM SOLVING

DIMENSION 2 • COMPETENCE

5.2 IDENTIFYING NEEDS AND TECHNOLOGICAL RESPONSES

To assess needs and to identify, evaluate, select and use digital tools and possible technological responses and to solve them.

To adjust and customise digital environments to personal needs (e.g. accessibility).

DIMENSION 3 • **PROFICIENCY LEVEL**

FOUNDATION	1	At basic level and with guidance, I can:	• **identify** needs, and • **recognise simple** digital tools and possible technological responses to solve those needs. • **choose simple** ways to adjust and customise digital environments to personal needs.
	2	At basic level and with autonomy and appropriate guidance where needed, I can:	• **identify needs**, and • **recognise simple** digital tools and possible technological responses to solve those needs. • **choose simple** ways to adjust and customise digital environments to personal needs.
INTERMEDIATE	3	On my own and solving straightforward problems, I can:	• **indicate well-defined and routine** needs, and • **select well-define and routine** digital tools and possible technological responses to solve those needs. • **select well-defined and routine** ways to adjust and customise digital environments to personal needs.
	4	Independently, according to my own needs, and solving well-defined and non-routine problems, I can:	• **explain** needs, and • **select** digital tools and possible technological responses to solve those needs. • **select** ways to adjust and customise digital environments to personal needs.
ADVANCED	5	As well as guiding others, I can:	• **assess** needs, • **apply different** digital tools and possible technological responses to solve those needs. • **use different** ways to adjust and customise digital environments to personal needs.
	6	At advanced level, according to my own needs and those of others, and in complex contexts, I can:	• **assess** needs, • **choose the most appropriate** digital tools and possible technological responses to solve those needs. • **decide the most appropriate ways** to adjust and customise digital environments to personal needs
HIGHLY SPECIALISED	7	At highly specialised level, I can:	• **create solutions to complex problems with limited definition** using digital tools and possible technological responses, and to adapt and customise digital environments to personal needs. • **integrate** my knowledge **to contribute to professional practice and knowledge and guide others** in identifying needs and technological responses.
	8	At the most advanced and specialised level, I can:	• **create solutions to solve complex problems with many interacting factors** using digital tools and possible technological responses, and to adapt and customise digital environments to personal needs. • I can **propose new** ideas and processes to the field.

DIMENSION 4 • **EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES**

NEW IN 2.2

KNOWLEDGE

227. Knows that it is possible to buy and sell goods and services on the internet through commercial transactions (e.g. e-commerce) and consumer-to-consumer transactions (e.g. sharing platforms). Different rules (e.g. legal consumer protections) apply when buying online from a company than from a private person.
228. Able to identify some examples of AI systems: product recommenders (e.g. on online shopping sites), voice recognition (e.g. by virtual assistants), image recognition (e.g. for detecting tumours in x-rays) and facial recognition (e.g. in surveillance systems). (**AI**)
229. Aware that many non-digital artefacts can be created using 3D printer (e.g. to print spare parts for domestic appliances or furniture.
230. Knows technical approaches that can improve the inclusiveness and accessibility of digital content and services, e.g. tools such as magnification or zoom and text-to-voice functionality. (**DA**)
231. Aware that AI-driven speech-based technology enables the use of spoken commands that can enhance the accessibility of digital tools and devices (e.g. for those with mobility or visual limitations, limited cognition, language or learning difficulties), however, languages spoken by smaller populations are often not available, or perform worse, due to commercial prioritisation. (**AI**) (**DA**)

SKILLS

232. Knows how to use the internet to conduct transactions (e.g. purchasing, selling) and non-commercial ones (e.g. donating, gifting) of goods and services of all kinds.
233. Knows how and when to use machine translation solutions (e.g. Google Translate, DeepL) and simultaneous interpretation apps (e.g. iTranslate) to get a rough understanding of a document or conversation. However, also knows that when the content requires an accurate translation (e.g. in healthcare, commerce or diplomacy), a more precise translation may be needed. (**AI**)
234. Knows how to choose assistive tools to better access information and content online (e.g. screen readers, voice recognition tools), and to take advantage of voice output options to produce speech (e.g. to be used by individuals who have limited or no means to communicate orally). (**DA**)

ATTITUDES

235. Values the benefits of managing finances and financial transactions through digital means while acknowledging the associated risks.
236. Open to explore and spot opportunities created by digital technologies for one´s personal needs (e.g. seeking hearing aids that pair with one's most-used devices, such as phone, TV, camera, smoke-alarm). Critically aware that exclusive reliance on digital technologies can pose risks too.

DIMENSION 5 • **USE CASES**

FOUNDATION 2

EMPLOYMENT SCENARIO: use of a digital learning platform to improve my career opportunities

With the help of a colleague from the Human Resource department who I can consult whenever I need

- From a list of online courses that the Human Resources department has prepared, I can identify those that fit with my career improvement needs.
- While reading the study material on the screen of my tablet, I can make the font larger to help the readability.

LEARNING SCENARIO: use of a digital learning platform to improve my math skills

In the classroom with my teacher who I can consult whenever I need:

- From a list of digital math resources prepared by my teacher, I can choose an educational game that can help me to practice my math skills.
- I can adjust the game's interface to match with my mother tongue.

DIMENSION 1 • COMPETENCE AREA

5. PROBLEM SOLVING

DIMENSION 2 • COMPETENCE

5.3 CREATIVELY USING DIGITAL TECHNOLOGY

To use digital tools and technologies to create knowledge and to innovate processes and products. To engage individually and collectively in cognitive processing to understand and resolve conceptual problems and problem situations in digital environments.

DIMENSION 3 • **PROFICIENCY LEVEL**

FOUNDATION	1	At basic level and with guidance, I can:	• **identify simple** digital tools and technologies that can be used to create knowledge and to innovate processes and products. • **show interest** individually and collectively in **simple** cognitive processing to understand and resolve **simple** conceptual problems and problem situations in digital environments.
	2	At basic level and with autonomy and appropriate guidance where needed, I can:	• **identify simple** digital tools and technologies that can be used to create knowledge and to innovate processes and products. • **follow** individually and collectively **simple** cognitive processing to understand and resolve **simple** conceptual problems and problem situations in digital environments.
INTERMEDIATE	3	On my own and solving straightforward problems, I can:	• **select** digital tools and technologies that can be used to create **well-defined** knowledge and **well-defined** innovative processes and products. • **engage** individually and collectively in some cognitive processing to understand and resolve **well-defined and routine** conceptual problems and problem situations in digital environments.
	4	Independently, according to my own needs, and solving well-defined and non-routine problems, I can:	• **differentiate** digital tools and technologies that can be used to create knowledge and to innovate processes and products. • **engage** individually and collectively in cognitive processing to understand and resolve conceptual problems and problem situations in digital environments.
ADVANCED	5	As well as guiding others, I can:	• **apply different** digital tools and technologies to create knowledge and innovative processes and products. • **apply** individually and collectively cognitive processing to resolve **different** conceptual problems and problem situations in digital environments.
	6	At advanced level, according to my own needs and those of others, and in complex contexts, I can:	• **adapt the most appropriate** digital tools and technologies to create knowledge and to innovate processes and products. • **resolve** individually and collectively conceptual problems and problem situations in digital environments.
HIGHLY SPECIALISED	7	At highly specialised level, I can:	• **create solutions to complex problems with limited definition** using digital tools and technologies. • **integrate** my knowledge **to contribute to professional practice and knowledge and guide others** in creatively using digital technologies.
	8	At the most advanced and specialised level, I can:	• **create solutions to solve complex problems with many interacting factors** using digital tools and technologies. • **propose new** ideas and processes to the field.

DIMENSION 4 • **EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES**

NEW IN 2.2

KNOWLEDGE

237. Knows that engaging in solving problems collaboratively, online or off-screen, means that one can take advantage of the variety of knowledge, perspectives and experiences from others which can lead to better outcomes.
238. Knows that digital technologies and electronic devices can be used as a tool to support the innovation of new processes and products, in order to create social, cultural and/or economic value (e.g. social innovation). Aware that what creates economic value might endanger or enhance social or cultural value.
239. Knows that applications of Internet of Things (IoT) technology have the potential to be used in many different sectors (e.g. healthcare, agriculture, industry, automobiles, citizen science activities).

SKILLS

240. Knows how to use digital technologies to help turn one's idea into action (e.g. master video making to open a channel to share recipes and nutrition tips for a specific dietary style).
241. Can identify online platforms that can be used to design, develop and test IoT technologies and mobile apps.
242. Knows how to plan a strategy using multiple IoT and mobile devices to implement a task (e.g. use a smartphone to optimise energy consumption in a room by setting the intensity of the lights based on the time of day and ambient light).
243. Knows how to engage in resolving social problems through digital, hybrid and non-digital solutions for the problem (e.g. envisioning and planning online time banks, public reporting systems, resource sharing platforms).

ATTITUDES

244. Willing to take part in challenges and contests aimed at solving intellectual, social or practical problems through digital technologies (e.g. hackathons, ideations, grants, joint initiation of projects).
245. Motivated to co-design and co-create new products and services using digital devices (i.e. end-user development) to create economic or social value for others (e.g. in makerspaces and other collective spaces).
246. Open to engage in collaborative processes to co-design and co-create new products and services based on AI systems to support and enhance citizens' participation in society. (**AI**)

DIMENSION 5 • **USE CASES**

INTERMEDIATE 3

EMPLOYMENT SCENARIO: use of a digital learning platform to improve my career opportunities

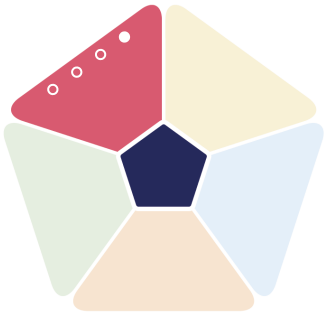
By myself:

- I can use a MOOC's forum to ask for well-defined information on the course I am following and I can use its tools (e.g. blog, wiki) to create a new entry for exchanging more information.
- I can engage in a collaborative exercise with other students using the mind map tool of the MOOC in order to understand a concrete issue in a new way.
- I can fix problems such as identifying that I am introducing a question or comment in the wrong place.

LEARNING SCENARIO: use of a digital learning platform to improve my math skills

By myself:

- I can use the MOOC's forum to ask for well-defined information on the course I am following, and I can use their tools (e.g. blog, wiki) to create a new entry for exchanging more information.
- I can engage in exercises of the MOOC that use simulations to practice a math problem that I failed to solve correctly at school. Discussing the exercises in chat with other students helped me to approach the problem differently and improve my skills.
- I can fix problems such as identifying that I am introducing a question or comment in the wrong place.



DIMENSION 1 • COMPETENCE AREA

5. PROBLEM SOLVING

DIMENSION 2 • COMPETENCE

5.4 IDENTIFYING DIGITAL COMPETENCE GAPS

To understand where one's own digital competence needs to be improved or updated. To be able to support others with their digital competence development. To seek opportunities for self-development and to keep up-to-date with the digital evolution.

DIMENSION 3 • **PROFICIENCY LEVEL**

FOUNDATION	1	At basic level and with guidance, I can:	• **recognise** where my own digital competence needs to be improved or updated. • **identify** where to seek opportunities for self-developments and to keep up-to-date with the digital evolution.
	2	At basic level and with autonomy and appropriate guidance where needed, I can:	• **recognise** where my own digital competence needs to be improved or updated, • **identify** where to seek opportunities for self-developments and to keep up-to-date with the digital evolution.
INTERMEDIATE	3	On my own and solving straightforward problems, I can:	• **explain** where my digital competence needs to be improved or updated, • **indicate** where to seek well-defined opportunities for self-developments and to keep up-to-date with the digital evolution.
	4	Independently, according to my own needs, and solving well-defined and non-routine problems, I can:	• **discuss** on where my digital competence needs to be improved or updated, • **indicate** how to support others to develop their digital competence. • **indicate** where to seek opportunities for self-developments and to keep up-to-date with the digital evolution.
ADVANCED	5	As well as guiding others, I can:	• **demonstrate** where my own digital competence needs to be improved or updated, • **illustrate different** ways to support others in the development of their digital competence. • **propose different** opportunities found for self-development and to keep up-to-date with the digital evolution.
	6	At advanced level, according to my own needs and those of others, and in complex contexts, I can:	• **decide** which are the **most appropriate** ways to improve or update one's own digital competence needs, • **assess** the development of others' digital competence. • **choose** the **most appropriate** opportunities for self-development and to keep up-to date with new developments.
HIGHLY SPECIALISED	7	At highly specialised level, I can:	• **create solutions to complex problems with limited definition** that are related to improving digital competence, and to find opportunities for self-development and to keep up-to-date with new developments. • **integrate** my knowledge **to contribute to professional practice and knowledge and to guide others** in identifying digital competence gaps.
	8	At the most advanced and specialised level, I can:	• **create solutions to solve complex problems with many interacting factors** that are related to improving digital competence, and to find opportunities for self-development and to keep up-to-date with the digital evolution. • **propose new** ideas and processes to the field.

DIMENSION 4 • **EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES**

NEW IN 2.2

KNOWLEDGE

247. Aware that being digitally competent entails the confident, critical and responsible use of digital technologies to achieve goals related to work, learning, leisure, inclusion and participation in society.
248. Aware that difficulties experienced while interacting with digital technologies may be due to technical issues, lack of confidence, one's own competence gap or inadequate choice of digital tool to solve the problem in question.
249. Aware that digital tools can be used to help identify one's learning interests and setting personal goals in life (e.g. learning pathways).
250. Knows that online learning can offer opportunities (e.g. video-tutorials, online-seminars, blended-learning-courses, Massive Open Online Courses) to keep up-to-date with developments in digital technologies and to develop new digital skills. Some online learning opportunities also accredit the learning outcomes (e.g. through micro-credentials, certifications).
251. Aware that AI is a constantly-evolving field, whose development and impact is still very unclear. (**AI**)

SKILLS

252. Knows how to get reliable feedback on digital competence through self-assessment tools, digital skills testing and certification.
253. Capable of reflecting on one's level of competence, and to make plans and take action to upskill (e.g. by joining the municipality training course on digital competence).
254. Knows how to talk about the importance of recognising "fake news" to others (e.g. elders, youngsters) by showing examples of reliable news sources, and how to differentiate between the two.

ATTITUDES

255. Has a disposition to keep learning, to educate oneself and stay informed about AI (e.g. to understand how AI algorithms work; to understand how automatic decision-making can be biased; to distinguish between realistic and unrealistic AI; and to understand the difference between Artificial Narrow Intelligence, i.e. today's AI capable of narrow tasks such as game playing, and Artificial General Intelligence, i.e. AI that surpasses human intelligence, which still remains science fiction). (**AI**)
256. Open to ask to be taught how to use an application (e.g. how to book a doctor's appointment on the internet) rather than delegating the task to someone else.
257. Willing to help others to improve their digital competencies, building on their strengths and mitigating their weaknesses.
258. Does not get discouraged by the fast pace of technological changes but believes that one can always learn more about how technology can be used in today's society.
259. Readiness to value one's own potential, as well as others´ potential, to continuously learn using digital technologies as a lifelong process that requires openness, curiosity and determination.

DIMENSION 5 • **USE CASES**

INTERMEDIATE 3

EMPLOYMENT SCENARIO: use of a digital learning platform to improve my career opportunities

By myself:

- I can use a MOOC's forum to ask for well-defined information on the course I am following and I can use its tools (e.g. blog, wiki) to create a new entry for exchanging more information.
- I can engage in a collaborative exercise with other students using the mind map tool of the MOOC in order to understand a concrete issue in a new way.
- I can fix problems such as identifying that I am introducing a question or comment in the wrong place.

LEARNING SCENARIO: use of a digital learning platform to improve my math skills

By myself:

- I can use the MOOC's forum to ask for well-defined information on the course I am following, and I can use their tools (e.g. blog, wiki) to create a new entry for exchanging more information.
- I can engage in exercises of the MOOC that use simulations to practice a math problem that I failed to solve correctly at school. Discussing the exercises in chat with other students helped me to approach the problem differently and improve my skills.
- I can fix problems such as identifying that I am introducing a question or comment in the wrong place.

3. RESOURCES SECTION

This section gives a snapshot of the existing reference material for DigComp consolidating previously released publications and references.

T.1 Resources and information to support use of DigComp

RESOURCE	THIS REPORT	OTHER SOURCE
DigComp website		ec.europa.eu/jrc/en/digcomp
Competence descriptors	p.9-50	
Explanation of different versions of DigComp	Annex 1 p.68	
DigComp translations (full and partial)	p.55	
Glossary	p.63	
Digital Skills Index (part of DESI index)	p.52	
Case study on translating the DigComp framework (the Slovenian case)		DigComp 2.1, p. 63
An example of Dim. 5 developed across all 8 levels (DigComp competence 1.1)		DigComp 2.1, p. 19
Changes between descriptors from 1.0 to 2.0		DigComp 2.0 p. 14-16, Annex 1
Mapping with UNESCO MIL framework		DigComp 2.0, Annex 2 and 3
Cross-reference with other Key Competences		DigComp 1.0, Annex V
Cross-reference between competences (1.0)		DigComp 1.0, Annex II

3.1. TOOLS FOR SELF-REFLECTION, MONITORING AND CERTIFICATION OF DIGITAL COMPETENCE

Europass CV online

Europass CV Online tool allows users to list and organise their digital skills in the Europass Profile following the DigComp model and then add it to their Curriculum Vitale (CV). The list can also include tools and software, as well as projects or achievements that they wish to highlight. In general, Europass CV outlines a format for structuring one's CV with information on education, training, work experience and skills.

WEBSITE: europa.eu/europass/en/how-describe-my-digital-skills

Self-assessment tool on Digital Skills and Jobs Platform

Using the Digital Skills and Jobs Platform, any EU citizen can access a self-assessment tool on digital competence. The tool is based on DigComp and it is available in all EU languages. By taking the test, one can learn more about their digital skills, and importantly, discover what the next step to improve them would be. For this purpose, the platform will give matching suggestions of courses and learning opportunities, and suggest which digital skills one should focus on.

WEBSITE: digital-skills-jobs.europa.eu/digitalskills

DigCompSat

DigCompSat is a self-reflection tool for the Digital Competence Framework for Citizens to assess all 21 DigComp competences corresponding to proficiency levels 1 to 6 (foundation, intermediate and advanced). The item bank is composed of 82 self-assessment questions that have sound psychometric properties including their validity and internal consistency. They perform three main functions: measuring existing competences at area level based on the respondents' self-assessment; identifying competence gaps; and raising awareness of what digital competence means nowadays. The item bank exists in English, Spanish and Latvian. The report with the

item bank is available under a CC BY 4.0 Creative Common licence which allows the re-use and translation, providing the original source is mentioned. The DigCompSAT report describes the process and methodology taken to achieve the result. This entailed involving several experts and running three pilot tests in Ireland, Spain and Latvia, with a total of over 600 representative members of the local populations. The report's annexes provide the analysis of statistical data and the bank of items used in the pre-pilot and pilot phases (in English, Spanish and Latvian). The research project was carried out by All Digital in 2019-20 after a call for tenders by the Joint Research Centre.

REPORT (2020): data.europa.eu/doi/10.2760/77437

MyDigiSkills

The MyDigiSkills is an online tool that allows citizens to self-reflect on their digital competence using the DigCompSat. The test is available in 11 languages: Dutch, English, French, German, Italian, Latvian, Lithuanian, Romanian, Russian, Spanish and Ukrainian. All Digital currently hosts the service (see more **BOX 2**. Origins of MyDigiSkills). MyDigiSkills partners and third parties can request a "test code" for running a test with a specific group of users, e.g. a school and its students, a city and its citizens. The test organisers can filter and extract the results by a cohort from the MyDigiSkills database as an anonymised data set. All Digital and the MyDigiSkills partners agreed to make available all the test results as anonymised open data for research purposes.

WEBSITE: mydigiskills.eu

Digital Skills Index

Since 2015, the European Commission has monitored the level of EU citizens' digital activities using the Digital Skills Index (DSI). Until 2019, this composite indicator was based on DigComp's four competence areas (information, communication, content creation and problem solving), and since 2022, the fifth area of Safety was added. DSI uses data collected by Eurostat using the European Union Survey on Internet Usage in Households and by Individuals. The survey focuses on how individuals have used the internet in the last three months and a number of variables from the survey are used as a proxy for digital skills. The survey covers a representative sample of the EU population between the ages of 16 and 74.

WEBSITE: ec.europa.eu/eurostat/cache/metadata/en/tepsr_sp410_esmsip2.htm
(See, 4. Statistical Indicator)

DigComp Certification work

A Community of Practice has been created for supporting the design and development of the European Digital Skills Certification (EDSC) feasibility tudy, and its eventual consultation and participation processes. As of early 2022, the Digital Skills Certifications Community of Practice gathers around 350 members from public, private and the third sector, working at local, regional, national and international level, including a fair representation from policy, E&T industry, business services and citizen's service actors.

WEBSITE: all-digital.org/certification-cop

BOX 2. Origins of MyDigiSkills

AUPEX (Asociación de Universidades Populares de Extremadura) is a Spanish not-for-profit organisation uniting local adult education centres and developing lifelong learning projects focusing on digital competence. In 2021, AUPEX developed a project to create an online digital competence self-assessment test. They used the 82 questions developed for DigCompSat, its answering options and scoring of results. Later, the online tool was offered to All Digital and its members to transform it into a multi-language service now known as MyDigiSkills. The interested partners will need to take care of their national version and make all translated content and interfaces available at their own expense.

3.2. REPORTS AND GUIDES FOR DIGCOMP IMPLEMENTATION

DigComp into Action: Get inspired, make it happen

This Guide supports stakeholders in the implementation of the DigComp Framework through sharing of 38 existing inspiring practices of DigComp implementations by a variety of actors in different domains: education and training, life-long learning and inclusion, and employment. These are illustrated by 50 content items consisting of short Case studies and Tools. The list of examples provided in the Guide's annex is not exhaustive and aims to illustrate the wide range of DigComp implementation practices.

GUIDE (2018): data.europa.eu/doi/10.2760/112945

DigComp at work

This report and its accompanying Guide (published separately) address and support stakeholders with analyses and 9 inspiring practices and related resources of DigComp implementations for employability and employment. It describes the use of DigComp by Labour Market Intermediaries (LMIs) that are working towards the development of digital skills of unemployed, jobseekers, employees and entrepreneurs(-to-be) with the aim of increasing their employability (both in the public and private sectors).

REPORT (2020): data.europa.eu/doi/10.2760/17763

DigComp at Work Implementation Guide

The Implementation Guide accompanies the "DigComp at Work" report published separately. It aims at supporting labour market intermediaries in their digital skilling actions in employability or employment contexts. It offers specific guidelines, examples, tips and useful resources for the use of DigComp for defining digital competence needs for specific jobs, for assessing digital competences and for cataloguing, developing and delivering training on digital competences.

GUIDE (2020): data.europa.eu/doi/10.2760/936769

3.3. INTERNATIONAL ORGANISATIONS' REVIEWS THAT INCLUDE DIGCOMP

UNESCO Institute for Statistics: A global framework of reference on digital literacy skills for SDG indicator 4.4.2

The objective was to develop a methodology that can serve as the foundation for Sustainable Development Goal (SDG) thematic Indicator 4.4.2: "Percentage of youth/adults who have achieved at least a minimum level of proficiency in digital literacy skills". Based on the findings, the project team proposes a final version to the UNESCO Institute for Statistics for consideration, it follows DigComp2.0 with 2 additions.

PUBLICATION (2018): unesdoc.unesco.org/ark:/48223/pf0000265403

UNICEF: Digital Literacy for Children: exploring definitions and frameworks

This scoping paper highlights existing competence frameworks (40 initiatives) and how they can be adapted to UNICEF's needs. The paper proposes that UNICEF should mainly rely on the DigComp framework of the European Commission, and when working in the context of developing countries and when a broader digital citizenship approach is preferred, the paper suggests the use of the Digital Kids Asia-Pacific framework developed by the UNESCO Asia and Pacific Regional Office in Bangkok.

PUBLICATION (2019): unicef.org/globalinsight/reports/digital-literacy-children

World Bank: Digital Skills: Frameworks and Programs

This paper presents a framework for digital skills, based on a review of international frameworks. For the area of digital skills for citizens and non-ICT professions, the report highlights the DigComp framework and/or its adaptation by UNESCO UIS in the Digital Literacy Global Framework (DLGF). It further emphasises the need for adaptation of the framework to the local contexts of countries in order to develop relevant education courses, training programs, and assessment frameworks.

PUBLICATION (2020): hdl.handle.net/10986/35080

3.4. DIGCOMP TRANSLATIONS AND ADAPTATIONS

TABLE 2 and **TABLE 3** show two different types of translations of the DigComp publications; the literal translations of the reports that are either fully or partially translated, and those that are national and/or sectorial adaptations of the framework. Sectorial adaptations deal with educators, students in tertiary education and civil servants.

The translations of the JRC DigComp reports are encouraged through an open EC licence which allows their re-use and translation, providing the original source is mentioned. Therefore, a translation can be done without a formal JRC authorisation. However, the DigComp Community of Practice can be used to inform the community about the new language versions.

T.2 Literal and partial translations of the DigComp reports

COUNTRY	BY WHOM	VERSION	YEAR
Belarus	Digital Skills Coalition Belarus	v2.1 (report)	2021
Czech Rep.	MUNI Press (Masaryk University Brno)	v2.1 (partial)	2019
Estonia	Ministry of Education and Research	v1.0 (report)	
Greece	Ministry of eGovernance	v.2.1 (partial)	2020
Hungary	DPMK, Ministry of Innovation and Technology	v.2.1 (report)	2019
Italy	AGID	v.2.1 (report)	2018
Italy	Cittadinanza Digitale.eu	v. 1.0 (partial)	
Italy	Cittadinanza Digitale.eu	v.2.0 (partial)	
Latvia	Ministry of Science and Education	v2.1 (report)	2021
Lithuania	Ugdymo plėtotės centras (Education Development Centre)	v2.1 (report)	2017
Poland	ECCC Foundation	v1.0 (report)	2016
Poland	ECDL Poland	v2.0 (report)	2016
Poland	ECCC Foundation	v2.1 (report)	2019
Portugal	CIDTFF - Department of Education and Psychology, University of Aveiro	v1.0 + v2.0 (report)	2017
Portugal	CIDTFF - Department of Education and Psychology, University of Aveiro	v2.1 (report)	2017
Slovenia	National Education Institute Slovenia	v2.1 (report)	2017
Spain	Murcia Regional Government - School of Public Administration	V1.0 (partial)	2016
Spain	Junta de Extremadura - Consejería de Educación y Empleo / AUPEX	v2.1 (partial)	2017
Spain	Asociación de Universidades Populares de Extremadura (AUPEX)	v2.1 (report)	2018

T.3 National, regional and sector specific adaptations of the framework

COUNTRY	BY WHOM		YEAR
Austria	Federal Ministry Digital and Economic Affairs	link	2019
Belgium	Department of Education of Flanders	link	
France	Ministry of Education	link	2017
Spain	National Institute of Educational Technologies and Teacher Training (INTEF)	link esp link eng	2017
Spain	REBIUN, the Network of Spanish University Libraries	lnk	
Spain	Murcia Regional Government - School of Public Administration	lnk	2016

3.5. DIGCOMP IN THE ESCO CLASSIFICATION AND TRANSLATIONS

ESCO is the multilingual classification of European Skills, Competences, Qualifications and Occupations which identifies and categorises about 3,000 occupations and 13,900 skills and competences that are relevant for the EU labour market and education and training. It also includes information on qualifications that are owned and managed by the European Member States.

The new version of the ESCO classification (ESCO v1.1) includes the titles and descriptions of the DigComp 2.0 five areas and 21 competences in its Skills/competences pillar. Some of them have been slightly modified to comply with ESCO rules (see **TABLE 4**). For instance, in ESCO, titles are not capitalised and they do not use the gerund form. In some cases, additional words have been added to disambiguate the concepts and clearly place them in the digital domain, e.g. the competence area "Information and data literacy" has been transformed into "digital data processing" in order to simplify the language. For the specific competences "programming" and "protecting devices", ESCO applied a different definition.

T.4 Mapping of DigComp competence areas and ESCO digital competencies

ESCO	DIGCOMP
digital data processing	Information and data literacy
digital communication and collaboration	Communication and collaboration
digital content creation	Digital content creation
ICT safety	Safety
problem-solving with digital tools	Problem solving

The DigComp competences are currently also available in the download section of the ESCO portal (in CSV and ODS formats) and through the ESCO web-service Application Program Interface (API) and an ESCO Local API. In the near future, it will be possible to filter for DigComp areas and competences directly in the ESCO skills pillar.

As all ESCO content, also the DigComp competences have been translated by the European Commission's translation services and checked by ESCO national correspondents in all 23 official EU languages, Norwegian, Icelandic and Arabic, and are linked to other ESCO skills. The translations are available in different file formats using the appropriate filters (select version 1.1.0 for the latest update) from the portal's Download section.

To facilitate access to these translations (except for Arabic), ESCO produced the report Translations of DigComp 2.0 in ESCO which provides for all 5 areas and 21 competences:

- the DigComp label/title
- the ESCO URI (only for the 21 specific competences - In the linked data format, any concept is identified by a Uniform Resource Identifier.)
- the ESCO label/title in English
- the translated ESCO label/title
- the DigComp descriptor
- the ESCO description in English, and the translated ESCO description

3.6. THE DIGCOMP COMMUNITY OF PRACTICE

The DigComp Community of Practice (CoP) is hosted online and is open to everyone, individuals and organizations alike, who work on digital competence development and have experience in using the DigComp framework. The CoP offers different perspectives and interest points: policy, research, education and training, employability and human resources development, inclusion projects and others.

By early 2022, the DigComp CoP hosted 575 members from 57 countries in Europe and elsewhere. As showed in **FIG. 4**, the largest group is represented by educational organisations, in particular university teachers, researchers and students (190 members). Among Third Sectors organisations, almost half (51) are represented by digital competence centres, including several All Digital members.

Besides specific activities run by working groups, like those related to the DigComp 2.2 revision process, the CoP hosts:

- discussions launched by members or moderators on various topics (e.g. approaches and tools for the validation of digital competence in education and other contexts; the digital competence of health professionals, teachers and other workers)
- requests and sharing of suggestions and resources on specific aspects (e.g. digital literacy initiatives and materials in developing countries; partner searches for new projects; sharing digital competence project and study reports; information about new calls and policy initiatives related to digital competence development at EU level)
- a repository of DigComp reference documents, other useful documents and brief descriptions shared by members of their DigComp implementation experiences
- webinars where CoP members and other stakeholders present their DigComp-related activities.

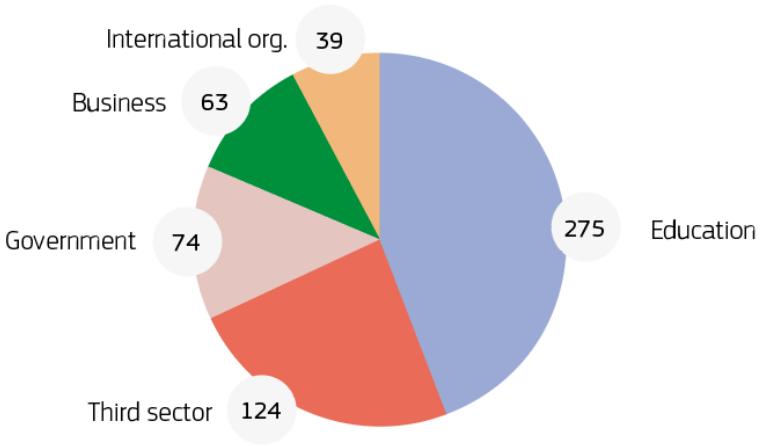


FIG.4 DigComp CoP member types

BOX 3. Origin of the DigComp online Community of Practice

Following the workshop on DigComp and employability that took place in Summer 2019 in Bilbao, All Digital and the Ikanos Project of the Basque Government joined forces to promote wider adoption and support the development of DigComp by establishing the European DigComp Community of Practice (CoP). All Digital made an online collaborative platform available to host the DigComp CoP. The DigComp CoP became active and started growing from early 2021 onwards when, in agreement with the JRC, it engaged in the DigComp 2.2 revision process.

4. OTHER FRAMEWORKS

4.1. INTERNATIONAL ORGANISATIONS

UNESCO: Media and Information Literacy framework

The **Media and Information Literacy framework (MIL)** by UNESCO was initially developed around the same time as the DigComp framework and they both have a common goal to enable people developing digital competence to support their life chances and employability. The UNESCO framework complements the DigComp framework especially in its focus on Media and information literacy to deepen the understanding of the role and functions of media in democratic societies. Many of the competences in both frameworks can be cross-referenced thus enabling curriculum and training material to be used in an inter-exchangeable manner. The mapping between DigComp and MIL elements is available in DigComp 2.0, Annex 2 and 3.

WEBSITE: en.unesco.org/themes/media-and-information-literacy

HANDBOOK (2021): unesdoc.unesco.org/ark:/48223/pf0000377068

UNESCO Digital Kids Asia Pacific: Digital Citizenship for Kids

The **Digital Kids Asia-Pacific (DKAP)** Framework guides children's digital citizenship interventions by providing a holistic, rights-based and child-centered approach structured across 5 domains and 16 competencies. The accompanying assessment tool is validated among 15-year-old students in four Asia-Pacific countries. At conceptual level, there are many complementarities between the frameworks (e.g. Digital literacy, Digital creativity and innovation, Safety, Digital participation). An interesting added value is the Socio-emotional domain focusing on Digital emotional intelligence, which is the part that is dealt with in the LifeComp framework in Key Competences for Lifelong learning (see LifeComp).

WEBSITE: dkap.org

4.2 FRAMEWORKS TO SUPPORT KEY COMPETENCES FOR LIFELONG LEARNING

The updated Council Recommendation on Key Competences for Lifelong Learning identifies eight key competences needed for personal fulfilment, a healthy and sustainable lifestyle, employability, active citizenship and social inclusion. Apart from the Digital competence, Key Competences are the following: Literacy, Multilingualism, Numerical, scientific and engineering skills, Interpersonal skills, and the ability to adopt new competences, Active citizenship, Entrepreneurship and Cultural awareness and expression.

A number of reference frameworks have been developed by the European Commission and the Council of Europe to support education and training institutions in providing education, training and lifelong learning for all (**FIG. 5**). The examples on the following pages are not exhaustive, for more examples, see report (2018): eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52018SC0014

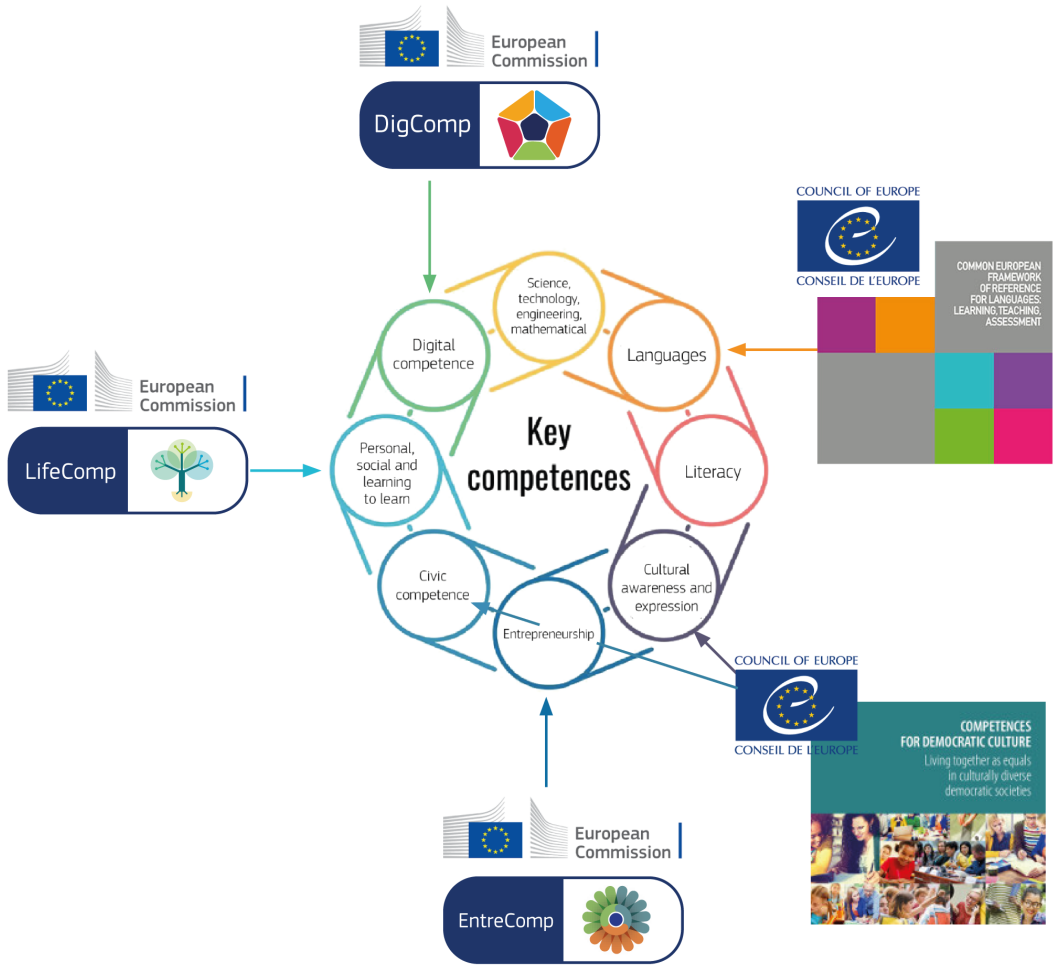


FIG.5 Both the European Commission and the Council of Europe have created reference frameworks to support the conceptualisation of the Key competences and their key terminology.

EntreComp

The development of the entrepreneurial capacity of European citizens is one of the eight Key Competences for Lifelong learning. Entrepreneurial value creation and entrepreneurial learning can take place in any sphere of life; turning ideas into shared value is equally relevant to progressing one's career, supporting one's local sports team or establishing a new social enterprise. The report entitled **EntreComp: The Entrepreneurship Competence Framework** describes entrepreneurship as a lifelong competence and identifies what are the elements that make someone entrepreneurial.

REPORT (2016): data.europa.eu/doi/10.2791/593884

NOTE: The Dimension 4 examples that focus on the interconnection between DigComp and EntreComp include the following: 237, 239, 242, 243, 244.

LifeComp

LifeComp: The European framework for the personal, social and learning to learn key competence is a framework to establish a shared understanding on the "personal, social and learning to learn" key competence. LifeComp is a non-prescriptive conceptual framework that can be used as a basis for the development of curricula and learning activities. The aim is to build a meaningful life, cope with complexity, be thriving individuals, responsible social agents, and reflective lifelong learners. LifeComp describes nine competences that can be learned by everyone in formal, informal and non-formal education.

PUBLICATION (2020): data.europa.eu/doi/10.2760/922681

NOTE: The Dimension 4 examples that focus on the interconnection between DigComp and LifeComp include the following: 4, 53, 55, 83, 89, 91, 95, 97, 100, 102, 103, 188, 196, 199, 248, 251, 256, 258.

CEFR

The **Common European Framework of Reference for Languages: Learning, teaching, assessment (CEFR)** was designed to provide a transparent, coherent and comprehensive basis for the elaboration of language syllabuses and curriculum guidelines, the design of teaching and learning materials, and the assessment of foreign language proficiency. The CEFR Companion Volume also contains the complete set of extended CEFR descriptors for mediation, online interaction, plurilingual/pluricultural competence, and sign language competences. The illustrative descriptors have been adapted with modality-inclusive formulations for sign languages and all descriptors are now gender-neutral.

PORTAL: coe.int/web/common-european-framework-reference-languages

Competences for Democratic Culture

A **Reference Framework of Competences for Democratic Culture** focuses on competences needed to participate effectively in a culture of democracy, and to live peacefully together with others in culturally diverse democratic societies. It describes a wide range of intercultural, civic, social and transversal competences that can be used to support teaching about the Key Competence of Cultural awareness and expression. The framework entails a series of statements setting out learning targets and outcomes for each competence to help educators design learning situations that enable them to observe learners' behaviour in relation to a given competence.

PORTAL: coe.int/web/reference-framework-of-competences-for-democratic-culture

NOTE: The Dimension 4 examples that focus on the interconnection between DigComp and Citizenship (as it is defined in the Key Competence recommendation) include the following: 72, 73, 77, 80, 81.

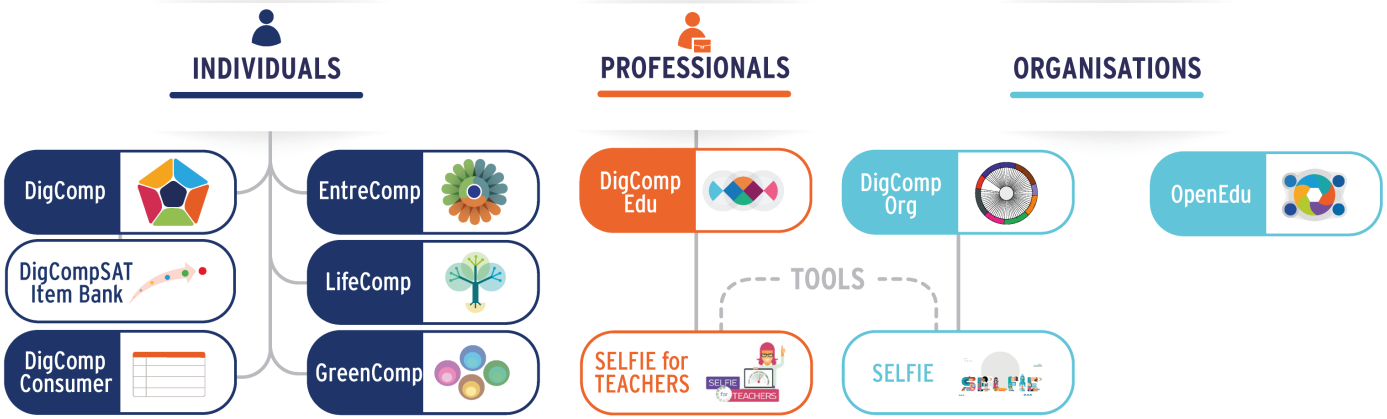


FIG.6 EC-JRC competence frameworks and tools

4.3 OTHER EU COMPETENCE FRAMEWORKS BY THE JRC

DigCompConsumers

The **Digital Competence Framework for Consumers** offers a reference framework to support and improve consumers' digital competence, i.e. the competence consumers need to function actively, safely and assertively in the digital marketplace. DigCompConsumers is considered as derivative work as it uses the DigComp conceptual reference model as the basis for a new digital competence framework in a specific context. DigCompConsumers is a product of collaboration between DG Justice and Consumers and the JRC.

FRAMEWORK IN 23 LANGUAGES (2016): ec.europa.eu/jrc/en/digcompconsumers

DigCompEdu

The **European Framework for the Digital Competence of Educators** is a framework describing what it means for educators to be digitally competent. It provides a general reference frame to support the development of educator-specific digital competences in Europe. DigCompEdu is directed towards educators at all levels of education, from early childhood to higher and adult education, including general and vocational education and training, special needs education, and non-formal learning contexts.

PUBLICATION (2017): data.europa.eu/doi/10.2760/178382

WEBSITE: ec.europa.eu/jrc/en/digcompedu, see Supporting materials for translations

TOOL: SELFIEforTEACHERS is an online self-reflection tool based on DigCompEdu.

DigCompOrg

There is a need to support educational organisations in their digital capacity building. The **European framework for digitally-competent educational organisations is** aimed at promoting effective digital-age learning. The framework can facilitate transparency and comparability between related initiatives throughout Europe and play a role in addressing fragmentation and uneven development across the Member States.

PUBLICATION (2015): data.europa.eu/doi/10.2791/54070

TOOL: SELFIE is an online self-reflection tool based on DigCompOrg: for schools' digital capacity.

GreenComp

The European Green Deal promotes learning on environmental sustainability in the European Union. GreenComp is a **European sustainability competence framework** that identifies a set of sustainability competences to feed into education programmes to help learners develop knowledge, skills and attitudes that promote ways to think, plan and act with empathy, responsibility, and care for our planet and for public health.

PUBLICATION (2021): data.europa.eu/doi/10.2760/13286

5. GLOSSARY

Algorithm

a finite sequence of well-defined instructions, typically used to solve a class of specific problems or to perform a computation. Modified from: en.wikipedia.org/wiki/Algorithm

Artificial intelligence

"AI refers to machine-based systems that can, given a set of human-defined objectives, make predictions, recommendations, or decisions that influence real or virtual environments. AI systems interact with us and act on our environment, either directly or indirectly. Often, they appear to operate autonomously, and can adapt their behaviour by learning about the context." Source: UNICEF, 2021, p.16

Artificial intelligence system (AI system)

a software that is developed with one or more of the techniques and approaches listed in Annex I of the AI Act proposal (e.g. machine learning, knowledge-based approaches and statistical models) and can, for a given set of human-defined objectives, generate outputs such as content, predictions, recommendations, or decisions influencing the environments they interact with. AI Act Proposal (COM/2021/206 final)

Data

a sequence of one or more symbols given meaning by specific act(s) of interpretation (data has no intrinsic meaning). Data can be analysed or used in an effort to gain knowledge or make decisions. Digital data is represented using the binary number system of ones (1) and zeros (0) as opposed to its analogue representation. Modified from: en.wikipedia.org/wiki/Data_(computing)

Data visualization

is an interdisciplinary field that deals with the graphic representation of data to communicate information clearly and efficiently to users. It makes complex data more accessible, understandable and usable, but can also be reductive. Modified from: en.wikipedia.org/wiki/Data_visualization

Digital accessibility (DA)

extent to which people from a population with the widest range of characteristics and capabilities can use digital products, systems, services, environments and facilities to achieve a specified goal in a specified context of use (direct use or use supported by assistive technologies). (Modified from EN 301547).

Accessibility benefits people with disabilities and others, for example: people using devices with small screens and different input modes; older people with changing abilities due to aging; people with "temporary disabilities" such as a broken arm or lost glasses; people with "situational limitations" such as in bright sunlight or in an environment where they cannot listen to audio; people using a slow Internet connection, or who have limited or expensive bandwidth (source). In DigComp 2.2, examples illustrating digital accessibility are marked as (**DA**).

Digital communication

refers to communication using digital technology. Various modes of communication exist, e.g. synchronous communication (real time communication, e.g. using skype or video chat or Bluetooth) and asynchronous ones (not concurrent communication, e.g. email, forum to send a message, sms) using for example, one to one, one to many, or many to many modes.

Digital content

data which is produced and supplied in digital form (Directive (EU) 2019/770), for example video, audio, applications, digital games and any other software. Digital content includes information that is broadcast, streamed, or contained in computer files. Modified from: en.wikipedia.org/wiki/Digital_content

Digital environment

a context, or a "place", that is enabled by technology and digital devices, often transmitted over the internet, or other digital means, e.g. mobile phone network. Records and evidence of an individual's interaction with a digital environment constitute their digital footprint. In DigComp, the term digital environment is used as a backdrop for digital actions without naming a specific technology or tool.

Digital service

allows a user (citizen, consumer) to create, process, store or access data in digital form and to share or interact with data in digital form uploaded or created by the same or other users of that service (Directive (EU) 2019/770).

Digital technology
any product that can be used to create, view, distribute, modify, store, retrieve, transmit and receive information electronically in a digital form. For example, personal computers and devices (e.g. a desktop, laptop, netbook, tablet computer, smart phones, PDA with mobile phone facilities, games consoles, media players, e-book readers, smart assistants, AR/VR headsets and other devices), digital television, robots.

Digital tools
digital technologies (see: digital technology) used for a given purpose or for carrying out a particular function of information processing, communication, content creation, safety or problem solving.

Disinformation and misinformation
disinformation is false information intentionally created and disseminated to deceive people whereas misinformation is false information regardless of intent to deceive or mislead people Source: europa.eu/learning-corner/spot-and-fight-disinformation_en

Echo chamber
refers to situations in social media and online discussion groups in which beliefs are amplified or reinforced by communication and repetition inside a closed, insulated system. Participants usually receive information that reinforces their existing views without encountering opposing views. Modified from: en.wikipedia.org/wiki/Echo_chamber_(media)

eIDAS
The Regulation on electronic identification and trust services is a legal framework for people, companies and public administrations to safely access services and carry out transactions online in just 'one click'. It will mean higher security and more convenience for any online activity such submitting tax declarations, enrolling in a foreign university, remotely opening a bank account, setting up a business in another Member State, authenticating for internet payments. In DigComp 2.2, examples no: 68, 70, 180 and 185 aim to illustrate different applications. More information: digital-strategy.ec.europa.eu/en/policies/eidas-regulation

Filter bubble
can result from personalised searches on the internet and/or social media when an algorithm selectively guesses what information a user would like to see based on information about the user, such as location, past click-behavior and search history. Modified from: en.wikipedia.org/wiki/Filter_bubble

GDPR
the General Data Protection Regulation (EU) 2016/679 is the legal framework that sets guidelines for the collection and processing of personal information of individuals within the European Union. GDPR came into effect across the EU on May 25, 2018. See more: gdpr.eu

Internet of things (IoT)
describes physical objects (or groups of such objects) that are embedded with sensors, processing ability, software, and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks. Modified from: en.wikipedia.org/wiki/Internet_of_things

Media literacy
refers to skills, knowledge and understanding that allow citizens to use media effectively and safely. In order to enable citizens to access information and to use, critically assess and create media content responsibly and safely, citizens need to possess advanced media literacy skills. Media literacy should not be limited to learning about tools and technologies, but should aim to equip citizens with the critical thinking skills required to exercise judgment, analyse complex realities and recognise the difference between opinion and fact. Source: the EU's Audiovisual Media Services Directive (2018)

Privacy policy
the term related to the protection of personal data, for example, how a service provider collects, stores, protects, discloses, transfers and uses information (data) about its users, what data are collected, etc. See also GDPR.

Problem solving
"an individual's capacity to engage in cognitive processing to understand and resolve problem situations where a method of solution is not immediately obvious. It includes the willingness to engage with such situations in order to achieve one's potential as a constructive and reflective citizen" (OECD, 2014, p. 30).

6. REFERENCES

Social inclusion

the process of improving the terms for individuals and groups to take part in society. Social inclusion aims to empower poor and marginalized people to take advantage of burgeoning global opportunities. It ensures that people have a voice in decisions which affect their lives and that they enjoy equal access to markets, services and political, social and physical spaces. Modified from the World Bank

Structured environment

where data resides in a fixed field within a record or file, e.g. relational databases and spreadsheets.

Technological response/solution

refers to the attempt to use technology (and/or engineering) to solve a problem.

Well-being

the term is related to the WHO definition of good health as a state of complete physical, social and mental well-being, and not merely the absence of disease or infirmity. Social well-being refers to the sense of involvement with others and with the communities (e.g. access and use of social capital, social trust, social connectedness and social networks).

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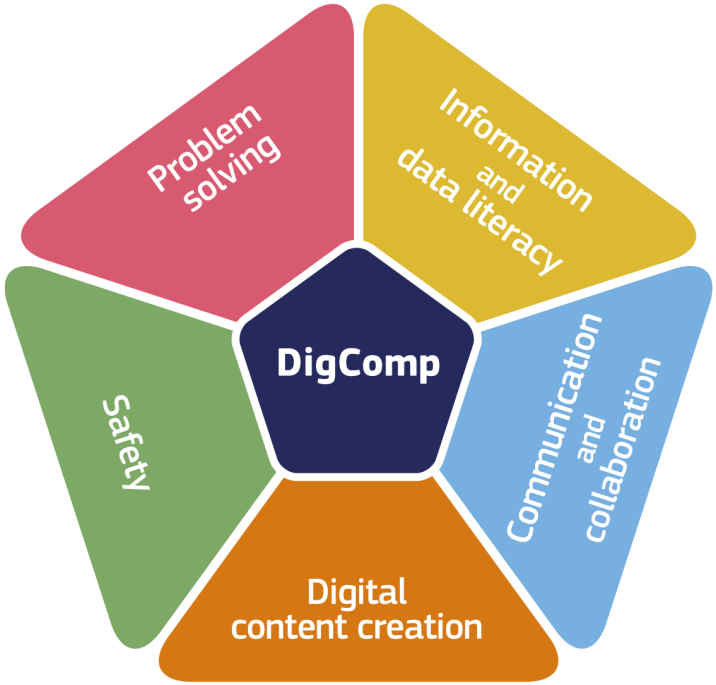
ANNEXES


Problem solving
Information and data literacy
DigComp
Communication and collaboration
Safety
Digital content creation

A1. METHODOLOGY UNDERLYING THE DIGCOMP FRAMEWORK AND ITS UPDATES

This section first explains the structure of the DigComp framework and then describes the methodology used to create it. As the DigComp update 2.2 focuses on Dimension 4 only, this section first starts from version 1 in 2013, then shortly references the methodology used for the update of the conceptual reference model (DigComp 2.0) and for DigComp 2.1 (proficiency levels; use cases) and finally describes the process for the 2.2 update.

The DigComp framework is composed of 5 dimensions (**TABLE 5**). Dimensions outline the underlying data model and organise all the elements showing how they relate to one another. The word 'dimension' also refers to the structure of the framework outlining the way in which the content of the framework is displayed. In DigComp, the concept of "dimension" is used in the same way as it is used in the eCompetence framework for ICT professionals (e-CF).

T.5 Main dimensions of DigComp

Dimension 1.	**Areas** identified to be part of the digital competence
Dimension 2.	**Competence descriptors and titles** that are pertinent to each area
Dimension 3.	**Levels of proficiency** for each competence
Dimension 4.	**Examples of the knowledge, skills and attitudes** applicable to each competence
Dimension 5.	**Use cases** on the applicability of the competence to different contexts.

Dimension 1 outlines the competence areas of which the digital competence is composed. Dimension 2 details the titles of each competence and their descriptors. Dimension 3 is used to describe the proficiency levels of each competence (see **TABLE 6** for more details). Dimension 4 and 5 describe various examples related to Dimension 2. They are provided to add value and context and thus, they are not intended to be exhaustive.

In the case of Dimension 4, these would include examples of knowledge, skills and attitudes related to each competence, whereas Dimension 5 provides use cases in specific contexts, learning and employment.

Each dimension has its specificities allowing for a flexible use of the framework so that it can be adapted to the needs and requirements that emerge from the context. For example, someone may only use Dimensions 1 and 2 without the use of proficiency levels. The use of dimensions also allows for better interoperability and comparability between various frameworks.

To keep track of different versions of DigComp updates, a sequential numbering scheme of two numbers (major.minor) is used. When a significant change in the conceptual reference model (Dimension 1-2) takes place, the first sequence (major) is changed (i.e. 1.0 to 2.0). When varying some aspects takes place (e.g. in Dimension 3, 4, 5), the changes to the sequence after the first number (minor) are made to represent changes (i.e. 2.1 to 2.2). In the following, the updates are shortly outlined.

DIGCOMP 1.0

The process to create the Digital Competence Framework for Citizens, also known by its acronym DigComp, was initiated in December 2010 by the Joint Research Centre on behalf of the Directorate General for Education and Culture. A number of mid-term publications first came out (Ala-Mutka, 2011; Janssen, Stoyanov, 2012, Ferrari, Punie, Redecker, 2012) before the final publication of the framework in 2013 by Ferrari.

"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." (Ferrari, 2013, p.5)

DigComp 1.0 defines digital competence as a combination of 21 competences that can be grouped in five main areas (Information, Communication and collaboration; Content creation; Safety; and Problem solving). Competence areas use a sequential numbering from 1 to 5. Each competence has a title and a descriptor which are descriptive rather than prescriptive. All competences within the area use two numbers (area.competence), the first sequence indicates the competence area and the second indicates the competence (e.g. 1.2).

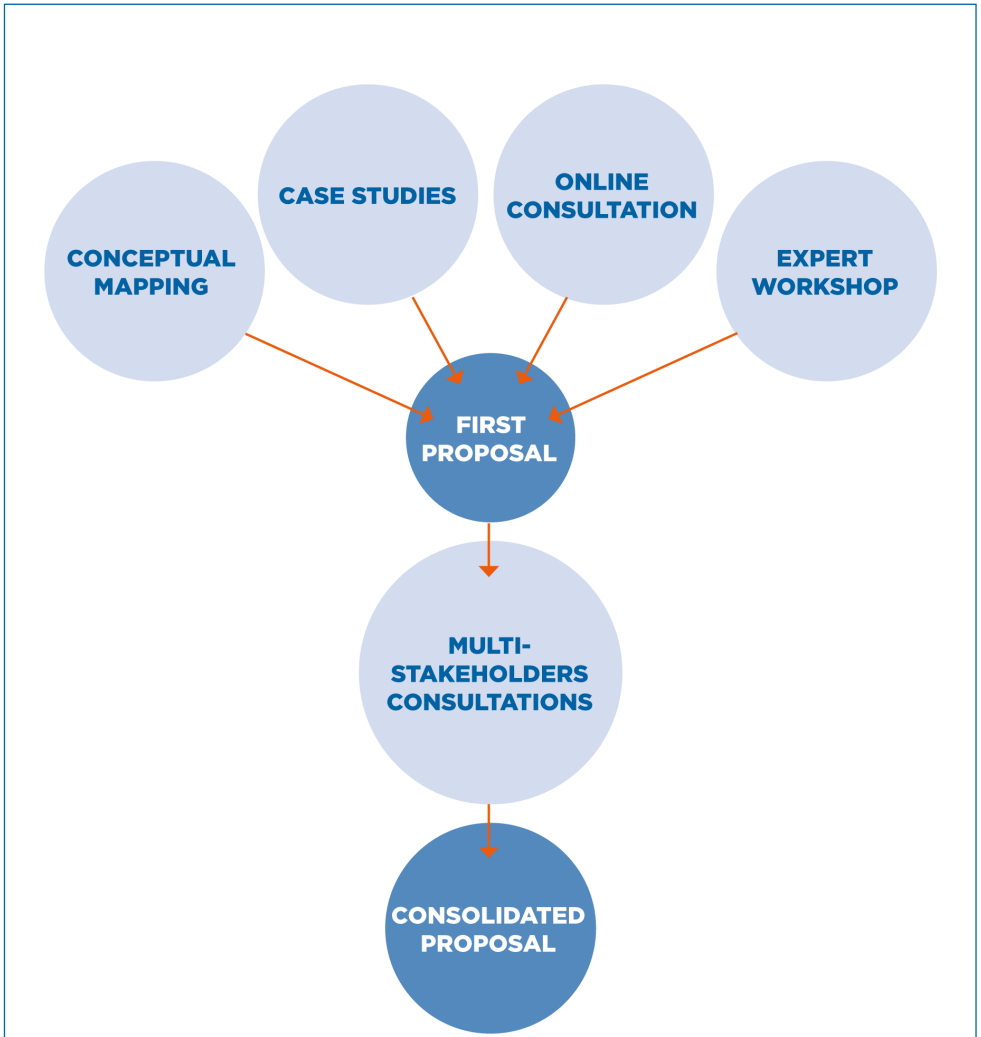


FIG.7 The process of creating DigComp 1.0

UPDATE 2.0: CONCEPTUAL REFERENCE MODEL (DIM. 1-2)

The update of the conceptual reference model took place in 2016 and consisted of an update of the five areas (Dimension 1) and a revision of the 21 competence titles and descriptors (Dimension 2). This update is known as DigComp 2.0 (Vuorikari et al., 2016).

The process of the DigComp 2.0 started in early 2015 with feedback from the Education and Training 2020 Working Group for Transversal Skills, these Groups are part of a way for the European Commission and Member States to cooperate in addressing key challenges at national and European levels in the field of education. In three separate sessions (February, June and October 2015), feedback was gathered on the different parts of the update process (e.g. conceptual reference model, use cases at the national level, proficiency levels). In November 2015, a fairly stable version of the conceptual reference model was made publicly available on the internet (through the JRC Science Hub) with a deadline for feedback of 15 March 2016. Throughout that period, feedback was gathered using different means, e.g. interviews, emails, consolidated feedback from Ministerial working groups, external reviewers. In general, the engagement of stakeholders and the Working Group members, some of whom were already using DigComp at regional/national level, was seen as an important step for the further success of the framework and stakeholder buy-in.

For competence descriptors, **DigComp 2.0 adopted a device-agnostic wording** of "digital technologies" so that it is not necessary to name a specific technology, software or application, and the use of a catch-all term of "digital environment" to describe the backdrop to digital actions. The idea was that these terms encompass not only the use of personal computers (e.g. a desktop computer, laptop), but also other hand-held devices (e.g. smart phones, wearable devices with mobile networking facilities), games consoles and other media players or e-book readers which, more often than not, are also networked and/or connected to the Internet. Nowadays sensors and other devices under the Internet of Things (IoT) are included. Such vocabulary allows for "future proofing" the framework against the fast speed of change in the field of technologies, while at the same time remaining device and application neutral, and only focusing on high-level competences that are deemed important (rather than being device- or application-specific).

UPDATE 2.1: PROFICIENCY LEVELS (DIM. 3) AND USE CASES (DIM. 5)

Dimension 3 of the framework reflects proficiency levels of each competence illustrating the progression in the acquisition of the competence. DigComp version 1.0 was developed in three proficiency levels (foundation, intermediate and advanced) and in DigComp 2.1 (Carretero et al., 2017), 8 proficiency levels were introduced. The process to shape DigComp 2.1 took a period of more than a year and it started around the publication of DigComp 2.0 in summer 2016.

In 2.1, the progression of competence acquisition is outlined in three different areas: the complexity of the tasks, the autonomy and guidance need for accomplishing it, and the cognitive domain indicated by the use of action verbs following the Bloom's taxonomy. The eight proficiency levels are inspired by the structure and vocabulary of the European Qualification Framework (EQF), however with no link to the qualifications or education and training systems . **TABLE 6** features the main keywords in each of the areas and it also shows how the levels are linked to the original 3 levels.

To illustrate the progression in the acquisition of the competence in three different areas, we could say that a citizen in level 2 is able to remember and to do a simple task in relation with the competence, guided by somebody with digital competence only when she/he needs help; while when a citizen is in level 5, she/he can apply the knowledge, doing different tasks and solving problems as well as to support others in doing or solving them.

Each level descriptor contains knowledge, skills and attitudes. All in all, this results in 168 descriptors (8 x 21 learning outcomes). In 2017, an online validation survey

helped to revise a first version of the levels and to produce a final version which was published in 2017 (Carretero, Vuorikari, Punie, 2017).

In 2.1, an update for Dimension 5 of the framework was also introduced. Dimension 5 contains use cases in a specific context, in this case in employment and learning. They are presented in the following way:

- The examples for all the 8 levels are only available in the first competence (1.1)
- For the rest of competences, only one example per level and area of use is provided.
- A "cascade" strategy is followed for the examples of use. This means that competence 1.2 has an example of use for level 1, competence 1.3 for level 2, competence 2.1 for level 3, etc. This way, the same number of proficiency levels and the same number of examples across the levels is given.

T.6 Main keywords that feature the proficiency levels

4 OVERALL LEVELS	**Foundation**		**Intermediate**		**Advanced**		**Highly specialised**	
8 GRANULAR LEVELS	1	2	3	4	5	6	7	8
COMPLEXITY OF TASKS	Simple task	Simple task	Well-defined and routine tasks, and straightforward problems	Tasks, and well-defined and non-routine problems	Different tasks and problems	Most appropriate tasks	Resolve complex problems with limited solutions	Resolve complex problems with many interacting factors
AUTONOMY	With guidance	Autonomy and with guidance when needed	On my own	Independent and according to my needs	Guiding others	Able to adapt to others in a complex context	Integrate to contribute to the professional practice and to guide others	Propose new ideas and processes to the field
COGNITIVE DOMAIN	Remembering	Remembering	Understanding	Understanding	Applying	Evaluating	Creating	Creating

UPDATE 2.2: EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES (DIM. 4)

The DigComp 2.2 revision process started in December 2020 with the focus on the examples of knowledge, skills and attitudes (KSA) applicable to each one of the 21 DigComp competences (Dimension 4). The terms are defined in **BOX 1**.

The update process was conducted in a close collaboration with the DigComp stakeholders' community, experts and a wider user-base in order to keep the spirit of co-construction. For this purpose, the online DigComp Community of Practice (CoP) was activated (see **SECTION 3.6**). The CoP is hosted by All Digital and it was used as a central point to coordinate the revision process which was comprised of 8 Steps (illustrated in **FIG. 8**). Starting in December 2020, a call for volunteers/contributors to join the DigComp CoP was first disseminated and an online kick-off event was held mid-January 2021 (Step 1).

The first concrete task was setting up the Working Groups that addressed:

- new and emerging topics and themes in the digital world: misinformation and disinformation; Artificial Intelligence (AI); remote working, data-related skills and datafication of digital services; emerging technologies such as virtual reality, social robotics, Internet of things, green ICT skills;
- more "established" topics and themes of the digital world that are important but are not explicitly dealt with in DigComp 2.0, e.g. e-commerce and

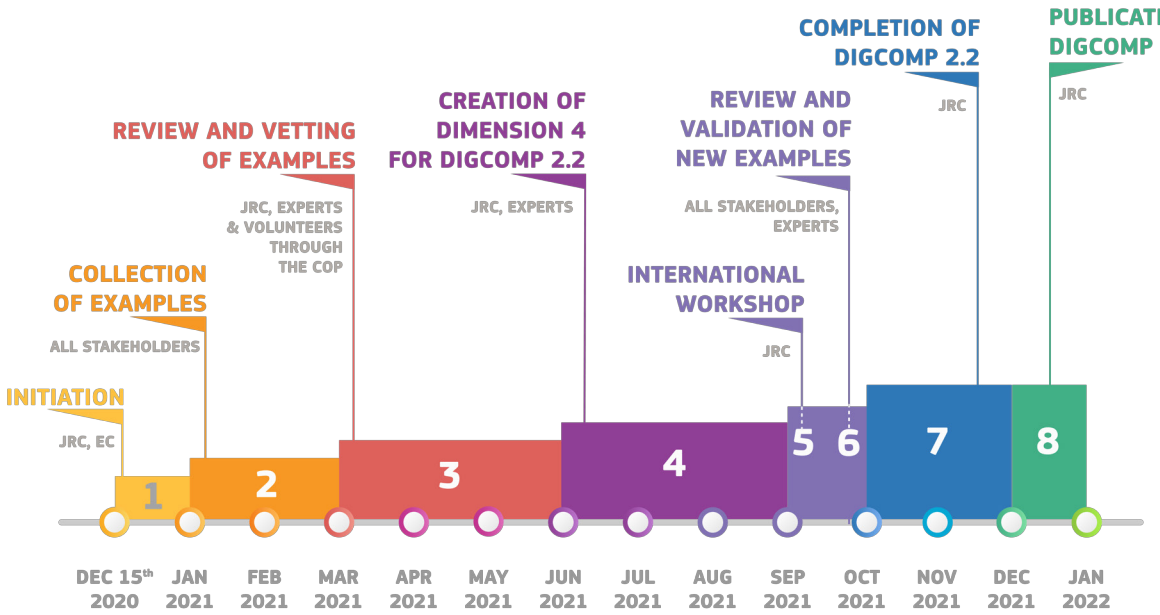


FIG.8 The process to finalise the DigComp 2.2 update

various dimensions of data literacy.

In total, 12 working groups were set up, each with 16 up to 64 people involved, most of them participating in parallel to several groups.:

1. Information literacy
2. Data literacy
3. Artificial intelligence
4. Internet of things
5. Programming
6. Privacy and personal data
7. Safety and security
8. Consumer transaction services
9. Creating multi/social media content
10. Digital and the environment
11. Teleworking
12. Digital accessibility

The working groups' mission in Step 2 of the process was first to identity the new digital competence requirements for citizens which stem from new developments in the digital world and then to make initial suggestions for relevant knowledge, skills and attitudes (KSA) examples related to those requirements. Both requirements and examples were to be drawn from: a wide-but-shallow desk review of academic and grey material; the learning goals and subject content outlined in training materials, syllabi and other educational and information sources; the analysis of important policy documents (e.g. the Digital Education Action Plan 2021-2027).

The output of Step 2 was a list of requirements and related KSA examples for citizens' digital competence, along with suggestions about where they might fit into the DigComp framework (see **BOX 4** with AI-related requirements and examples).

BOX 4. Example of Step 2 output to list new, emerging or evolving requirements for citizens to deal with digital technologies, e.g. an emerging field of Artificial Intelligence which was previously not elaborated in DigComp

A. Requirements (currently not included) of citizens' digital competence

Requirement 1: *Citizens should be aware that AI is used in different ways in today's societies and that it can affect various aspects of their lives*

- Knowledge (K): Artificial intelligence (AI) is a technology applied in different contexts from industry to leisure, e.g. in medicine, banking, self-parking vehiczles, recommending music). AI is also often used in digital environments, e.g. web searching, customer recommendations, digital assistants, and in digital devices, e.g. mobile phone cameras.

Requirement 2: *Citizens should be able to interact with day-to-day technologies that rely on AI*

- Skills (S): e.g. use voice recognition to interact with Siri, Alexa; use automated reply options in email software style "OK, thanks!"; interact face-recognition feature in phone's image software that automatically recognises some familiar faces in pictures.

Requirement 3: *Citizens should be wary that many AI systems collect their interaction data to improve services or to manipulate user behaviour.*

- Attitude (A): e.g. A critical attitude allows seeing opportunities, but also weigh risks, for example in areas designed to protect privacy and to ensure citizen's safety.

B. Where do these requirements fit into the DigComp framework?

Typically a theme, like those elaborated above, may spread across different DigComp competences. As part of Step 2, please highlight requirements that do not seem to fit under the existing 21 competences.

From March 2021 onwards, a review and vetting of the pool of requirements was organised in Working Groups (Step 3). In more concrete terms, this meant that the requirements, which were produced in Step 2, were now allocated to each of the 21 competences outlined in the DigComp framework and a more concrete work of defining examples of knowledge, skills and attitudes was undertaken. Since the nature of the task was to move from generic requirements to work following the DigComp conceptual reference model, from this step onwards, some of the Working Groups were merged. For example, that of Artificial Intelligence was grouped together with Internet of Things (IoT), Data Literacy, Programming and Personal Data to allow for a better overall picture of the situation to emerge. Separate groups of Information Literacy and Media Literacy were merged together too. This was crucial for the creation of the new examples of knowledge, skills and attitude in these emerging themes and facilitated the process of choosing under which DigComp competence the examples could eventually be allocated. On the other hand, at this Step, some of the Working Groups were asked to take a very horizontal view, e.g. topics of Accessibility, Telework and Data Literacy covered topics that ran across all 21 DigComp competences.

During Steps 2 and 3, in addition to hosting the Working Groups, the online CoP was also used for thematic webinars on the WG themes so that a wider audience could also engage in the discussions and better follow the process of the update. This was important so as to keep the process open and transparent, and also to facilitate the access to the Working Groups of those who signed up to the CoP at a later stage. Especially in Step 3, as the conceptual work intensified, a core group of very committed experts in the field carried out a big part of the work (see Acknowledgement section for details). The Working Group leaders were offered a small grant to support the delivery.

The initial idea was that the CoP members would be involved in the co-creation process from Step 2 to Step 3 for a period of 6 months, and get involved again at a later stage in the validation process (Step 6). In the meantime, the JRC staff with a small number of experts would work on more concrete formulations of the new statements which required the use of adequate action verbs, for example (Step 4). However, in

BOX 5. Participating organisations to the intl. outreach workshop in 2021

United Nations

- University Institute for the Advanced Study of Sustainability
- UN agency on Artificial Intelligence (AI)
- UNICEF AI for Children project

World Bank

- EdTech team
- Digital Economy for Africa

UNESCO

- Media and Information literacy Unit
- Technology and Artificial Intelligence in Education unit;

Academia

- Université Paris-Sorbonne nouvelle
- London School of Economics
- University College London

European Union Agencies

- Education and Training Foundation (ETF)
- European Union Intellectual Property Office (EUIPO)

European Commission

- Directorate General for Education, Youth, Sport and Culture
- Directorate General for Employment, Social Affairs & Inclusion
- Joint Research Centre

reality, the WGs advanced and delivered at different times, and some WG members remained engaged through Step 4 concretely working on creating and revising the statements over summer 2021.

An important part of Step 4 was also to "stress test" the adequacy of the current conceptual reference model (i.e. 21 competences and 5 areas). The idea was to better understand whether the results from Step 3 (i.e. the new requirements) would still fit into the existing conceptual reference model or whether the model should be modified (e.g. add new competences or areas, merge or delete some)? As the DigComp 2.2 update only focused on elaborating the new KSA examples, changing the conceptual model as such was outside the scope (to know more about how versioning of the DigComp framework and its numbering scheme, see p. 68). However, this process gave good information on which parts modifications might be needed in the future updates.

The DigComp framework having achieved international recognition (e.g. publications by UNESCO, UNICEF, the World Bank, see **SECTION 4.1**), and its complementarity to UNESCO's Media and Information Literacy framework, it was important **to engage other international organisations in the co-creation process** (Step 5). In September 22 2021, an international outreach workshop was organised with actors from other international institutions and academia (see **BOX 5**). The aim was to discuss the scope of the DigComp 2.2 exercise:

- Do the new DigComp 2.2 statements cover themes and topics that your organisation also highlights and prioritises?
- Are these new themes and topics arising as strategical also at the global levels?
- How can DigComp 2.2 contribute to further the global agenda of citizens' digital skills challenge?

The public online validation of the new KSA examples (Step 6) was run for a period of 6 weeks from November 9 to December 22 2021 using an online tool called EU Survey. Overall, 373 examples were included in the public validation (**FIG. 9**). The survey questions focused on the relevance of the examples for the DigComp frame-

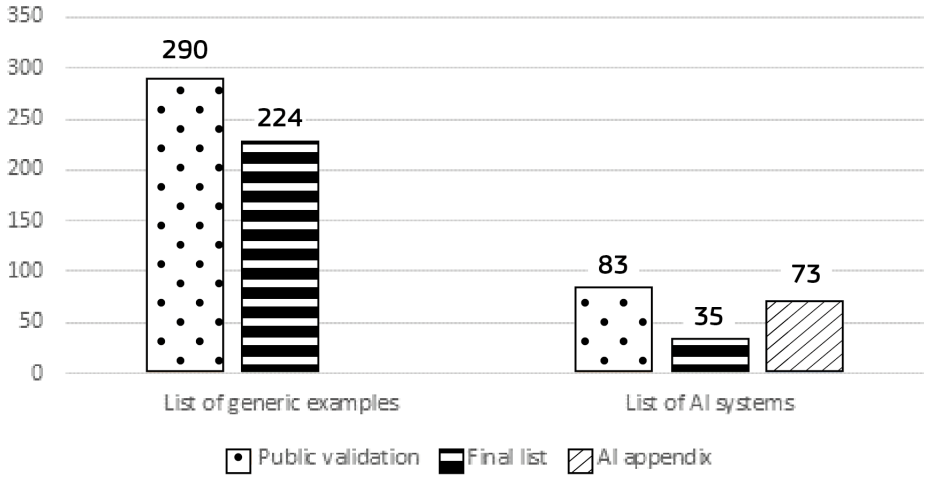


FIG.9 Selection of DigComp 2.2 examples

work and on their clarity. Each of the 21 DigComp competence had its own survey with about 20 KSA examples. Additionally, there were thematic surveys for Citizens interacting with AI systems (4 parts) and one for Telework.

A total of 447 replies were received with the minimum threshold being set to 15 replies/competence (**TABLE 7**). Most replies came from representatives of an organisation (231), the rest from individual experts (170) and others including students (46). In terms of organisations, most responses came from those working in Education and Training organisations (25%) followed by those in Governmental organisations (17%) and others (17%). Furthermore, academics were represented by 14%, and 10% of responses came from those working in international organisations and another 10% came from training providers (figures are rounded up). 8% did not wish to identify their organisation.

In general, the survey question on relevance was intended to help rank examples based on public opinion (this was not a binding vote), whereas the question on clarity helped revise examples, their syntax and terms used. During the process, the ranking of examples based on their relevance was used as a guide to select the "final list", however, in some cases, own editorial judgements were made. In general, the public validation helped filter out about 30% of examples which were eventually discarded (**FIG. 9**). A special case was applied to the list of examples on citizens interacting with AI systems. It was decided that most of them would be included in the separate appendix in order to share more examples on this new topic.

Last, an editorial note to say that there were no hard guidelines for the final number of examples per competence. In general, during the process the aim had been set at around 15-20. Additionally, the split between Knowledge, Skills and Attitudes could vary, as some competences were more "knowledge heavy" whereas others are more skills, etc.

T.7 Public online validation: respondents' profile

NUMBER OF REPLIES	BY WHOM?
231	Representatives of an organisation
170	Individual experts
42	Other
4	Students
447	**Total of validation replies**
25%	Education and Training Institution
17%	Governmental organisation
17%	Other
14%	Academia
10%	International organisation
8%	No Answer
5%	Commercial training provider
5%	Non-commercial training provider

A2. CITIZENS INTERACTING WITH AI SYSTEMS

Main authors: Riina Vuorikari, Wayne Holmes

Today, for citizens to engage confidently, critically and safely with new and emerging technologies, including systems driven by artificial intelligence (AI), they need to acquire a basic understanding of such tools and technologies (DEAP2).

Greater awareness will also lead to improved sensibility towards potential issues related to data protection and privacy, ethics, children's rights and bias – including accessibility, gender bias and disabilities. The DigComp 2.2 update addresses the topic of citizens interacting with AI systems rather than focusing on the knowledge about Artificial Intelligence per se (see Box 6).

The co-creation process of the 2.2 update resulted in a list of more than 80 examples of knowledge, skills and attitudes related to citizens interacting with AI systems (see more about the process in **FIG.9**). 35 are included in Dimension 4 so that each DigComp competence area has a number of examples that illustrate various aspects to pay attention to when citizens interact with AI systems. The selection was guided by the feedback collected through public validation.

Additionally, a separate appendix on this new topic was created. It covers all 73 examples which have been revised according to comments received through the public validation. In this appendix, the examples are thematically grouped so as to facilitate the reading. After each example, the corresponding number to the competence is given. This can help curriculum developers and trainers to get inspired when updating their content regarding new and emerging technologies. The list of examples below should not be considered as a ready curriculum to teach about AI as such. Whereas these examples cover competences outlined in the DigComp conceptual reference model, they leave out some themes and topics that might be considered rudimentary when providing a curriculum outline or a training syllabus about AI and emerging technologies (e.g. what is AI, history of AI, different types of AI).

A. What do AI systems do and what do they not do?
B. How do AI systems work?
C. When interacting with AI systems
D. The challenges and ethics of AI
E. Attitudes regarding human agency and control

A **little red dot** identifies the examples **included in DigComp2.2**

BOX 6. Requirements for citizens interacting with AI systems

As part of the update process focusing on citizens interacting with AI systems, the requirements gathering captured the following:

KNOWLEDGE

- To be aware of what AI systems do and what they do not do
- To understand the benefits, limitations and challenges of AI systems

SKILLS

- To use, interact and give feedback to AI systems as an end-user
- To configure, supervise and adapt AI systems (e.g. overwrite, tweak)

ATTITUDES

- Human agency and control
- Critical yet open attitude
- Ethical considerations of usage

A. WHAT DO AI SYSTEMS DO AND WHAT DO THEY NOT DO?

To engage confidently, critically and safely with AI systems, examples include that a citizen...

AI 01. ● Knows how to identify areas where AI can bring benefits to various aspects of everyday life. For example, in healthcare, AI might contribute to early diagnosis, while in agriculture, it might be used to detect pest infestations. (**2.3**)

AI 02. Able to identify some examples of AI systems: product recommenders (e.g. on online shopping sites), voice recognition (e.g. by virtual assistants), image recognition (e.g. for detecting tumours in x-rays) and facial recognition (e.g. in surveillance systems). (**5.2**)

AI 03. ● Aware that search engines, social media and content platforms often use AI algorithms to generate responses that are adapted to the individual user (e.g. users continue to see similar results or content). This is often referred to as "personalisation". (**1.1**)

AI 04. ● Aware that AI systems collect and process multiple types of user data (e.g. personal data, behavioural data and contextual data) to create user profiles which are then used, for example, to predict what the user might want to see or do next (e.g. offer advertisements, recommendations, services). (**2.6**)

AI 05. ● Aware that AI systems can be used to automatically create digital content (e.g. texts, news, essays, tweets, music, images) using existing digital content as its source. Such content may be difficult to distinguish from human creations. (**3.1**)

AI 06. Aware that in the news media and journalism, for example, AI can be used to author and produce news stories, and also distribute stories based on users' online behaviour. (**3.1**)

AI 07. Aware that AI systems can help the user to edit and process digital content (e.g. some photo editing software uses AI to automatically age a face, while some text applications use AI to suggest words, sentences and paragraphs). (**3.2**).

AI 08. Aware that some AI systems aim to provide human-like interaction with machines (e.g. conversational agents such as customer service chatbots). (**2.1**)

AI 09. Aware that some AI systems can detect users' moods, sentiments and emotions automatically from one's online content and context (e.g. content posted on social media), but this application is not always accurate and can be controversial. (**2.5**)

AI 10. Aware that some AI systems have been designed to support teaching and training humans (e.g. to carry out tasks and assignments in education, at work or doing sports). (**5.4**).

AI 11. Aware that digital tools (including AI-driven ones) can contribute to energy efficiency (e.g. through monitoring the need for heating at home and optimising its management). (**4.3**)

AI 12. Aware that AI is involved in many other technologies (e.g. the Internet of Things (IoT), blockchain, virtual reality). (**5.2**)

AI 13. Aware that many AI systems require a combination of AI techniques to function in real-world scenarios (e.g. a virtual agent might use natural language processing to process instructions and reasoning in uncertainty to make recommendations). (**5.2**)

AI 14. Aware that AI is not involved in all digital technologies (e.g. in GPS systems, AI is not used to determine the location, but it can be used to calculate a route). (**5.2**)

B. HOW DO AI SYSTEMS WORK?

AI 15. Aware that search results, social media activity streams and content recommendations are often ranked using AI algorithms (software rules followed by computers) and models (simplified representations of the real world). (**1.1**)

AI 16. Aware that AI systems use statistics and algorithms to process (analyse) data and generate outcomes (e.g. predict what video the user might like to watch). (**1.3**)

AI 17. ● Aware that sensors used in many digital technologies and applications

(e.g. facial tracking cameras, virtual assistants, wearable technologies, mobile phones, smart devices) automatically generate large amounts of data, including personal data, that can be used to train an AI system. (**1.3**)

AI 18. Aware that AI systems can use personal tracking identifiers related to one's digital identity to combine multiple sources of data (e.g. mobile devices, wearable technology, IoT devices, digital environments). For example, by drawing on mobile phone positioning data and a user profile, a display could offer adaptable advertisement to a person standing in front of it. (**2.6**)

What is AI?

Aware that "AI refers to machine-based systems that can, given a set of human-defined objectives, make predictions, recommendations, or decisions that influence real or virtual environments. AI systems interact with us and act on our environment, either directly or indirectly. Often, they appear to operate autonomously, and can adapt their behaviour by learning about the context." (UNICEF, 2021)

AI 19. ● Aware that AI is a product of human intelligence and decision-making (i.e. humans choose, clean and encode the data, they design the algorithms, train the models, and curate and apply human values to the outputs) and therefore does not exist independently of humans. (**5.1**)

AI 20. Aware that what is usually meant by AI today is Machine Learning, which is only one type of AI. What distinguishes Machine Learning from other types of AI (e.g. rule-based AI and Bayesian networks) is that it requires huge amounts of data. (**5.1**)

AI 21. Aware that some AI algorithms and models are created by human engineers, while other AI algorithms and models are automatically created by AI systems (e.g. huge amounts of data are used to 'train' the AI). (**3.4**)

AI 22. Aware that, while we often think of AI in human or physical terms, such as humanoid robots, most AI is software and so is unseen by users. (**5.4**)

AI 23. ● Aware that AI is a constantly-evolving field, whose development and impact is still very unclear. (**5.4**)

AI 24. Aware that there are many myths and exaggerated claims about AI, and that it is important to dig beneath the headlines to achieve a better understanding. (**5.4**)

AI 25. ● Knows that AI per se is neither good nor bad. What determines whether the outcomes of an AI system are positive or negative for society are how the AI system is designed and used, by whom and for what purposes. (**2.3**)

AI 26. Aware that what AI systems can do easily (e.g. identify patterns in huge amounts of data), humans are not able to do; while many things that humans can do easily (e.g. understand, decide what to do, and apply human values), AI systems are not able to do. (**5.2**)

AI 27. Recognises that AI tools designed to create images, writing and music depend on humans (e.g. to set the original parameters and select the outcomes), while humans can use AI tools to enhance their creativity. (**5.3**)

AI 28. Aware that while most AI systems process data centrally (or 'in the cloud'), some distribute the processing across several devices ('distributed AI'), while others process the data on the device (e.g. a mobile phone) itself ('edge AI'). (**1.3**)

C. WHEN INTERACTING WITH AI SYSTEMS

Looking for information

AI 29. ● Knows how to formulate search queries to achieve the desired output when interacting with conversational agents or smart speakers (e.g. Siri, Alexa, Cortana, Google Assistant), e.g. recognising that, for the system to be able to respond as required, the query must be unambiguous and spoken clearly so that the system can respond. (**1.1**)

AI 30. ● Able to recognise that some AI algorithms may reinforce existing views in digital environments by creating "echo chambers" or "filter bubbles" (e.g. if a social media stream favours a particular political ideology, additional recommendations can reinforce that ideology without exposing it to opposing arguments). (**1.2**)

AI 31. ● Weighs the benefits and disadvantages of using AI-driven search engines (e.g. while they might help users find the desired information, they may

compromise privacy and personal data, or subject the user to commercial interests). (**1.1**)

Using AI systems and Apps

AI 32. ● Open to AI systems supporting humans to make informed decisions in accordance with their goals (e.g. users actively deciding whether to act upon a recommendation or not). (**2.1**)

AI 33. ● Able to interact and give feedback to the AI system (e.g. by giving user ratings, likes, tags to online content) to influence what it next recommends (e.g. to get more recommendations on similar movies that the user previously liked. (**2.1**)

AI 34. Knows that sometimes not reacting to the content that an AI system proposes (e.g. on an activity stream) can also be taken as a signal by the system (e.g. an indication that the user is not interested in that particular content). (**2.1**)

AI 35. ● Knows how to modify user configurations (e.g. in apps, software, digital platforms) to enable, prevent or moderate the AI system tracking, collecting or analysing data (e.g. not allowing the mobile phone to track the user's location). (**2.6**)

AI 36. ● Knows how and when to use machine translation solutions (e.g. Google Translate, DeepL) and simultaneous interpretation apps (e.g. iTranslate) to get a rough understanding of a document or conversation. However, also knows that when the content requires an accurate translation (e.g. in healthcare, commerce or diplomacy), a more precise translation may be needed. (**5.2**)

AI 37. ● Aware that AI-driven speech-based technology enables the use of spoken commands that can enhance the accessibility of digital tools and devices (e.g. for those with mobility or visual limitations, limited cognition, language or learning difficulties), however, languages spoken by smaller populations are often not available, or perform worse, due to commercial prioritisation. (**5.2**)

AI 38. ● Knows how to incorporate AI edited/manipulated digital content in one's own work (e.g. incorporate AI generated melodies in one's own musical composition). This use of AI can be controversial as it raises questions about the role of AI in artworks, and for example, who should be credited. (**3.2**)

Focusing on privacy and personal data

AI 39. ● Knows that the processing of personal data is subject to local regulations such as the EU's General Data Protection Regulation (GDPR) (e.g. . voice interactions with a virtual assistant are personal data in terms of the GDPR and can expose users to certain data protection, privacy and security risks. (**4.2**)

AI 40. ● Weighs the benefits and risks of using biometric identification techniques (e.g. fingerprint, face images) as they can affect safety in unintended ways. If biometric information is leaked or hacked, it becomes compromised and can lead to identity fraud. (**4.1**)

AI 41. Aware that AI systems that rely on users' personal data (e.g. voice assistants, chatbots) might collect and process that data more than is necessary. This would be considered 'disproportionate' and so would violate the principle of proportionality specified by GDPR. (**4.2**)

AI 42. Weighs the benefits and risks before activating a virtual assistant (e.g. Siri, Alexa, Cortana, Google assistant) or AI-driven Internet of Things (IoT) devices as they may expose personal daily routines and private conversations. (**2.6**)

AI 43. ● Weighs the benefits and risks before allowing third parties to process personal data (e.g. recognises that a voice assistant on a smartphone, that is used to give commands to a robot vacuum cleaner, could give third parties - companies, governments, cybercriminals - access to the data). (**4.2**)

AI 44. ● Identifies both the positive and negative implications of the use of all data (collection, encoding and processing), but especially personal data, by AI-driven digital technologies such as apps and online services. (**2.6**)

AI 45. ● Aware that everything that one shares publicly online (e.g. images, videos, sounds) can be used to train AI systems. For example, commercial software companies who develop AI facial recognition systems can use personal images shared online (e.g. family photographs) to train and improve the software's capability to automatically recognise those persons in other images, which might not be desirable (e.g. might be a breach of privacy). (**2.2**)

AI 46. Aware that an AI system can link different pieces of apparently anonymous information together, which can lead to de-anonymisation (i.e. the identification of a particular person). (**2.6**)

AI 47. Can help mitigate the risks of personal data breaches by expressing concerns to relevant authorities relating to the usage of AI systems that collect data, especially if there is a suspicion that there is a violation of the GDPR or when the company does not make the information available. (**4.2**)

D. THE CHALLENGES AND ETHICS OF AI

Challenges

AI 48. ● Aware that AI algorithms might not be configured to provide only the information that the user wants; they might also embody a commercial or political message (e.g. to encourage users to stay on the site, to watch or buy something particular, to share specific opinions). This can also have negative consequences (e.g. reproducing stereotypes, sharing misinformation). (**1.2**)

AI 49. ● Aware that the data, on which AI depends, may include biases. If so, these biases can become automated and worsened by the use of AI. For example, search results about occupation may include stereotypes about male or female jobs (e.g. male bus drivers, female sales persons). (**1.2**)

AI 50. ● Aware that AI algorithms work in ways that are usually not visible or easily understood by users. This is often referred to as "black box" decision-making as it may be impossible to trace back how and why an algorithm makes specific suggestions or predictions. (**1.1**)

AI 51. ● Knows that the term "deep-fakes" refers to AI-generated images, videos or audio recordings of events or persons that did not really happen (e.g. speeches by politicians, celebrity faces on pornographic imagery). They may be impossible to distinguish from the real thing. (**1.2**)

AI 52. Aware that so-called "personalised" results (e.g. from search engines, social media, content platforms) are based on patterns and averages of interactions of millions of users. In other words, the AI system might predict group behaviour but not the behaviour of any one person, therefore the term personalised might be misleading. (**1.2**)

AI 53. Aware that the EU is striving to ensure that AI systems are trustworthy. However, not all AI systems are trustworthy and not all AI systems developed in the world are regulated by the EU law (**4.1**).

AI 54. Aware that the question of ownership of personal data in AI systems can be controversial (e.g. the data created by people using social media or students using AI systems in classrooms). The business models of many AI commercial organisations depend on them being able to collate and analyse that data. Others have argued that personal data belongs instead to the person who created it (like any other copyrighted materials such as texts, images or music). (**3.3**)

AI 55. Aware that AI systems are typically developed in English-speaking contexts which means that they might work less accurately in non-English contexts. For example, AI-based automatic translation systems work better with often used languages (e.g. English to Spanish) than less used ones (e.g. Slovenian to Finnish). (**2.5**)

AI 56. Aware that AI systems are typically developed by those from narrow demographic backgrounds (e.g. white males from higher-socio economic groups in higher-income countries) which can mean that the systems they develop are less sensitive to the needs of women, people from different ethnic minority groups, lower socio-economic groups, people who require digital accessibility (e.g. with disabilities, functional limitations), or citizens from lower-income countries. (**2.5**)

Ethics

AI 57. ● Considers the ethical consequences of AI systems throughout their life-cycle: they include both the environmental impact (environmental consequences of the production of digital devices and services) and societal impact (e.g. platformisation of work and algorithmic management that may repress workers' privacy or rights; the use of low-cost labour for labelling images to train AI systems). (**4.4**)

AI 58. ● Readiness to contemplate ethical questions related to AI systems (e.g. in which contexts, such as sentencing criminals, should AI recommendations not be used without human intervention?) (**2.3**)

AI 59. ● Aware that certain activities (e.g. training AI and producing cryptocurrencies like Bitcoin) are resource intensive processes in terms of data and computing power. Therefore, energy consumption can be high which can also have a high environmental impact. (**4.4**)

AI 60. Aware that AI-based technologies can be used to replace some human functions (e.g. customer service), which might lead to some job losses or reallocations, but that new jobs might be created to address new needs. (**2.4**)

AI 61. ● Considers ethics (including but not limited to human agency and oversight, transparency, non-discrimination, accessibility, and biases and fairness) as one of the core pillars when developing or deploying AI systems. (**3.4**)

E. ATTITUDES REGARDING HUMAN AGENCY AND CONTROL

AI 62. ● Open to AI systems supporting humans to make informed decisions in accordance with their goals (e.g. users actively deciding whether to act upon a recommendation or not). (**2.1**)

AI 63. ● Recognises that while the application of AI systems in many domains is usually uncontroversial (e.g. AI that helps avert climate change), AI that directly interacts with humans and takes decisions about their life can often be controversial (e.g. CV-sorting software for recruitment procedures, scoring of exams that may determine access to education). (**2.3**)

AI 64. ● Knows that all EU citizens have the right to not be subject to fully automated decision-making (e.g. if an automatic system refuses a credit application, the customer has the right to ask for the decision to be reviewed by a person). See here (**2.3**)

AI 65. Weighs the benefits of adopting the use of AI systems to improve the quality of human interaction in communication (e.g. use AI-generated replies to emails might risk dehumanising interactions). (**2.4**)

AI 66. Willing to collaborate with AI projects for social good in order to create value for others (e.g. by sharing data so long as appropriate and robust controls are in place). (**2.2**)

AI 67. Open to contribute to the improvement of AI systems by reporting errors, risks, biases or misconceptions in data or outputs (e.g. image recognition software being trained only on images of people belonging to certain groups). (**1.3**)

AI 68. ● Open to engage in collaborative processes to co-design and co-create new products and services based on AI systems to support and enhance citizens' participation in society. (**5.3**)

AI 69. Willing to take part in citizen-led collective actions (e.g. through civic participation channels, opinion campaigns, voting, activism and advocacy) to initiate changes in AI services and products (e.g. business models, developments). (**5.3**)

AI 70. Aware that sometimes the best way to control an AI system (e.g. to protect oneself and others), is to not interact with it or to turn it off. (**5.1**)

AI 71. Interested in experimenting with various types of AI systems depending on one's own personal needs (e.g. virtual assistant, image analysis software, speech and face recognition systems, autonomous cars, "embodied" AI such as robots). (**5.2**)

AI 72. ● Has a disposition to keep learning, to educate oneself and stay informed about AI (e.g to understand how AI algorithms work; to understand how automatic decision-making can be biased; to distinguish between realistic and unrealistic AI; and to understand the difference between Artificial Narrow Intelligence, i.e. today's AI capable of narrow tasks such as game playing, and Artificial General Intelligence, i.e. AI that surpasses human intelligence, which still remains science fiction). (**5.4**)

AI 73. Open and curious towards today's emerging technologies and applications (e.g. reads reviews about Virtual Reality, gaming, AI) and intentionally discusses about their use with other people. (**5.4**)

A3. REMOTE WORKING EXAMPLES

RW 01. ● Able to achieve effective communication in asynchronous (non-simultaneous) mode using digital tools (e.g. for reporting and briefing, sharing ideas, giving feedback and advice, scheduling meetings, communicating milestones). (**2.1**)

RW 02. ● Knows how to use digital tools for informal communication with colleagues in order to develop and maintain social relations (e.g. to reproduce conversations such as those during face-to-face coffee breaks). (**2.1**)

RW 03. ● Knows how to share and show information from one's own device (e.g. show graphs from a laptop) to support a message being conveyed during a real time online session (e.g. video conference). (**2.2**)

RW 04. ● Knows how to use digital tools and technologies in a remote working context for idea generation and co-creation of digital content (e.g. shared mind maps and whiteboards, polling tools). (**2.4**)

RW 05. Can use digital tools for project management to plan, share tasks, resources and responsibilities, coordinate activities, and monitor progress in a collaborative remote working context, e.g. digital calendar, time reporting, workflow management tools. (**2.4**)

RW 06. Observant about applying the corporate policies on data management and security, device and privacy protection, etc., also when in remote and mobile working contexts. (**4.1**)

RW 07. Proactive in keeping clear boundaries between work and private life, and in minimising risks related to remote working, e.g. practices good health habits - exercise, pauses - to avoid technology addiction, sedentary behaviour, prolonged isolation and bad eating habits. (**4.3**)

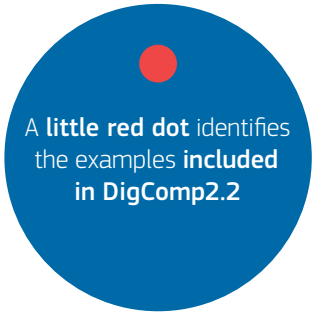
RW 08. Understands that remote online occupation (work or study) has benefits (e.g. flexibility, location-independence, reduced commuting time) and risks, e.g. lack of in person social contact, loss of clear boundaries between work and leisure. (**4.3**)

RW 09. Knows how to create a healthy and ergonomic space for remote work or study, e.g. quiet environment, correct position of chair, table, keyboard, mouse, monitor(s) and light, breaks and leisure time. (**4.3**)

RW 10. Able to use digital tools to manage working time in a remote working context, e.g. using personal productivity methods and tools; organising effectively work-related activities avoiding interruptions and multi-tasking; establishing and managing distinct time slots for personal rest and personal activities. (**5.2**)

RW 11. Considers the importance of good practices and digital tools in self-management and organisation of tasks in less structured and less controlled remote working contexts, e.g. multi-device calendars and task managers. (**5.2**)

RW 12. Able to identify and assess individual and team members' skills gaps for remote working, and to provide suitable training methods and mentoring mechanisms to meet them. (**5.4**)



A4. ACCESSIBLE VERSION OF THE FRAMEWORK

Creating accessible digital resources is an important priority today and a goal that everyone can contribute to. In the following pages a fully accessible version of the DigComp 2.2 framework is made available. The DigComp 2.2 Working Group on Accessibility, led by Prof Luis Fernández-Sanz (Universidad de Alcalá), worked relentlessly to help the DigComp community not only gain full awareness of this challenge, but also put it into practice.

How to read it?

The DigComp framework is composed of 5 dimensions:

- **Dimension 1** outlines the competence areas of which the digital competence is composed.They have a single-numbered title.
- **Dimension 2** details the titles of each competence and their descriptors, and have a two-numbered title, eg 1.2.
- **Dimension 3** is used to describe the proficiency levels of each competence .
- **Dimension 4 and 5** describe various examples related to Dimension 2. They are provided to add value and context and thus, they are not intended to be exhaustive.
- **In Dimension 4**, the examples relating to Artificial intelligence, Remote Working and Digital Accessibility examples are indicated with (**AI**), (**RW**), (**DA**) at the end of the example.
- **Dimension 5** provides use cases in the context of learning and education. Dimension 5 uses a “cascade” strategy: competence 1.2 has an example for level 1, competence 1.3 for level 2, competence 2.1 for level 3, etc.

DIMENSION 1: COMPETENCE AREA

1. INFORMATION AND DATA LITERACY

DIMENSION 2: COMPETENCE

1.1: BROWSING, SEARCHING AND FILTERING DATA, INFORMATION AND DIGITAL CONTENT

To articulate information needs , to search for data, information and content in digital environments, to access them and to navigate between them. To create and update personal search strategies.

DIMENSION 3: PROFICIENCY LEVEL

Foundation level 1

At basic level and with guidance, I can:

- **identify** my information needs, find data, information and content through a **simple** search in digital environments,
- **find** how to access these data, information and content and navigate between them,
- **identify simple** personal search strategies.

Foundation level 2

At basic level and with autonomy and appropriate guidance where needed, I can:

- **identify** my information needs,
- **find** data, information and content through a **simple** search in digital environments,
- **find** how to access these data, information and content and navigate between them.
- **identify simple** personal search strategies.

Intermediate level 3

On my own and solving straightforward problems, I can:

- **explain** my information needs,
- **perform well-defined and routine** searches to find data, information and content in digital environments,
- **explain** how to access them and navigate between them,
- **explain well-defined and routine** personal search strategies.

Intermediate level 4

Independently, according to my own needs, and solving well-defined and non-routine problems, I can:

- **illustrate** information needs,
- **organise** the searches of data, information and content in digital environments,
- **describe** how to access these data, information and content, and navigate between them,
- **organise** personal search strategies.

Advanced level 5

As well as guiding others, I can:

- **respond** to information needs,
- **apply** searches to obtain data, information and content in digital environments,
- **show** how to access these data, information and content and navigate between them.
- **propose** personal search strategies.

Advanced level 6

At advanced level, according to my own needs and those of others, and in complex contexts, I can:

- **assess** information needs,
- **adapt** my searching strategy to find the **most appropriate** data, information and content in digital environments,
- **explain** how to access these **most appropriate** data, information and content and navigate among them,
- **vary** personal search strategies.

Highly Specialised level 7

At highly specialised level, I can:

- **create solutions to complex problems with limited definition** that are related to browsing, searching and filtering of data, information and digital content,
- **integrate** my knowledge **to contribute to professional practice and knowledge and guide others** in browsing, searching and filtering data, information and digital content.

Highly Specialised level 8

At the most advanced and specialised level, I can

- **create solutions to solve complex problems with many interacting factors** that are related to browsing, searching and filtering data, information and digital content.
- **propose new** ideas and processes to the field.

DIMENSION 4: EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES

Knowledge

1. Knows that some online content in search result may not be open access or freely available and may require a fee or signing up for a service in order to access it.
2. Aware that online content that is available to users at no monetary cost is often paid for by advertising or by selling the user's data.
3. Aware that search results, social media activity streams and content recommendations on the internet are influenced by a range of factors. These factors include the search terms used, the context (e.g. geographical location), the device (e.g. laptop or mobile phone), local regulations (which sometimes dictate what can or cannot be shown), the behaviour of other users (e.g. trending searches or recommendations) and the user's past online behaviour across the internet.
4. Aware that search engines, social media and content platforms often use AI algorithms to generate responses that are adapted to the individual user (e.g. users continue to see similar results or content). This is often referred to as "personalisation". (**AI**)
5. Aware that AI algorithms work in ways that are usually not visible or easily understood by users. This is often referred to as "black box" decision-making as it may be impossible to trace back how and why an algorithm makes specific suggestions or predictions. (**AI**)

Skills

6. Can choose the search engine that most likely meets one's information needs as different search engines can provide different results even for the same query.
7. Knows how to improve search results by using a search engine's advanced features (e.g. specifying exact phrase, language, region, date last updated).
8. Knows how to formulate search queries to achieve the desired output when interacting with conversational agents or smart speakers (e.g. Siri, Alexa, Cortana, Google Assistant), e.g. recognising that, for the system to be able to respond as required, the query must be unambiguous and spoken clearly so that the system can respond..(**AI**)
9. Can make use of information presented as hyperlinks, in non-textual form (e.g. flowcharts, knowledge maps) and in dynamic representations (e.g. data).
10. Develops effective search methods for personal purposes (e.g. to browse a list of most popular films) and professional purposes (e.g. to find appropriate job advertisements).
11. Knows how to handle information overload and "infodemic" (i.e. increase of false or misleading information during a disease outbreak) by adapting personal search methods and strategies.

Attitudes

12. Intentionally avoids distractions and aims to avoid information overload when accessing and navigating information, data and content.
13. Values tools designed to protect search privacy and other rights of users (e.g. browsers such as DuckDuckGo).
14. Weighs the benefits and disadvantages of using AI-driven search engines (e.g. while they might help users find the desired information, they may compromise privacy and personal data, or subject the user to commercial interests). (**AI**)
15. Concerned that much online information and content may not be accessible to people with a disability, for example to users who rely on screen reader technologies to read aloud the content of a web page (**DA**).

DIMENSION 5: USE CASES

Employment Scenario: Job seeking process

Foundation level 1: with help from an employment adviser

- I can identify, from a list, those job portals which can help me look for a job.
- I can also find these job portals in my smartphone's app store, and access and navigate between them.
- From a list of generic keywords for job seeking available in a blog on job hunting, I can also identify the keywords that are useful for me.

Learning Scenario: Prepare a short report on a specific topic

Foundation level 1: with help from my teacher

- I can identify websites, blogs and digital databases from a list in my digital textbook to look for literature on the report topic.
- I can also identify literature on the report topic in these websites, blogs and digital databases, and access and navigate among them.
- Using a list of generic keywords and tags available in my digital textbook, I can also identify those which would be useful for finding literature on the report topic.

DIMENSION 1: COMPETENCE AREA

1. INFORMATION AND DATA LITERACY

DIMENSION 2: COMPETENCE

1.2: EVALUATING DATA, INFORMATION AND DIGITAL CONTENT

To analyse, compare and critically evaluate the credibility and reliability of sources of data, information and digital content. To analyse, interpret and critically evaluate the data, information and digital content.

DIMENSION 3: PROFICIENCY LEVEL

Foundation level 1

At basic level and with guidance, I can:

- **detect** the credibility and reliability of common sources of data, information and their digital content.

Foundation level 2

At basic level and with autonomy and appropriate guidance where needed, I can:

- **detect** the credibility and reliability of common sources of data, information and their digital content.

Intermediate level 3

On my own and solving straightforward problems, I can:

- **perform** the analysis, comparison and evaluation of the credibility and reliability of **well-defined** sources of data, information and digital content.
- **perform** the analysis, interpretation and evaluation of **well-defined** data, information and digital content

Intermediate level 4

Independently, according to my own needs, and solving well-defined and non-routine problems, I can:

- **perform** the analysis, comparison and evaluation of sources of data, information and digital content.
- **perform** the analysis, interpretation and evaluation of data, information and digital content.

Advanced level 5

As well as guiding others, I can:

- **carry out** an evaluation of the credibility and reliability of **different** sources of data, information and digital content.
- **carry out** an evaluation of **different** data, information and digital content.

Advanced level 6

At advanced level, according to my own needs and those of others, and in complex contexts, I can:

- critically **assess** the credibility and reliability of sources of data, information and digital content.
- critically **assess** data, information and digital content.

Highly Specialised level 7

At highly specialised level, I can:

- **create solutions to complex problems with limited definition** that are related to analysing and evaluating credible and reliable sources of data, information and content in digital environments.
- **integrate** my knowledge **to contribute to professional practices and knowledge** and to **guide others** in the analysis and evaluation of the credibility and reliability of data, information and digital content and their sources.

Highly Specialised level 8

At the most advanced and specialised level, I can:

- **create solutions to solve complex problems with many interacting factors** that are related to analysing and evaluating credible and reliable sources of data, information and content in digital environments.
- **propose new** ideas and processes to the field.

DIMENSION 4: EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES

Knowledge

16. Aware that online environments contain all types of information and content including misinformation and disinformation, and even if a topic is widely reported it does not necessarily mean it is accurate.
17. Understands the difference between disinformation (false information with the intent to deceive people) and misinformation (false information regardless of intent to deceive or mislead people).
18. Knows the importance of identifying who is behind information found on the internet (e.g. on social media) and verifying it by checking multiple sources, to help recognise and understand point of view or bias behind particular information and data sources.
19. Aware of potential information biases caused by various factors (e.g. data, algorithms, editorial choices, censorship, one's own personal limitations).
20. Knows that the term "deep-fakes" refers to AI-generated images, videos or audio recordings of events or persons that did not really happen (e.g. speeches by politicians, celebrity faces on pornographic imagery). They may be impossible to distinguish from the real thing. (**AI**)
21. Aware that AI algorithms might not be configured to provide only the information that the user wants; they might also embody a commercial or political message (e.g. to encourage users to stay on the site, to watch or buy something particular, to share specific opinions). This can also have negative consequences (e.g. reproducing stereotypes, sharing misinformation). (**AI**)
22. Aware that the data, on which AI depends, may include biases. If so, these biases can become automated and worsened by the use of AI. For example, search results about occupation may include stereotypes about male or female jobs (e.g. male bus drivers, female sales persons). (**AI**)

Skills

23. Carefully considers the top/first search results in both text-based and audio searches, as they may reflect commercial and other interests rather than be the most appropriate results for the query.
24. Knows how to differentiate sponsored content from other content online (e.g. recognising advertisements and marketing messages on social media or search engines) even if it is not marked as sponsored.
25. Knows how to analyse and critically evaluate search results and social media activity streams, to identify their origins, to distinguish fact-reporting from opinion, and to determine whether outputs are truthful or have other limitations (e.g. economic, political, religious interests).
26. Knows how to find the author or the source of the information, to verify whether it is credible (e.g. an expert or authority in a relevant discipline).
27. Able to recognise that some AI algorithms may reinforce existing views in digital environments by creating "echo chambers" or "filter bubbles" (e.g. if a social media stream favours a particular political ideology, additional recommendations can reinforce that ideology without exposing it to opposing arguments). (**AI**)

Attitudes

28. Inclined to ask critical questions in order to evaluate the quality of online information, and concerned about purposes behind spreading and amplifying disinformation.
29. Willing to fact-check a piece of information and assess its accuracy, reliability and authority, while preferring primary sources over secondary sources of information where possible.
30. Carefully considers the possible outcome before clicking a link. Some links (e.g. compelling titles) could be "clickbait" that takes the user to sponsored or unwanted content (e.g. pornography).

DIMENSION 5: USE CASES

Employment Scenario: Job seeking process

Foundation level 1: with help from an employment adviser

- I can identify in a list of job portals and apps a friend has found in an employment office's blog, those that are commonly used because they have credible and reliable job offers.

Learning Scenario: Prepare a short report on a specific topic

Foundation level 1: with help from my teacher

- I can identify, from a list in my textbook of blogs and digital databases containing available literature, those that are commonly used because they are credible and reliable.

DIMENSION 1: COMPETENCE AREA

1. INFORMATION AND DATA LITERACY

DIMENSION 2: COMPETENCE

1.3: MANAGING DATA, INFORMATION AND DIGITAL CONTENT

To organise, store and retrieve data, information, and content in digital environments. To organise and process them in a structured environment.

DIMENSION 3: PROFICIENCY LEVEL

Foundation level 1

At basic level and with guidance, I can:

- **identify** how to organise, store and retrieve data, information and content in a **simple way** in digital environments.
- **recognise** where to organise them in a **simple way** in a structured environment.

Foundation level 2

At basic level and with autonomy and appropriate guidance where needed, I can:

- **identify** how to organise, store and retrieve data, information and content in a **simple way** in digital environments.
- **recognise** where to organise them in a **simple way** in a structured environment.

Intermediate level 3

On my own and solving straightforward problems, I can:

- **select** data, information and content in order to organise, store and retrieve them in a **routine way** in digital environments.
- **organise** them in a **routine way** in a structured environment.

Intermediate level 4

Independently, according to my own needs, and solving well-defined and non-routine problems, I can:

- **organise** information, data and content to be easily stored and retrieved.
- **organise** information, data and content in a structured environment.

Advanced level 5

As well as guiding others, I can:

- **manipulate** information, data and content for their easier organisation, storage and retrieval.
- **carry out** their organisation and processing in a structured environment.

Advanced level 6

At advanced level, according to my own needs and those of others, and in complex contexts, I can:

- **adapt** the management of information, data and content for **the most appropriate** easy retrieval and storage.
- **adapt** them to be organised and processed in **the most appropriate** structured environment.

Highly Specialised level 7

At highly specialised level, I can:

- **create solutions to complex problems with limited definition** that are related to managing data, information, and content for their organisation, storage and retrieval in a structured digital environment.
- **integrate** my knowledge **to contribute to professional practices and knowledge and to guide others** in managing data, information and digital content in a structured digital environment.

Highly Specialised level 8

At the most advanced and specialised level, I can:

- **create solutions to solve complex problems with many interacting factors** that are related to managing data, information, and content for their organisation, storage and retrieval in a structured digital environment.
- **propose new** ideas and processes to the field.

DIMENSION 4: EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES

Knowledge

31. Aware that many applications on the internet and mobile phones collect and process data (personal data, behavioural data and contextual data) that the user can access or retrieve, for example, to monitor their activities online (e.g. clicks in social media, searches on Google) and offline (e.g. daily steps, bus rides on public transport).
32. Aware that for data (e.g. numbers, text, images, sounds) to be processed by a program, they have to be first properly digitised (i.e. digitally encoded).
33. Knows that data collected and processed, for example by online systems, can be used to recognise patterns (e.g. repetitions) in new data (i.e. other images, sounds, mouse clicks, online behaviours) to further optimise and personalise online services (e.g. advertisements).
34. Aware that sensors used in many digital technologies and applications (e.g. facial tracking cameras, virtual assistants, wearable technologies, mobile phones, smart devices) generate large amounts of data, including personal data, that can be used to train an AI system. (**AI**)
35. Knows that open data repositories exist where anyone can get data to support some problem solving activities (e.g. citizens can use open data to generate thematic maps or other digital content).

Skills

36. Knows how to collect digital data using basic tools such as online forms, and present them in an accessible way (e.g. using headers in tables).
37. Can apply basic statistical procedures to data in a structured environment (e.g. spreadsheet) to produce graphs and other visualisations (e.g. histograms, bar charts, pie charts).
38. Knows how to interact with dynamic data visualisation and can manipulate dynamic graphs of interest (e.g. as provided by Eurostat, government websites).
39. Can differentiate between different types of storage locations (local devices, local network, cloud) that are the most appropriate to use (e.g. data on the cloud is available anytime and from anywhere, but has implications for access time).
40. Can use data tools (e.g. databases, data mining, analysis software) designed to manage and organise complex information, to support decision-making and solving problems.

Attitudes

41. Considers transparency when manipulating and presenting data to ensure reliability, and spots data that are expressed with underlying motives (e.g. unethical, profit, manipulation) or in misleading ways.
42. Watchful of accuracy when evaluating sophisticated representations of data (e.g. tables or visualisations as they could be used to mislead one's judgement by trying to give a false sense of objectivity.

DIMENSION 5: USE CASES

Employment Scenario: Job seeking process

Foundation level 2: at home with my sister who I ask whenever I need

- I can identify how and where to organise and keep track of job ads in a job app (e.g. www.indeed.com) of my smartphone in order to retrieve them when I need them along my job seeking.

Learning Scenario: Prepare a short report on a specific topic

Foundation level 2: in the classroom with my teacher who I can consult whenever I need

- I can identify an app in my tablet to organise and store links to those websites, blogs and digital databases related with a specific topic of literature and use it to retrieve them when needed for my report.

DIMENSION 1: COMPETENCE AREA

2. COMMUNICATION AND COLLABORATION

DIMENSION 2: COMPETENCE

2.1: INTERACTING THROUGH DIGITAL TECHNOLOGIES

To interact through a variety of digital technologies and to understand appropriate digital communication means for a given context.

DIMENSION 3: PROFICIENCY LEVEL

Foundation level 1

At basic level and with guidance, I can:

- **select simple** digital technologies to interact, and
- **identify** appropriate **simple** communication means for a given context.

Foundation level 2

At basic level and with autonomy and appropriate guidance where needed, I can:

- **select simple** digital technologies to interact, and
- **identify** appropriate **simple** communication means for a given context.

Intermediate level 3

On my own and solving straightforward problems, I can:

- **perform well-defined and routine** interactions with digital technologies, and
- **select well-defined and routine** appropriate digital communication means for a given context.

Intermediate level 4

Independently, according to my own needs, and solving well-defined and non-routine problems, I can:

- **select** a variety of digital technologies to interact, and
- **select** a variety of appropriate digital communication means for a given context.

Advanced level 5

As well as guiding others, I can:

- **use** a variety of digital technologies in order to interact,
- **show** others **the most appropriate** digital communication means for a given context

Advanced level 6

At advanced level, according to my own needs and those of others, and in complex contexts, I can:

- **adapt** a variety of digital technologies for **the most appropriate** interaction, and
- **adapt the most appropriate** communication means for a given context.

Highly Specialised level 7

At highly specialised level, I can:

- **create solutions to complex problems with limited definition** that are related to interacting through digital technologies and digital communication means.
- **integrate** my knowledge **to contribute to professional practices and knowledge and to guide others** in the interaction through digital technologies.

Highly Specialised level 8

At the most advanced and specialised level, I can:

- **create solutions to solve complex problems with many interacting factors** that are related to interacting through digital technologies and digital communication means
- **propose new** ideas and processes to the field.

DIMENSION 4: EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES

Knowledge

43. Knows that many communication services (e.g. instant messaging) and social media are free of charge because they are partly paid for by advertising and monetising user data.
44. Aware that many communication services and digital environments (e.g. social media) use mechanisms such as nudging, gamification and manipulation to influence user behaviour.
45. Aware which communication tools and services (e.g. phone, email, video conference, social network, podcast) are appropriate in specific circumstances (e.g. synchronous, asynchronous), depending on the audience, context and purpose of the communication. Aware that some tools and services also provide an accessibility statement. (**DA**)
46. Aware of the need to formulate messages in digital environments so that they are easily understandable by the targeted audience or the recipient.

Skills

47. Knows how to use a variety of videoconferencing features (e.g. moderating a session, recording audio and video).
48. Able to achieve effective communication in asynchronous (non-simultaneous) mode using digital tools (e.g. for reporting and briefing, sharing ideas, giving feedback and advice, scheduling meetings, communicating milestones). (**RW**)
49. Knows how to use digital tools for informal communication with colleagues in order to develop and maintain social relations (e.g. to reproduce conversations such as those during face-to-face coffee breaks). (**RW**)
50. Knows how to identify signs that indicate whether one is communicating with a human or an AI-based conversational agent (e.g. when using text- or voice-based chatbots). (**AI**)
51. Able to interact and give feedback to the AI system (e.g. by giving user ratings, likes, tags to online content) to influence what it next recommends (e.g. to get more recommendations on similar movies that the user previously liked). (**AI**)
52. Considers the need to balance asynchronous and synchronous communication activities (e.g. to minimise video conferencing fatigue, to respect co-workers time and preferred working hours).

Attitudes

53. Willing to listen to others and to engage in online conversations with confidence, clarity and reciprocity, both in personal and social contexts.
54. Open to AI systems supporting humans to make informed decisions in accordance with their goals (e.g. users actively deciding whether to act upon a recommendation or not). (**AI**)
55. Willing to adapt an appropriate communication strategy depending on the situation and digital tool: verbal strategies (written, oral language), non-verbal strategies (body language, facial expressions, tone of voice), visuals strategies (signs, icons, illustrations) or mixed strategies.

DIMENSION 5: USE CASES

Employment Scenario: Organise an event

Intermediate level 3: by myself

- I can interact with participants and other colleagues using my corporate email account app on my smartphone in order to organise an event for my company.
- I can also select options available in my email suite to organise the event, such as sending calendar invitations.
- I can fix problems, e.g. an incorrect email address.

Learning Scenario: Prepare group work with my classmates

Intermediate level 3: by myself

- I can use a commonly-used chat on my smartphone (e.g. Facebook messenger or WhatsApp) to talk to my classmates and organise group work.
- I can choose other digital communication means on the classroom tablet (e.g. my classroom forum) that could be useful to talk about the details of organising group work.
- I can fix problems such as adding or deleting members to the chat group.

DIMENSION 1: COMPETENCE AREA

2. COMMUNICATION AND COLLABORATION

DIMENSION 2: COMPETENCE

2.2: SHARING THROUGH DIGITAL TECHNOLOGIES

To share data, information and digital content with others through appropriate digital technologies. To act as an intermediary, to know about referencing and attribution practices.

DIMENSION 3: PROFICIENCY LEVEL

Foundation level 1

At basic level and with guidance, I can:

- **recognise simple** appropriate digital technologies to share data, information and digital content.
- **identify simple** referencing and attribution practices.

Foundation level 2

At basic level and with autonomy and appropriate guidance where needed, I can:

- **recognise simple** appropriate digital technologies to share data, information and digital content.
- **identify simple** referencing and attribution practices.

Intermediate level 3

On my own and solving straightforward problems, I can:

- **select well-defined and routine** appropriate digital technologies to share data, information and digital content.
- **explain** how to act as an intermediary for sharing information and content through **well-defined** and **routine** digital technologies,
- **illustrate well-defined and routine** referencing and attribution practices.

Intermediate level 4

Independently, according to my own needs, and solving well-defined and non-routine problems, I can:

- **manipulate** appropriate digital technologies to share data, information and digital content.
- **explain** how to act as an intermediary for sharing information and content through digital technologies,
- **illustrate** referencing and attribution practices.

Advanced level 5

As well as guiding others, I can:

- **share** data, information and digital content through a **variety of** appropriate digital tools,
- **show** others how to act as an intermediary for sharing information and content through digital technologies.
- **apply a variety of** referencing and attribution practices.

Advanced level 6

At advanced level, according to my own needs and those of others, and in complex contexts, I can:

- **assess the most appropriate** digital technologies to share information and content.
- **adapt** my intermediation role,
- **vary** the use of the **more appropriate** referencing and attribution practices.

Highly Specialised level 7

At highly specialised level, I can:

- **create solutions to complex problems with limited definition** that are related to sharing through digital technologies.
- **integrate** my knowledge **to contribute to professional practices and knowledge and guide others** in sharing through digital technologies.

Highly Specialised level 8

At the most advanced and specialised level, I can:

- **create solutions to solve complex problems with many interacting factors** that are related to sharing through digital technologies.
- **propose new** ideas and processes to the field.

DIMENSION 4: EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES

Knowledge

56. Aware that everything that one shares publicly online (e.g. images, videos, sounds) can be used to train AI systems. For example, commercial software companies who develop AI facial recognition systems can use personal images shared online (e.g. family photographs) to train and improve the software's capability to automatically recognise those persons in other images, which might not be desirable (e.g. might be a breach of privacy). (**AI**)
57. Knows the role and responsibilities of the online facilitator to structure and guide a discussion group (e.g. how to act as an intermediary when sharing information and digital content in digital environments).

Skills

58. Knows how to share digital content (e.g. pictures) across multiple devices (e.g. from smartphones to cloud services).
59. Knows how to share and show information from one's own device (e.g. show graphs from a laptop) to support a message being conveyed during a real time online session (e.g. video conference). (**RW**)
60. Able to select and restrict with whom the content is shared (e.g. giving access only to friends on social media, allowing only co-workers to read and comment on a text).
61. Knows how to curate content on content sharing platforms so as to add value for oneself and others (e.g. shares music playlists, shares comments on online services).
62. Knows how to acknowledge the original source and authors of shared content.
63. Knows how to flag or report disinformation and misinformation to fact-checking organisations and to social media platforms in order to stop it spreading.

Attitudes

64. Willing to share expertise on the internet, for example through intervening in online forums, contributing to Wikipedia or through creating Open Educational Resources.
65. Open towards sharing digital content that might be interesting and useful to others.
66. Inclined not to share digital resources if not able to cite their author or source in an appropriate manner.

DIMENSION 5: USE CASES

Employment Scenario: Organise an event

Intermediate level 4

- I can use my company's digital storage system to share the event's agenda with the list of participants I created on my PC.
- I can show my colleagues on their smartphones how to access and share the agenda using my organisation's digital storage system.
- I can show my boss examples on her tablet of the digital sources I use to design the event's agenda.
- I can respond to any issue while I am doing these activities, such as unexpected problems with sharing the agenda with the participants.

Learning Scenario: Prepare group work with my classmates

Intermediate level 4

- I can use a cloud-based storage system (e.g. Dropbox, Google Drive) to share material with other members of my group.
- I can explain to other members of my group, using the class laptop, how I share the material in the digital storage system.
- I can show my teacher, on her tablet, the digital sources I use to prepare the material for group work.
- While I am doing these activities, I can solve any issue that may arise such as solving problems to do with storage or sharing material with other members of my group.

DIMENSION 1: COMPETENCE AREA

2. COMMUNICATION AND COLLABORATION

DIMENSION 2: COMPETENCE

2.3: ENGAGING IN CITIZENSHIP THROUGH DIGITAL TECHNOLOGIES

To participate in society through the use of public and private digital services. To seek opportunities for self-empowerment and for participatory citizenship through appropriate digital technologies.

DIMENSION 3: PROFICIENCY LEVEL

Foundation level 1

At basic level and with guidance, I can:

- **identify simple** digital services in order to participate in society.
- **recognise simple** appropriate digital technologies to empower myself and to participate in society as a citizen.

Foundation level 2

At basic level and with autonomy and appropriate guidance where needed, I can:

- **identify simple** digital services in order to participate in society.
- **recognise simple** appropriate digital technologies to empower myself and to participate in society as a citizen.

Intermediate level 3

On my own and solving straightforward problems, I can:

- **select well-defined and routine** digital services in order to participate in society.
- **indicate well-defined and routine** appropriate digital technologies to empower myself and to participate in society as a citizen.

Intermediate level 4

Independently, according to my own needs, and solving well-defined and non-routine problems, I can:

- **select** digital services in order to participate in society.
- **discuss** appropriate digital technologies to empower myself and to participate in society as a citizen.

Advanced level 5

As well as guiding others, I can:

- **propose differen**t digital services to participate in society.
- **use** appropriate digital technologies to empower myself and to participate in society as a citizen.

Advanced level 6

At advanced level, according to my own needs and those of others, and in complex contexts, I can:

- **vary** the use of the **most appropriate** digital services in order to participate in society.
- **vary** the use of the **most appropriate** digital technologies to empower myself and to participate in society as a citizen.

Highly Specialised level 7

At highly specialised level, I can:

- **create solutions to complex problems with limited definition** that are related to engaging in citizenship through digital technologies.
- **integrate** my knowledge **to contribute to professional practices and knowledge and guide others** in engaging in citizenship through digital technologies.

Highly Specialised level 8

At the most advanced and specialised level, I can:

- **create solutions to solve complex problems with many interacting factors** that are related to engaging in citizenship through digital technologies.
- **propose new** ideas and processes to the field.

DIMENSION 4: EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES

Knowledge

67. Knows about different types of digital services on the internet: public ones (e.g. services to consult tax information or make an appointment in the health care centre), community-based services (e.g. knowledge repositories such as Wikipedia, map services such as Open Street Map, environmental monitoring services such as Sensor Community) and private services (e.g. e-commerce, online banking).
68. Knows that a secure electronic identification, (e.g. identity cards which contain digital certificates), enables citizens to increase safety when using online services provided by the government or by the private sector.
69. Knows that all EU citizens have the right to not be subject to fully automated decision-making (e.g. if an automatic system refuses a credit application, the customer has the right to ask for the decision to be reviewed by a person). (**AI**)
70. Recognises that while the application of AI systems in many domains is usually uncontroversial (e.g. AI that helps avert climate change), AI that directly interacts with humans and takes decisions about their life can often be controversial (e.g. CV-sorting software for recruitment procedures, scoring of exams that may determine access to education). (**AI**)
71. Knows that AI per se is neither good nor bad. What determines whether the outcomes of an AI system are positive or negative for society are how the AI system is designed and used, by whom and for what purposes. (**AI**)
72. Aware of civil society platforms on the internet that offer opportunities for citizens to participate in actions targeting global developments to reach sustainability goals on local, regional, national, European and international level.
73. Aware of the role of traditional (e.g. newspapers, television) and new forms of media (e.g. social media, the internet) in democratic societies.

Skills

74. Knows how to acquire certificates from a certification authority (CA) for the purpose of a secure electronic identification.
75. Knows how to monitor public spending of local and national government (e.g. through open data on the government's website and open data portals).
76. Knows how to identify areas where AI can bring benefits to various aspects of everyday life. For example, in healthcare, AI might contribute to early diagnosis, while in agriculture, it might be used to detect pest infestations. (**AI**)
77. Knows how to engage with others through digital technologies for the sustainable development of society (e.g. create opportunities for joint action across communities, sectors and regions with different interests in sustainability challenges) with an awareness of technology´s potential for both inclusion/participation and exclusion.

Attitudes

78. Open to change one's own administrative routines and adopt digital procedures when dealing with government and public services.
79. Readiness to contemplate ethical questions related to AI systems (e.g. in which contexts, such as sentencing criminals, should AI recommendations not be used without human intervention)? (**AI**)
80. Considers responsible and constructive attitudes on the internet as they are the foundation for human rights. Together with values such as respect for human dignity, freedom, democracy and equality"
81. Proactive about using the internet and digital technologies to seek opportunities for constructive participation in democratic decision-making and civic activities (e.g. by participating in consultations organised by municipality, policy-makers, NGOs; signing a petition using a digital platform).

DIMENSION 5: USE CASES

Employment Scenario: Organise an event

Advanced level 5

- I can propose and use different media strategies (e.g. Survey on FaceBook, Hastags on Instagram and Twitter) to empower the citizens of my city to participate in defining the main topics of an event on the use of sugar in food production.
- I can inform my colleagues about these strategies and show them how to use a particular one to empower citizens to participate.

Learning Scenario: Prepare group work with my classmates

Advanced level 5

- I can propose and use different micro-blogs (e.g. Twitter), blogs and wikis, for a public consultation regarding social inclusion of migrants in my neighbourhood to collect proposals on the topic of the group work.
- I can inform my classmates about these digital platforms and guide them on how to use a particular one to empower citizenship participation in their neighbourhood.

DIMENSION 1: COMPETENCE AREA

2. COMMUNICATION AND COLLABORATION

DIMENSION 2: COMPETENCE

2.4: COLLABORATING THROUGH DIGITAL TECHNOLOGIES

To use digital tools and technologies for collaborative processes, and for co-construction and co-creation of data, resources and knowledge.

DIMENSION 3: PROFICIENCY LEVEL

Foundation level 1

At basic level and with guidance, I can:

- **choose simple** digital tools and technologies for collaborative processes.

Foundation level 2

At basic level and with autonomy and appropriate guidance where needed, I can:

- **choose simple** digital tools and technologies for collaborative processes.

Intermediate level 3

On my own and solving straightforward problems, I can:

- **select well-defined and routine** digital tools and technologies for collaborative processes.

Intermediate level 4

Independently, according to my own needs, and solving well-defined and non-routine problems, I can:

- **select** digital tools and technologies for collaborative processes.

Advanced level 5

As well as guiding others, I can:

- **propose different** digital tools and technologies for collaborative processes.

Advanced level 6

At advanced level, according to my own needs and those of others, and in complex contexts, I can:

- **vary** the use of the **most appropriate** digital tools and technologies for collaborative processes.
- **choose** the **most appropriate** digital tools and technologies for co-constructing and co-creating data, resources and knowledge.

Highly Specialised level 7

At highly specialised level, I can:

- **create solutions to complex problems with limited definition** that are related to using collaborative processes and co-construction and co-creation of data, resources and knowledge through digital tools and technologies.
- **integrate** my knowledge **to contribute to professional practice and knowledge and guide others** in collaborating through digital technologies.

Highly Specialised level 8

At the most advanced and specialised level, I can:

- **create solutions to solve complex problems with many interacting factors** that are related to using collaborative processes and co-construction and co-creation of data, resources and knowledge through digital tools and technologies.
- **propose new** ideas and processes to the field.

DIMENSION 4: EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES

Knowledge

82. Aware of the advantages of using digital tools and technologies for remote collaborative processes (e.g. reduced commuting time, join specialised skills together regardless of location).
83. Understands that in order to co-create digital content with other people, good social skills (e.g. clear communication, ability to clarify misunderstandings) are important to compensate for the limitations of online communication .

Skills

84. Knows how to use digital tools in a collaborative context to plan and share tasks and responsibilities within a group of friends, a family or a sport or work team (e.g. digital calendar, planners for trips and leisure activities).
85. Knows how to use digital tools to facilitate and improve collaborative processes, for example through shared visual boards and digital canvases (e.g. Mural, Miro, Padlet).
86. Knows how to engage collaboratively in a wiki (e.g. negotiate opening a new entry on a subject that is missing from Wikipedia to increase public knowledge).
87. Knows how to use digital tools and technologies in a remote working context for idea generation and co-creation of digital content (e.g. shared mind maps and whiteboards, polling tools). (**RW**)
88. Knows how to evaluate the advantages and disadvantages of digital applications for making collaboration effective (e.g. the use of online spaces for co-creation, shared project management tools).

Attitudes

89. Encourages everyone to express their own opinions constructively when collaborating in digital environments.
90. Acts in trustworthy ways to achieve group goals when engaging in co-construction of resources or knowledge.
91. Inclined to use appropriate digital tools for fostering collaboration between the members of a team while, at the same time, ensuring digital accessibility. (**DA**)

DIMENSION 5: USE CASES

Employment Scenario: Organise an event

Advanced level 6

- I can use the most appropriate digital tools at work (e.g. Dropbox, Google Drive, wiki) to create with my colleagues a leaflet and a blog on the event.
- I can also differentiate between appropriate and inappropriate digital tools for collaborative processes. The latter are those tools that do not address the purpose and scope of the task - e.g. two people editing text simultaneously using a wiki is impractical.
- I can overcome unexpected situations that can arise in the digital environment when co-creating the leaflet and the blog (e.g. controlling access to edit documents or a colleague cannot save changes to the material).

Learning Scenario: Prepare group work with my classmates

Advanced level 6

- I can use the most appropriate digital resources in order to create a video related to the work on my tablet with my classmates. I can also differentiate between appropriate and inappropriate digital resources to create this video and work in a digital environment together with classmates.
- I can overcome unexpected situations that arise on the digital environment when co-creating data and content and making a video on group work. (e.g. a file is not updating the changes made by the members, a member doesn't know how to upload a file in the digital tool).

DIMENSION 1: COMPETENCE AREA

2. COMMUNICATION AND COLLABORATION

DIMENSION 2: COMPETENCE

2.5: NETIQUETTE

To be aware of behavioural norms and know-how while using digital technologies and interacting in digital environments. To adapt communication strategies to the specific audience and to be aware of cultural and generational diversity in digital environments.

DIMENSION 3: PROFICIENCY LEVEL

Foundation level 1

At basic level and with guidance, I can:

- **differentiate simple** behavioural norms and know-how while using digital technologies and interacting in digital environments.
- **choose simple** communication modes and strategies adapted to an audience and
- **differentiate simple** cultural and generational diversity aspects to consider in digital environments.

Foundation level 2

At basic level and with autonomy and appropriate guidance where needed, I can:

- **differentiate simple** behavioural norms and know-how while using digital technologies and interacting in digital environments.
- **choose simple** communication modes and strategies adapted to an audience and
- **differentiate simple** cultural and generational diversity aspects to consider in digital environments.

Intermediate level 3

On my own and solving straightforward problems, I can:

- **clarify well-defined and routine** behavioural norms and know-how while using digital technologies and interacting in digital environments.
- **express well-defined and routine** communication strategies adapted to an audience.
- **describe well-defined and routine** cultural and generational diversity aspects to consider in digital environments.

Intermediate level 4

Independently, according to my own needs, and solving well-defined and non-routine problems, I can:

- **discuss** behavioural norms and know-how while using digital technologies and interacting in digital environments.
- **discuss** communication strategies adapted to an audience and
- **discuss** cultural and generational diversity aspects to consider in digital environments.

Advanced level 5

As well as guiding others, I can:

- **apply different** behavioural norms and know-how while using digital technologies and interacting in digital environments.
- **apply different** communication strategies in digital environments adapted to an audience and
- **apply different** cultural and generational diversity aspects to consider in digital environments.

Advanced level 6

At advanced level, according to my own needs and those of others, and in complex contexts, I can:

- **adapt** the **most appropriate** behavioural norms and know-how while using digital technologies and interacting in digital environments.
- **adapt** the **most appropriate** communication strategies in digital environments to an audience and
- **apply different** cultural and generational diversity aspects in digital environments.

Highly Specialised level 7

At highly specialised level, I can:

- **create solutions to complex problems with limited definition** that are related to digital etiquettes respectful of different audiences and cultural and generational diversity.
- **integrate** my knowledge **to contribute to professional practice and knowledge and guide others** in digital etiquette

Highly Specialised level 8

At the most advanced and specialised level, I can:

- **create solutions to solve complex problems with many**

interacting factors that are related to digital etiquettes respectful to different audiences and cultural and generational diversity.

- **propose new** ideas and processes to the field.

DIMENSION 4: EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES

Knowledge

92. Aware of the meaning of non-verbal messages (e.g. smiley faces, emojis) used in digital environments (e.g. social media, instant messaging) and knowing that their use can culturally differ between countries and communities.
93. Aware of the existence of some expected rules about one's behaviour when using digital technologies (e.g. using audio headsets instead of loudspeakers when taking calls in public places or listening to music).
94. Understands that inappropriate behaviours in digital environments (e.g. drunken, being overly intimate and other sexually explicit behaviour) can damage social and personal aspects of lives over a long term.
95. Aware that adapting one's behaviour in digital environments depends on one's relationship with other participants (e.g. friends, co-workers, managers) and the purpose in which the communication takes place (e.g. to instruct, inform, persuade, order, entertain, inquire, socialise).
96. Aware of accessibility requirements when communicating in digital environments so that communication is inclusive and accessible for all users (e.g. for people with disabilities, older people, those with low literacy, speakers of another language). (**DA**)

Skills

97. Knows how to stop receiving unwanted disturbing messages or emails.
98. Able to manage one's feelings when talking with other people on the internet.
99. Knows how to recognise hostile or derogatory messages or activities online that attack certain individuals or groups of individuals (e.g. hate speech).
100. Can manage interactions and conversations in different socio-cultural contexts and domain-specific situations.

Attitudes

101. Believes that it is necessary to define and share rules within digital communities (e.g. explain codes of conduct for creating, sharing or posting content).
102. Inclined to adopt an empathic perspective in communication (e.g. being responsive to another person's emotions and experiences, negotiating disagreements to build and sustain fair and respectful relationships).
103. Open to and respectful of the views of people on the internet with different cultural affiliations, backgrounds, beliefs, values, opinions or personal circumstances; open to the perspectives of others even if they differ from one's own.

DIMENSION 5: USE CASES

Employment Scenario: Organise an event

Highly specialised level 7

- While organising an event for my organisation, I can solve problems that arise while writing and communicating in digital environments, (e.g. inappropriate comments about my organisation in a social network).
- I can create rules from this practice for my current and future colleagues to implement and use as a guide.

Learning Scenario: Prepare group work with my classmates

Highly specialised level 7

- I can solve problems of etiquette that arise with my classmates while using a digital collaborative platform (blog, wiki, etc.) for group work (e.g. classmates criticising each other).
- I can create rules for appropriate behaviour while working online as a group which can be used and shared in the school's digital learning environment. I can also guide my classmates as to what constitutes appropriate digital behaviour while working with others on a digital platform.

DIMENSION 1: COMPETENCE AREA

2. COMMUNICATION AND COLLABORATION

DIMENSION 2: COMPETENCE

2.6: MANAGING DIGITAL IDENTITY

To create, and manage one or multiple digital identities, to be able to protect one's own reputation, to deal with the data that one produces through several digital tools, environments and services.

DIMENSION 3: PROFICIENCY LEVEL

Foundation level 1

At basic level and with guidance, I can:

- **identify** a digital identity,
- **describe simple** ways to protect my reputation online,
- **recognise simple** data I produce through digital tools, environments or services.

Foundation level 2

At basic level and with autonomy and appropriate guidance where needed, I can:

- **identify** a digital identity,
- **describe simple** ways to protect my reputation online,
- **recognise simple** data I produce through digital tools, environments or services.

Intermediate level 3

On my own and solving straightforward problems, I can:

- **discriminate** a range of well-defined and routine digital identities,
- **explain well-defined and routine** ways to protect my reputation online,
- **describe well-defined** data I **routinely** produce through digital tools, environments or services.

Intermediate level 4

Independently, according to my own needs, and solving well-defined and non-routine problems, I can:

- **display** a **variety** of specific digital identities,
- **discuss specific** ways to protect my reputation online,
- **manipulate** data I produce through digital tools, environments or services.

Advanced level 5

As well as guiding others, I can:

- **use** a **variety** of digital identities,
- **apply different** ways to protect my reputation online,
- **use** data I produce through several digital tools environment and services.

Advanced level 6

At advanced level, according to my own needs and those of others, and in complex contexts, I can:

- **discriminate** multiple digital identities,
- **explain** the more appropriate ways to protect one's own reputation,
- **change** the data produced through several tools, environments and services.

Highly Specialised level 7

At highly specialised level, I can:

- **create solutions to complex problems with limited definition** that are related to managing digital identities and protection of people's online reputation.
- **integrate** my knowledge **to contribute to professional practice** and knowledge and **guide others** in managing digital identity.

Highly Specialised level t8

At the most advanced and specialised level, I can:

- **create solutions to solve complex problems with many interacting factors** that are related to managing digital identities and protection of people's online reputation.
- **propose new** ideas and processes to the field.

DIMENSION 4: EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES

Knowledge

104. Aware that digital identity refers to (1) the method of authenticating a user on a website or an online service, and also to (2) a set of data identifying a user by means of tracing their digital activities, actions and contributions on the internet or digital devices (e.g. pages viewed, purchase history), personal data (e.g. name, username, profile data such as age, gender, hobbies) and context data (e.g. geographical location).
105. Aware that AI systems collect and process multiple types of user data (e.g. personal data, behavioural data and contextual data) to create user profiles which are then used, for example, to predict what the user might want to see or do next (e.g. offer advertisements, recommendations, services). (**AI**)
106. Knows that in the EU, one has the right to ask a website's or search engine's administrators to access personal data held about you (right of access), to update or correct them (right of rectification), or remove them (right of erasure, also known as the Right To Be Forgotten) .
107. Aware that there are ways to limit and manage the tracking of one's activities on the internet, such as software features (e.g. private browsing, deletion of cookies) and privacy-enhancing tools and product/service features (e.g. custom consent for cookies, opting out of personalised ads).

Skills

108. Knows how to create and manage profiles in digital environments for personal purposes (e.g. civic participation, e-commerce, social media use) and professional purposes (e.g. create a profile on an online employment platform).
109. Knows how to adopt information and communication practices in order to build a positive online identity (e.g. by adopting healthy, safe and ethical behaviours, such as avoiding stereotypes and consumerism).
110. Able to conduct an individual or family name search in order to inspect one's own digital footprint in online environments (e.g. to detect any potentially troubling posts or images, to exercise one's legal rights).
111. Able to verify and modify what type of metadata (e.g. location, time) is included in pictures being shared in order to protect privacy.
112. Knows what strategies to use in order to control, manage or delete data that is collected/curated by online systems (e.g. keeping track of services used, listing online accounts, deleting accounts that are not in use).
113. Knows how to modify user configurations (e.g. in apps, software, digital platforms) to enable, prevent or moderate the AI system tracking, collecting or analysing data (e.g. not allowing the mobile phone to track the user's location). (**AI**)

Attitudes

114. Considers the benefits (e.g. fast authentication process, user preferences) and risks (e.g. having identities stolen, personal data exploited by third parties) when managing one or multiple digital identities across digital systems, apps and services.
115. Inclined to check and select website cookies to be installed (e.g. accepting only technical cookies) when the website provides users with this option.
116. Careful about keeping one's own and others' personal information private (e.g. vacations or birthday photos; religious or political comments).
117. Identifies both the positive and negative implications of the use of all data (collection, encoding and processing), but especially personal data, by AI driven digital technologies such as apps and online services. (**AI**)

DIMENSION 5: USE CASES

Employment Scenario: Organise an event

Highly specialised level 8

- I can propose to my boss a new social media procedure that avoids actions which could harm our company's digital reputation (e.g. spam) when promoting the company's events.

Learning Scenario: Prepare group work with my classmates

Highly specialised level 8

- I can propose a new procedure to my school that avoids the publication of digital content (texts, pictures, videos), that can harm the students' reputation.

DIMENSION 1: COMPETENCE AREA

3. DIGITAL CONTENT CREATION

DIMENSION 2: COMPETENCE

3.1: DEVELOPING CONTENT

To create and edit digital content in different formats, to express oneself through digital means.

DIMENSION 3: PROFICIENCY LEVEL

Foundation level 1

At basic level and with guidance, I can:

- **identify** ways to create and edit simple content in **simple** formats,
- **choose** how I express myself through the creation of **simple** digital means.

Foundation level 2

At basic level and with autonomy and appropriate guidance where needed, I can:

- **identify** ways to create and edit **simple** content in simple formats,
- **choose** how I express myself through the creation of **simple** digital means.

Intermediate level 3

On my own and solving straightforward problems, I can:

- **indicate** ways to create and edit **well-defined and routine** content in **well-defined and routine** formats,
- **express** myself through the creation of **well-defined and routine** digital means.

Intermediate level 4

Independently, according to my own needs, and solving well-defined and non-routine problems, I can:

- **indicate** ways to create and edit content in different formats,
- **express** myself through the creation of digital means.

Advanced level 5

As well as guiding others, I can:

- **apply** ways to create and edit content in different formats,
- **show** ways to express myself through the creation of digital means.

Advanced level 6

At advanced level, according to my own needs and those of others, and in complex contexts, I can:

- **change** content using the **most appropriate** formats,
- **adapt** the expression of myself through the creation of the **most appropriate** digital means.

Highly Specialised level 7

At highly specialised level, I can:

- **create solutions to complex problems with limited definition** that are related to content creation and edition in different formats, and self-expression through digital means.
- **integrate** my knowledge **to contribute to professional practice and knowledge and guide others i**n developing content.

Highly Specialised level 8

At the most advanced and specialised level, I can:

- **create solutions to solve complex problems with many interacting factors** that are related to content creation and edition in different formats, and self-expression through digital means.
- **propose new** ideas and processes to the field.

DIMENSION 4: EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES

Knowledge

118. Knows that digital content exists in a digital form and that there are many different types of digital content (e.g. audio, image, text, video, applications) that are stored in various digital file formats.
119. Knows that AI systems can be used to automatically create digital content (e.g. texts, news, essays, tweets, music, images) using existing digital content as its source. Such content may be difficult to distinguish from human creations. (**AI**)
120. Aware that "digital accessibility" means ensuring that everyone, including people with disabilities, can use and navigate the internet. Digital accessibility includes accessible websites, digital files and documents, and other web-based applications (e.g. for online banking, accessing public services, and messaging and video-calling services). (**DA**)
121. Aware that virtual reality (VR) and augmented reality (AR) allow new ways to explore simulated environments and interactions within the digital and physical worlds.

Skills

122. Can use tools and techniques to create accessible digital content (e.g. add ALT text to images, tables and graphs; create a proper and well-labelled document structure; use accessible fonts, colours, links) (**DA**)
123. Knows how to select the appropriate format for digital content according to its purpose (e.g. saving a document in an editable format vs one that cannot be modified but is easily printed).
124. Knows how to create digital content to support one's own ideas and opinions (e.g. to produce data representations such as interactive visualisations using basic datasets such as open government data).
125. Knows how to create digital content on open platforms (e.g. create and modify text in a wiki environment).
126. Knows how to use Internet of Things (IoT) and mobile devices to create digital content (e.g. use embedded cameras and microphones to produce photos or videos).

Attitudes

127. Inclined to combine various types of digital content and data to better express facts or opinions for personal and professional use.
128. Open to explore alternative pathways to find solutions to produce digital content.
129. Inclined to follow official standards and guidelines (e.g. WCAG 2.1 and EN 301 549) to test the accessibility of a website, digital files, documents, e-mails or other web-based applications that one has created. (**DA**)

DIMENSION 5: USE CASES

Employment Scenario: Develop a short course (tutorial) to train the staff on a new procedure to be applied in the organisation

Foundation level 1: helped by a colleague who has advanced digital competence

- I can identify, from a tutorial video on YouTube, how to create a brief support video on my tablet to present the new organisational procedure to the staff on our intranet.
- From a list already prepared that my colleague found in a wiki, I can also identify alternative digital means to create the procedure to the staff.

Learning Scenario: Prepare a presentation on a certain topic that I will make to my classmates

Foundation level 1: helped by my teacher

- I can find out how to create a digital animated presentation, using a video tutorial from YouTube provided by my teacher to help me to present my work to my classmates.
- I can also identify other digital means from an article in my textbook that can help me to present the work as an animated digital presentation to my classmates on the interactive digital whiteboard.

DIMENSION 1: COMPETENCE AREA

3. DIGITAL CONTENT CREATION

DIMENSION 2: COMPETENCE

3.2: INTEGRATING AND RE-ELABORATING DIGITAL CONTENT

To modify, refine, improve and integrate information and content into an existing body of knowledge to create new, original and relevant content and knowledge.

DIMENSION 3: PROFICIENCY LEVEL

Foundation level 1

At basic level and with guidance, I can:

- **select** ways to modify, refine, improve and integrate **simple** items of new content and information to create new and original ones.

Foundation level 2

At basic level and with autonomy and appropriate guidance where needed, I can:

- **select** ways to modify, refine, improve and integrate **simple** items of new content and information to create new and original ones.

Intermediate level 3

On my own and solving straightforward problems, I can:

- **explain** ways to modify, refine, improve and integrate **well-defined** items of new content and information to create new and original ones.

Intermediate level 4

Independently, according to my own needs, and solving well-defined and non-routine problems, I can:

- **discuss** ways to modify, refine, improve and integrate new content and information to create new and original ones.

Advanced level 5

As well as guiding others, I can:

- **operate** with new **different** items of content and information, modifying, refining, improving and integrating them in order to create new and original ones.

Advanced level 6

At advanced level, according to my own needs and those of others, and in complex contexts, I can:

- **assess** the **most appropriate** ways to modify, refine, improve and integrate specific new items of content and information to create new and original ones.

Highly Specialised level 7

At highly specialised level, I can:

- **create solutions to complex problems with limited definition** that are related to modifying, refining, improving and integrating new content and information into existing knowledge to create new and original ones.
- **integrate** my knowledge **to contribute to professional practice and knowledge and guide others** in integrating and re-elaborating content.

Highly Specialised level 8

At the most advanced and specialised level, I can:

- **create solutions to solve complex problems with many interacting factors** that are related to modifying, refining, improving and integrating new content and information into existing knowledge to create new and original ones.
- **propose new** ideas and processes to the field.

DIMENSION 4: EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES

Knowledge

130. Aware that it is possible to integrate hardware (e.g. sensors, cables, motors) and software structures to develop programmable robots and other non-digital artefacts (e.g. Lego Mindstorms, Micro:bit, Raspberry Pi, EV3, Arduino, ROS).

Skills

131. Can create infographics and posters combining information, statistical content and visuals using available apps or software.
132. Knows how to use tools and applications (e.g. add-ons, plug-ins, extensions) to enhance digital accessibility of digital content (e.g. adding captions in video players to a recorded presentation). (**DA**)
133. Knows how to integrate digital technologies, hardware and sensor data to create a new (digital or non-digital) artefact (e.g. makerspace and digital fabrication activities).
134. Knows how to incorporate AI edited/manipulated digital content in one's own work (e.g. incorporate AI generated melodies in one's own musical composition). This use of AI can be controversial as it raises questions about the role of AI in artworks, and for example, who should be credited. (**AI**)

Attitudes

135. Open to creating something new from existing digital content using iterative design processes (e.g. create, test, analyse and refine ideas).
136. Inclined to help others to improve their digital content (e.g. through providing useful feedback).
137. Inclined to use available tools to verify whether images or videos have been modified (e.g. by deep-fake techniques).

DIMENSION 5: USE CASES

Employment Scenario: Develop a short course (tutorial) to train the staff on a new procedure to be applied in the organisation

Foundation level 2: with the help of a colleague (who has advanced digital competence and who I can consult whenever I need) and having as support a tutorial video with the steps on how to do it

- I can find out how to add new dialogues and images onto a brief support video already created on the intranet to illustrate the new organisational procedures.

Learning Scenario: Prepare a presentation on a certain topic that I will make to my classmates

Foundation level 2: at home with my mother (who I can consult whenever I need) and the help of a list (stored on my tablet provided by my teacher with the steps on how to do it)

- I can identify how to update a digital animated presentation I have created to present my work to my classmates, adding text, images and visual effects to be shown in the classroom using the interactive digital whiteboard.

DIMENSION 1: COMPETENCE AREA

3. DIGITAL CONTENT CREATION

DIMENSION 2: COMPETENCE

3.3: COPYRIGHT AND LICENSES

To understand how copyright and licenses apply to data, digital information and content.

DIMENSION 3: PROFICIENCY LEVEL

Foundation level 1

At basic level and with guidance, I can:

- **identify simple** rules of copyright and licenses that apply to data, digital information and content.

Foundation level 2

At basic level and with autonomy and appropriate guidance where needed, I can:

- **identify simple** rules of copyright and licenses that apply to data, digital information and content.

Intermediate level 3

On my own and solving straightforward problems, I can:

- **indicate well-defined and routine** rules of copyright and licenses that apply to data, digital information and content.

Intermediate level 4

Independently, according to my own needs, and solving well-defined and non-routine problems, I can:

- **discuss** rules of copyright and licenses that apply to digital information and content.

Advanced level 5

As well as guiding others, I can:

- **apply different** rules of copyright and licenses that apply to data, digital information and content.

Advanced level 6

At advanced level, according to my own needs and those of others, and in complex contexts, I can:

- **choose** the **most appropriate** rules that apply copyright and licences to data, digital information and content.

Highly Specialised level 7

At highly specialised level, I can:

- **create solutions to complex problems with limited definition** that are related to applying copyright and licenses to data, digital information and content.
- **integrate** my knowledge to contribute to professional practice and knowledge and guide others in applying copyright and licenses.

Highly Specialised level 8

At the most advanced and specialised level, I can:

- **create solutions to solve complex problems with many interacting factors** that are related to applying copyright and licenses to data, digital information and content.
- **propose new** ideas and processes to the field.

DIMENSION 4: EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES

Knowledge

138. Knows that digital content, goods and services might be protected under intellectual property (IP) rights (e.g. copyright, trademarks, designs, patents).
139. Aware that the creation of digital content (e.g. pictures, texts, music) when original is considered protected by copyright as soon as it exists (automatic protection).
140. Aware that certain copyright exceptions exist (e.g. use for the purpose of illustration for teaching, for caricature, parody, pastiche, for quotation, private uses).
141. Knows different models of licensing software (e.g. proprietary, free and open-source software) and that some types of licences need to be renewed once the licence period expires.
142. Aware of the legal limitations of using and sharing digital content (e.g. music, movies, books) and the possible consequences of illegal actions (e.g. sharing copyrighted content with others can give rise to legal sanctions).
143. Aware that mechanisms and methods to block or limit access to digital content exist (e.g. passwords, geo-blocking, Technical Protection Measures, TPM).

Skills

144. Able to identify and select digital content for downloading or uploading legally (e.g. public domain databases and tools, open licences).
145. Knows how to use and share digital content legally (e.g. checks the terms and conditions and licensing schemes available, such as the various types of Creative Commons) and knows how to assess whether limitations and copyright exceptions apply.
146. Able to identify when uses of copyright-protected digital content fall under the scope of a copyright exception so that no prior consent is needed (e.g. teachers and students in the EU can use copyright protected content for the purpose of illustration for teaching)..
147. Able to check and understand the right to use and/or re-use digital content created by a third party (e.g. knows about collective licencing schemes and contacts the relevant collective management organisations , understands the various Creative Commons licences).
148. Can choose the most suitable strategy, including the licensing, for the purpose of sharing and protecting one's own original creation (e.g. by registering it in an optional copyright deposit system; choosing open licences such as Creative Commons).

Attitudes

149. Respectful of rights affecting others (e.g. ownership, contract terms), only using legal sources for downloading digital content (e.g. movies, music, books) and when relevant, opting for open-source software.
150. Open to consider whether open licences or other licence schemes are more suitable when producing and publishing digital content and resources.

DIMENSION 5: USE CASES

Employment Scenario: Develop a short course (tutorial) to train the staff on a new procedure to be applied in the organisation

Foundation level 1: by myself

- I can tell a colleague which image banks I usually use to find images that I can download free of charge for a brief tutorial video on a new procedure for my organisation's staff.
- I can deal with problems such as identifying the symbol that indicates whether an image is licensed with a certain type of Creative Commons licence and therefore can be reused without the author's permission.

Learning Scenario: Prepare a presentation on a certain topic that I will make to my classmates

Foundation level 1: by myself

- I can explain to a friend which image banks I usually use to find images that I can download completely free of charge to create a digital animation to present my work to my classmates.
- I can fix problems such as identifying the symbol that indicate that an image is copyrighted and therefore cannot be used without the author's permission.

DIMENSION 1: COMPETENCE AREA

3. DIGITAL CONTENT CREATION

DIMENSION 2: COMPETENCE

3.4: PROGRAMMING

To plan and develop a sequence of understandable instructions for a computing system to solve a given problem or perform a specific task.

DIMENSION 3: PROFICIENCY LEVEL

Foundation level 1

At basic level and with guidance, I can:

- **list simple** instructions for a computing system to solve a simple problem or perform a simple task.

Foundation level 2

At basic level and with autonomy and appropriate guidance where needed, I can:

- **list simple** instructions for a computing system to solve a simple problem or perform a simple task.

Intermediate level 3

On my own and solving straightforward problems, I can:

- **list well-defined and routine** instructions for a computing system to solve routine problems or perform routine tasks.

Intermediate level 4

Independently, according to my own needs, and solving well-defined and non-routine problems, I can:

- **list** instructions for a computing system to solve a given problem or perform a specific task.

Advanced level 5

As well as guiding others, I can:

- **operate** with instructions for a computing system to solve a different problem or perform different tasks.

Advanced level 6

At advanced level, according to my own needs and those of others, and in complex contexts, I can:

- **determine** the **most appropriate** instructions for a computing system to solve a given problem and perform specific tasks.

Highly Specialised level 7

At highly specialised level, I can:

- **create solutions to complex problems with limited definition** that are related to planning and developing instructions for a computing system and performing a task using a computing system.
- **integrate** my knowledge **to contribute to professional practice and knowledge and guide others** in programming.

Highly Specialised level 8

At the most advanced and specialised level, I can:

- **create solutions to solve complex problems with many interacting factors** that are related to planning and developing instructions for a computing system and performing a task using a computing system.
- **propose new** ideas and processes to the field.

DIMENSION 4: EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES

Knowledge

151. Knows that computer programs are made of instructions, written according to strict rules in a programming language.
152. Knows that programming languages provide structures that allow program instructions to be executed in sequence, repeatedly, or only under certain conditions, and to group them to define new instructions.
153. Knows that programs are executed by computing devices/systems, that are able to automatically interpret and execute instructions.
154. Knows that programs produce output data depending on input data, and that different inputs usually yield different outputs (e.g. a calculator will provide output 8 to the 3+5 input and output 15 to the 7+8 input).
155. Knows that, to produce its output, a program stores and manipulates data in the computer system that executes it, and that it sometimes behaves unexpectedly (e.g. faulty behaviour, malfunction, data leakage).
156. Knows that a program's blueprint is based on an algorithm, i.e. a step-wise method to produce an output from an input.
157. Knows that algorithms, and consequently programs, are designed to help solve real life problems; input data models the known information about the problem, while output data provides information relevant to the problem's solution. There are different algorithms, and consequently programs, solving the same problem.
158. Knows that any program requires time and space (hardware resources) to compute its output, depending on the input's size and/or problem's complexity.
159. Knows that there are problems that cannot be solved exactly by any known algorithm in reasonable time, thus, in practice they are frequently dealt with by approximate solutions (e.g. DNA sequencing, data clustering, weather forecasting).

Skills

160. Knows how to combine a set of program blocks (e.g. as in the visual programming tool Scratch), in order to solve a problem.
161. Knows how to detect issues in a sequence of instructions, and make changes to resolve them (e.g. to find an error in the program and correct it; to detect the reason why the execution time or output of the program is not as expected).
162. Able to identify input and output data in some simple programs.
163. Given a program, being able to recognise the execution order of instructions, and how information is processed.

Attitudes

164. Willing to accept that algorithms, and hence programs, may not be perfect in solving the problem that they aim to address.
165. Considers ethics (including but not limited to human agency and oversight, transparency, non-discrimination, accessibility, and biases and fairness) as one of the core pillars when developing or deploying AI systems. (**AI**)

DIMENSION 5: USE CASES

Employment Scenario: Develop a short course (tutorial) to train the staff on a new procedure to be applied in the organisation

Intermediate level 4

- Using a programming language (e.g. Ruby, Python), I can provide instructions to develop an educational game to introduce the new procedure to be applied in the organisation.
- I can resolve issues such as debugging the programme to fix problems with my code.

Learning Scenario: Prepare a presentation on a certain topic that I will make to my classmates

Intermediate level 4

- Using a simple graphical programming interface (e.g. Scratch Jr), I can develop a smartphone app that presents my work to my classmates.
- If a problem appears, I know how to debug the programme and I can fix easy problems in my code.

The examples under this competence are abbreviated from Programming for All: Understanding the Nature of Programs (Brodnik et al., 2021). The document offers a more complete list of knowledge, skills and attitude statements that are accompanied with examples from everyday life.

For example, when reading example no: 157, the interested reader can go to the document and find more information about "programs" under the section "A.2 Programs are made of instructions" (p.14), or to understand more about data models, the reader should direct to the knowledge statement "K3.4" on p.18.

DIMENSION 1: COMPETENCE AREA

4. SAFETY

DIMENSION 2: COMPETENCE

4.1: PROTECTING DEVICES

To protect devices and digital content, and to understand risks and threats in digital environments. To know about safety and security measures and to have a due regard to reliability and privacy.

DIMENSION 3: PROFICIENCY LEVEL

Foundation level 1

At basic level and with guidance, I can:

- **identify simple** ways to protect my devices and digital content, and
- differentiate simple risks and threats in digital environments.
- choose simple safety and security measures, and
- **identify simple** ways to have due regard to reliability and privacy.

Foundation level 2

At basic level and with autonomy and appropriate guidance where needed, I can:

- **identify simple** ways to protect my devices and digital content, and
- differentiate simple risks and threats in digital environments.
- follow simple safety and security measures.
- **identify simple** ways to have due regard to reliability and privacy.

Intermediate level 3

On my own and solving straightforward problems, I can:

- **indicate well-defined and routine** ways to protect my devices and digital content, and
- differentiate well-defined and routine risks and threats in digital environments, and
- **select well-defined and routine** safety and security measures.
- **indicate well-defined and routine** ways to have due regard to reliability and privacy

Intermediate level 4

Independently, according to my own needs, and solving well-defined and non-routine problems, I can:

- **organise** ways to protect my devices and digital content, and
- **differentiate** risks and threats in digital environments.
- **select** safety and security measures.
- **explain** ways to have due regard to reliability and privacy.

Advanced level 5

As well as guiding others, I can:

- **apply different** ways to protect devices and digital content, and
- **differentiate a variety** of risks and threats in digital environments.
- **apply** safety and security measures.
- **employ different** ways to have due regard to reliability and privacy.

Advanced level 6

At advanced level, according to my own needs and those of others, and in complex contexts, I can:

- **choose** the **most appropriate** protection for devices and digital content, and
- **discriminate** risks and threats in digital environments.
- **choose** the **most appropriate** safety and security measures.
- **assess** the **most appropriate** ways to have due regard to reliability and privacy.

Highly Specialised level 7

At highly specialised level, I can:

- **create solutions to complex problems with limited definition** that are related to protecting devices and digital content, managing risks and threats, applying safety and security measures, and reliability and privacy in digital environments.
- **integrate** my knowledge **to contribute to professional practice and knowledge and guide others** in protecting devices.

Highly Specialised level 8

At the most advanced and specialised level, I can:

- **create solutions to solve complex problems with many interacting factors** that are related to protecting devices and digital content, managing risks and threats, applying safety and security measures, and reliability and privacy in digital environments.
- **propose new** ideas and processes to the field.

DIMENSION 4: EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES

Knowledge

166. Knows that using different strong passwords for different online services is a way to mitigate the negative effects of an account being compromised (e.g. hacked).
167. Knows about measures to protect devices (e.g. password, fingerprints, encryption) and prevent others (e.g. a thief, commercial organisation, government agency) from having access to all data.
168. Knows about the importance of keeping the operating system and applications (e.g. browser) up-to-date, in order to fix security vulnerabilities and protect against malicious software (i.e. malware).
169. Knows that a firewall blocks certain kinds of network traffic, aiming to prevent different security risks (e.g. remote logins).
170. Aware of different types of risks in digital environments, such as identity theft (e.g. someone committing fraud or other crimes using another person's personal data), scams (e.g. financial scams where victims are tricked into sending money), malware attacks (e.g. ransomware).

Skills

171. Knows how to adopt a proper cyber-hygiene strategy regarding passwords (e.g. selecting strong ones difficult to guess) and managing them securely (e.g. using a password manager).
172. Knows how to install and activate protection software and services (e.g. antivirus, anti-malware, firewall) to keep digital content and personal data safer.
173. Knows how to activate two-factor authentication when available (e.g. using one-time passwords, OTP, or codes along with access credentials).
174. Knows how to check the type of personal data an app accesses on one's mobile phone and, based on that, decides whether to install it and configures the appropriate settings.
175. Able to encrypt sensitive data stored on a personal device or in a cloud storage service.
176. Can respond appropriately to a security breach (i.e. an incident that results in unauthorised access to digital data, applications, networks or devices, the leaking of personal data such as logins or passwords).

Attitudes

177. Vigilant not to leave computers or mobile devices unattended in public places (e.g. shared workplaces, restaurants, trains, car backseat).
178. Weighs the benefits and risks of using biometric identification techniques (e.g. fingerprint, face images) as they can affect safety in unintended ways. If biometric information is leaked or hacked, it becomes compromised and can lead to identity fraud.
179. Keen to consider some self-protective behaviours such as not using open Wi-fi networks to make financial transactions or online banking.

DIMENSION 5: USE CASES

Employment Scenario: Use of a Twitter account to share information on my organization

Advanced level 5

- I can protect the corporate Twitter account using different methods (e.g. a strong password, control the recent logins) and show new colleagues how to do it.
- I can detect risks like receiving tweets and messages from followers with false profiles or phishing attempts.
- I can apply measures to avoid them (e.g. control the privacy settings).
- I can also help my colleagues to detect risks and threats while using Twitter.

Learning Scenario: Use of the school's digital learning platform to share information on interested topics

Advanced level 5

- I can protect information, data and content on my school's digital learning platform (e.g. a strong password, control the recent logins).
- I can detect different risks and threats when accessing school's digital platform and apply measures to avoid them (e.g. how to virus-check attachments before downloading).
- I can also help my classmates to detect risks and threat while using the digital learning platform on their tablets (e.g. controlling who can access the files).

DIMENSION 1: COMPETENCE AREA

4. SAFETY

DIMENSION 2: COMPETENCE

4.2: PROTECTING PERSONAL DATA AND PRIVACY

To protect personal data and privacy in digital environments. To understand how to use and share personally identifiable information while being able to protect oneself and others from damages. To understand that digital services use a "Privacy policy" to inform how personal data is used.

DIMENSION 3: PROFICIENCY LEVEL

Foundation level 1

At basic level and with guidance, I can:

- **select simple** ways to protect my personal data and privacy in digital environments,
- **identify simple** ways to use and share personally identifiable information while protecting myself and others from damages.
- **identify simple** privacy policy statements of how personal data is used in digital services.

Foundation level 2

At basic level and with autonomy and appropriate guidance where needed, I can:

- **select simple** ways to protect my personal data and privacy in digital environments,
- **identify simple** ways to use and share personally identifiable information while protecting myself and others from damages.
- **identify simple** privacy policy statements of how personal data is used in digital services.

Intermediate level 3

On my own and solving straightforward problems, I can:

- **explain well-defined and routine** ways to protect my personal data and privacy in digital environments, and
- **explain well-defined and routine** ways to use and share personally identifiable information while protecting myself and others from damages.
- **indicate well-defined and routine** privacy policy statements of how personal data is used in digital services.

Intermediate level 4

Independently, according to my own needs, and solving well-defined and non-routine problems, I can:

- **discuss** ways to protect my personal data and privacy in digital environments, and
- **discuss** ways to use and share personally identifiable information while protecting myself and others from damages.
- **indicate** privacy policy statements of how personal data is used in digital services.

Advanced level 5

As well as guiding others, I can:

- **apply different** ways to protect my personal data and privacy in digital environments,
- **apply different** specific ways to share my data while protecting myself and others from dangers.
- **explain** privacy policy statements of how personal data is used in digital services.

Advanced level 6

At advanced level, according to my own needs and those of others, and in complex contexts, I can:

- **choose the more appropriate ways** to protect personal data and privacy in digital environments, and
- **evaluate the most appropriate ways** of using and sharing personally identifiable information while protecting myself and others from damages.
- **evaluate the appropriateness** of privacy policy statements on how personal data are used.

Highly Specialised level 7

At highly specialised level, I can:

- **create solutions to complex problems with limited definition** that are related to protecting personal data and privacy in digital environments, using and sharing personally identifiable information protecting self and others from dangers, and privacy policies to use my personal data.
- **integrate** my knowledge **to contribute to professional practice and knowledge and guide others** in protecting personal data and privacy

Highly Specialised level 8

At the most advanced and specialised level, I can:

- **create solutions to solve complex problems with many interacting factors** that are related to protecting personal data and privacy in digital environments, using and sharing personally identifiable information protecting self and others from dangers, and privacy policies to use my personal data.
- **propose new** ideas and processes to the field.

DIMENSION 4: EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES

Knowledge

180. Aware that secure electronic identification is a key feature designed to enable safer sharing of personal data with third parties when conducting public sector and private transactions.
181. Knows that the "privacy policy" of an app or service should explain what personal data it collects (e.g. name, brand of device, geolocation of the user), and whether data are shared with third parties.
182. Knows that the processing of personal data is subject to local regulations such as the EU's General Data Protection Regulation (GDPR) (e.g. voice interactions with a virtual assistant are personal data in terms of the GDPR and can expose users to certain data protection, privacy and security risks). (**AI**)

Skills

183. Knows how to identify suspicious e-mail messages that try to obtain sensitive information (e.g. personal data, banking identification) or might contain malware. Knows that these emails are often designed to trick people who do not check carefully and who are thus more susceptible to fraud, by containing deliberate errors that prevent vigilant people clicking on them.
184. Knows how to apply basic security measures in online payments (e.g. never sending a scan of credit cards or giving the pin code of a debit/payment/credit card).
185. Knows how to use electronic identification for services provided by public authorities or public services (e.g. filling-in your tax form, applying for social benefits, requesting certificates) and by the business sector, such as banks and transport services.
186. Knows how to use digital certificates acquired from certifying authorities (e.g. digital certificates for authentication and digital signing stored on national identity cards).

Attitudes

187. Weighs the benefits and risks before allowing third parties to process personal data (e.g. recognises that a voice assistant on a smartphone, that is used to give commands to a robot vacuum cleaner, could give third parties - companies, governments, cybercriminals - access to the data). (**AI**)
188. Confident in carrying out online transactions after taking appropriate safety and security measures.

DIMENSION 5: USE CASES

Employment Scenario: Use of a Twitter account to share information on my organization

Advanced level 6

- I can select the most appropriate way to protect the personal data of my colleagues (e.g. address, phone number) when sharing digital content (e.g. a picture) on the corporate Twitter account.
- I can distinguish between appropriate and inappropriate digital content to share it on the corporate Twitter account, so that my privacy and that of my colleagues are not damaged.
- I can assess whether personal data are used on the Corporate Twitter appropriately according to the European Data Protection Law and Right to be Forgotten.
- I can deal with complex situations that can arise with personal data in my organisation while on Twitter, such as removing pictures or names to protect personal information in accordance with the European Data Protection Law and Right to be Forgotten.

Learning Scenario: Use of the school's digital learning platform to share information on interested topics

Advanced level 6

- I can select the most appropriate way to protect my personal data (e.g. address, phone number), before sharing it on the school's digital platform.
- I can distinguish between appropriate and inappropriate digital content to share it on my school's digital platform, so that my privacy and that of my classmates are not damaged.
- I can assess whether the way my personal data are used on the digital platform is appropriate and acceptable as regards my rights and privacy.
- I can overcome complex situations that can arise with my personal data and those of my classmates while on the digital education platform, such as personal data is not used in accordance to the "Privacy policy" of the platform.

DIMENSION 1: COMPETENCE AREA

4. SAFETY

DIMENSION 2: COMPETENCE

4.3: PROTECTING HEALTH AND WELL-BEING

To be able to avoid health-risks and threats to physical and psychological well-being while using digital technologies. To be able to protect oneself and others from possible dangers in digital environments (e.g. cyber bullying). To be aware of digital technologies for social well-being and social inclusion.

DIMENSION 3: PROFICIENCY LEVEL

Foundation level 1

At basic level and with guidance, I can:

- **differentiate simple** ways to avoid health risks and threats to physical and psychological well-being while using digital technologies.
- **select simple** ways to protect myself from possible dangers in digital environments.
- **identify simple** digital technologies for social well-being and social inclusion.

Foundation level 2

At basic level and with autonomy and appropriate guidance where needed, I can:

- **differentiate simple** ways to avoid health risks and threats to physical and psychological well-being while using digital technologies.
- **select simple** ways to protect myself from possible dangers in digital environments.
- **identify simple** digital technologies for social well-being and social inclusion.

Intermediate level 3

On my own and solving straightforward problems, I can:

- **explain well-defined and routine** ways to how to avoid health risks and threats to physical and psychological well-being while using digital technologies.
- **select well-defined and routine** ways to protect myself from dangers in digital environments.
- **indicate well-defined and routine** digital technologies for social well-being and social inclusion.

Intermediate level 4

Independently, according to my own needs, and solving well-defined and non-routine problems, I can:

- **explain** ways to how to avoid threats to my physical and psychological health related with the use of technology.
- **select** ways to protect self and others from dangers in digital environments.
- **discuss** on digital technologies for social well-being and inclusion.

Advanced level 5

As well as guiding others, I can:

- **show different** ways to avoid health -risks and threats to physical and psychological well-being while using digital technologies.
- **apply different** ways to protect myself and others from dangers in digital environments.
- **show different** digital technologies for social well-being and social inclusion.

Advanced level 6

At advanced level, according to my own needs and those of others, and in complex contexts, I can:

- **discriminate** the **most appropriate** ways to avoid health risks and threats to physical and psychological well-being while using digital technologies.
- **adapt** the **most appropriate** ways to protect myself and others from dangers in digital environments.
- **vary** the use of digital technologies for social well-being and social inclusion.

Highly Specialised level 7

At highly specialised level, I can:

- **create solutions to complex problems with limited definition** that are related to avoiding health -risks and threats to well-being while using digital technologies, to protect self and others from dangers in digital environments, and to the use of digital technologies for social well-being and social inclusion.
- **integrate** my knowledge **to contribute to professional practice and knowledge and guide others** in protecting health.

Highly Specialised level 8

At the most advanced and specialised level, I can:

- **create solutions to solve complex problems with many interacting factors** that are related to avoiding health risks and threats to well-being while using digital

technologies, to protect self and others from dangers in digital environments, and to the use of digital technologies for social well-being and social inclusion.

- **propose new** ideas and processes to the field.

DIMENSION 4: EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES

Knowledge

189. Aware of the importance of balancing the use of digital technologies with non-use as an option, as many different factors in digital life can impact on personal health, wellbeing and life satisfaction.
190. Knows signs of digital addictions (e.g. loss of control, withdrawal symptoms, dysfunctional mood regulation) and that digital addiction can cause psychological and physical harm.
191. Aware that for many digital health applications, there are no official licensing procedures as is the case in mainstream medicine.
192. Aware that some applications on digital devices (e.g. smartphones) can support the adoption of healthy behaviours by monitoring and alerting the user about health conditions (e.g. physical, emotional, psychological). However, some actions or images proposed by such applications could also have negative impacts on physical or mental health (e.g. viewing 'idealised' body images can cause anxiety).
193. Understands that cyberbullying is bullying with the use of digital technologies (i.e. a repeated behaviour aimed at scaring, angering or shaming those who are targeted).
194. Knows that the "online disinhibition effect" is the lack of restraint one feels when communicating online in comparison to communicating in-person. This can lead to an increased tendency towards online flaming (e.g. offensive language, posting insults online) and inappropriate behaviours.
195. Aware that vulnerable groups (e.g. children, those with lower social skills and lack of in-person social support) are at a higher risk of victimisation in digital environments (e.g. cyber bullying, grooming).
196. Aware that digital tools can create new opportunities for participation in society for vulnerable groups (e.g. older people, people with special needs). However, digital tools can also contribute to isolation or the exclusion of those who do not use them.

Skills

197. Knows how to apply, for oneself and others, a variety of digital usage monitoring and limitation strategies (e.g. rules and agreements on screen-free times, delayed availability of devices for children, installing time limitation and filter software).
198. Knows how to recognise embedded user experience techniques (e.g. clickbait, gamification, nudging) designed to manipulate and/or to weaken one's ability to be in control of decisions (e.g. make users to spend more time on online activities, encourage consumerism).
199. Can apply and follow protection strategies to fight online victimisation (e.g. block receiving further messages from sender(s), not reacting/responding, forwarding or saving messages as evidence for legal procedures, deleting negative messages to avoid repeated viewing).

Attitudes

200. Inclined to focus on physical and mental wellbeing, and avoid the negative impacts of digital media (e.g. overuse, addiction, compulsive behaviour).
201. Assumes responsibility for protecting personal and collective health and safety when evaluating the effects of medical and medical-like products and services online, as the internet is awash with false and potentially dangerous information about health.
202. Wary of the reliability of recommendations (e.g. are they by a reputable source) and their intentions (e.g. do they really help the user vs encourage to use the device more to be exposed to advertising).

DIMENSION 5: USE CASES

Employment Scenario: Use of a Twitter account to share information on my organization

Highly specialised level 7

- I can create a digital campaign of possible health dangers of using Twitter
- for professional reasons (e.g. bullying, addictions, physical well-being) which can be shared and used by other colleagues and professionals on their smartphones or tablets.

Learning Scenario: Use of the school's digital learning platform to share information on interested topics

Highly specialised level 7

- I can create a blog on cyberbullying and social exclusion for my school's digital learning platform, which helps my classmates to recognise and face up to violence in digital environments.

DIMENSION 1: COMPETENCE AREA

4. SAFETY

DIMENSION 2: COMPETENCE

4.4: PROTECTING THE ENVIRONMENT

To be aware of the environmental impact of digital technologies and their use.

DIMENSION 3: PROFICIENCY LEVEL

Foundation level 1

At basic level and with guidance, I can:

- **recognise simple** environmental impacts of digital technologies and their use.

Foundation level 2

At basic level and with autonomy and appropriate guidance where needed, I can:

- **recognise simple** environmental impacts of digital technologies and their use.

Intermediate level 3

On my own and solving straightforward problems, I can:

- **indicate well-defined and routine** environmental impacts of digital technologies and their use.

Intermediate level 4

Independently, according to my own needs, and solving well-defined and non-routine problems, I can:

- **discuss** ways to protect the environment from the impact of digital technologies and their use.

Advanced level 5

As well as guiding others, I can:

- **show different** ways to protect the environment from the impact of digital technologies and their use.

Advanced level 6

At advanced level, according to my own needs and those of others, and in complex contexts, I can:

- **choose** the **most appropriate** solutions to protect the environment from the impact of digital technologies and their use.

Highly Specialised level 7

At highly specialised level, I can:

- **create solutions to complex problems with limited definition** that are related to protecting the environment from the impact of digital technologies and their use.
- **integrate my knowledge to contribute to professional practice and knowledge and guide other**s in protecting the environment.

Highly Specialised level 8

At the most advanced and specialised level, I can:

- **create solutions to solve complex problems with many interacting factors** that are related to protecting the environment from the impact of digital technologies and their use.
- **propose new** ideas and processes to the field.

DIMENSION 4: EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES

Knowledge

203. Aware of the environmental impact of everyday digital practices (e.g. video streaming that rely on data transfer), and that the impact is composed of energy use and carbon emissions from devices, network infrastructure and data centres.
204. Aware of the environmental impact of the manufacturing of digital devices and batteries (e.g. pollution and toxic by-products, consumption of energy) and that at the end of their life, such devices must be appropriately disposed of to minimise their environmental impact and to enable reuse of rare and expensive components and natural resources.
205. Aware that some components of electronic and digital devices can be replaced to extend their life or performance, however, some might be purposefully designed to stop functioning correctly after a certain period (planned obsolescence).
206. Knows 'green' behaviours to follow when buying digital devices, e.g. choose products with less energy consumption during use and stand-by, less polluting (products easier to dismantle and recycle) and less toxic (limited use of substances harmful to the environment and health).
207. Knows that e-commerce practices such as purchasing and delivery of physical goods have an impact on the environment (e.g. carbon footprint of transport, generation of waste).
208. Aware that digital technologies (including AI-driven ones) can contribute to energy efficiency, for example through monitoring the need for heating at home and optimising its management.
209. Aware that certain activities (e.g. training AI and producing cryptocurrencies like Bitcoin) are resource intensive processes in terms of data and computing power. Therefore, energy consumption can be high which can also have a high environmental impact. (**AI**)

Skills

210. Knows how to apply efficient low-tech strategies for protecting the environment, e.g. shutting down devices and switching off Wi-fi, not printing out documents, repair and replace component to avoid the unnecessary replacement of digital devices.
211. Knows how to reduce the energy consumption of devices and services used, e.g. change the quality settings of video streaming services, using Wi-fi rather than data connectivity when at home, closing apps, optimising email attachments).
212. Knows how to use digital tools to improve the environmental and social impact of one's consumer behaviour (e.g. by looking for local produce, by searching for collective deals and car-pooling options for transportation).

Attitudes

213. Seeks out ways in which digital technologies could help live and consume in a way which respects the sustainability of human society and the natural environment.
214. Seeks out information regarding the environmental impact of technology to influence one's behaviour and that of others (e.g. friends and family) to be more eco-responsible in their digital practices.
215. Considers product's overall impact on the planet when choosing digital means over physical products, e.g. reading a book online does not need paper and thus transport costs are low, however, one should consider digital devices including toxic component and needed energy to be charged.
216. Considers the ethical consequences of AI systems throughout their life-cycle: they include both the environmental impact (environmental consequences of the production of digital devices and services) and societal impact, e.g. platformisation of work and algorithmic management that may repress workers' privacy or rights; the use of low-cost labour for labelling images to train AI systems. (**AI**)

DIMENSION 5: USE CASES

Employment Scenario: Use of a Twitter account to share information on my organization

Highly specialised level 8

- I can create an illustrated video which answers questions on the sustainable use of digital devices in organisations of my sector, to be shared on Twitter, and to be used by staff and by other professionals in the sector.

Learning Scenario: Use of the school's digital learning platform to share information on interested topics

Highly specialised level 8

- I can create a new eBook to answer questions on the sustainable use of digital devices at school and home, and share it on my school's digital learning platform in order to be used by other schoolmates and their families.

DIMENSION 1: COMPETENCE AREA

5. PROBLEM SOLVING

DIMENSION 2: COMPETENCE

5.1: SOLVING TECHNICAL PROBLEMS

To identify technical problems when operating devices and using digital environments, and to solve them (from trouble-shooting to solving more complex problems).

DIMENSION 3: PROFICIENCY LEVEL

Foundation LEVEL 1

At basic level and with guidance, I can:

- **identify simple** technical problems when operating devices and using digital environments, and
- **identify simple** solutions to solve them.

Foundation level 2

At basic level and with autonomy and appropriate guidance where needed, I can:

- **identify simple** technical problems when operating devices and using digital environments, and
- **identify simple** solutions to solve them.

Intermediate level 3

On my own and solving straightforward problems, I can:

- **indicate well-defined and routine** technical problems when operating devices and using digital environments, and
- **select well-defined and routine** solutions to them.

Intermediate level 4

Independently, according to my own needs, and solving well-defined and non-routine problems, I can:

- **differentiate** technical problems when operating devices and using digital environments, and
- **select** solutions to them.

Advanced level 5

As well as guiding others, I can:

- **assess** technical problems when using digital environments and operating digital devices, and
- **apply different** solutions to them.

Advanced level 6

At advanced level, according to my own needs and those of others, and in complex contexts, I can:

- **appraise** technical problems when operating devices and using digital environments,
- **resolve** them with the **most appropriate** solutions.

Highly Specialised level 7

At highly specialised level, I can:

- **create solutions to complex problems with limited definition** that are related to technical problems when operating devices and using digital environments.
- **integrate** my knowledge **to contribute to professional practice and knowledge and to guide others** in solving technical problems.

Highly Specialised level 8

At the most advanced and specialised level, I can:

- **create solutions to solve complex problems with many interacting factors** that are related to technical problems when operating devices and using digital environments.
- **propose new** ideas and processes to the field.

DIMENSION 4: EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES

Knowledge

217. Knows the main functions of the most common digital devices (e.g. computer, tablet, smartphone).
218. Knows some reasons why a digital device may fail to connect online (e.g. wrong Wi-fi password, airplane mode on).
219. Knows that computing power or storage capacity can be improved to overcome fast obsolescence of hardware (e.g. by contracting power or storage as a service).
220. Aware that the most frequent sources of problems in Internet of Thing (IoT) and mobile devices, and in their applications, are related to connectivity/ network availability, battery/power, limited processing power.
221. Aware that AI is a product of human intelligence and decision-making (i.e. humans choose, clean and encode the data, they design the algorithms, train the models, and curate and apply human values to the outputs) and therefore does not exist independently of humans. (**AI**)

Skills

222. Knows how to identify and solve a camera and/or a microphone issue when in an online meeting.
223. Knows how to verify and troubleshoot problems related to interconnected IoT devices and their services.
224. Takes a step-by-step approach to identify the root of a technical problem (e.g. hardware vs software) and explores various solutions when facing a technical malfunction.
225. Knows how to find solutions on the internet when facing a technical problem

Attitudes

226. Takes an active and curiosity driven approach to explore how digital technologies operate.

DIMENSION 5: USE CASES

Employment Scenario: Use of a digital learning platform to improve my career opportunities

Foundation level 1: helped by a colleague from the IT department

- I can identify a simple technical problem from a list of those that can arise while using a digital learning platform, and
- I can identify what type of IT support would solve it.

Learning Scenario: UUse of a digital learning platform to improve my math skills

Foundation level 1: helped by a friend

- I can identify a simple technical problem from a list of those that can arise while using a digital learning platform, and
- I can identify what type of IT support would solve it.

DIMENSION 1: COMPETENCE AREA

5. PROBLEM SOLVING

DIMENSION 2: COMPETENCE

5.2: IDENTIFYING NEEDS AND TECHNOLOGICAL RESPONSES

To assess needs and to identify, evaluate, select and use digital tools and possible technological responses and to solve them. To adjust and customise digital environments to personal needs (e.g. accessibility).

DIMENSION 3: PROFICIENCY LEVEL

Foundation level 1

At basic level and with guidance, I can:

- **identify** needs, and
- **recognise simple** digital tools and possible technological responses to solve those needs.
- **choose simple** ways to adjust and customise digital environments to personal needs.

Foundation level 2

At basic level and with autonomy and appropriate guidance where needed, I can:

- **identify needs**, and
- **recognise simple** digital tools and possible technological responses to solve those needs.
- **choose simple** ways to adjust and customise digital environments to personal needs.

Intermediate level 3

On my own and solving straightforward problems, I can:

- **indicate well-defined and routine** needs, and
- **select well-define and routine** digital tools and possible technological responses to solve those needs.
- **select well-defined and routine** ways to adjust and customise digital environments to personal needs.

Intermediate level 4

Independently, according to my own needs, and solving well-defined and non-routine problems, I can:

- **explain** needs, and
- **select** digital tools and possible technological responses to solve those needs.
- **select** ways to adjust and customise digital environments to personal needs.

Advanced level 5

As well as guiding others, I can:

- **assess** needs,
- **apply different** digital tools and possible technological responses to solve those needs.
- **use different** ways to adjust and customise digital environments to personal needs.

Advanced level 6

At advanced level, according to my own needs and those of others, and in complex contexts, I can:

- **assess** needs,
- **choose the most appropriate** digital tools and possible technological responses to solve those needs.
- **decide the most appropriate ways** to adjust and customise digital environments to personal needs

Highly Specialised level 7

At highly specialised level, I can:

- **create solutions to complex problems with limited definition** using digital tools and possible technological responses, and to adapt and customise digital environments to personal needs.
- **integrate** my knowledge **to contribute to professional practice and knowledge and guide others** in identifying needs and technological responses.

Highly Specialised level 8

At the most advanced and specialised level, I can:

- **create solutions to solve complex problems with many interacting factors** using digital tools and possible technological responses, and to adapt and customise digital environments to personal needs.
- I can **propose new** ideas and processes to the field.

DIMENSION 4: EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES

Knowledge

227. Knows that it is possible to buy and sell goods and services on the internet through commercial transactions (e.g. e-commerce) and consumer-to-consumer transactions (e.g. sharing platforms). Different rules (e.g. legal consumer protections) apply when buying online from a company than from a private person.
228. Able to identify some examples of AI systems: product recommenders (e.g. on online shopping sites), voice recognition (e.g. by virtual assistants), image recognition (e.g. for detecting tumours in x-rays) and facial recognition (e.g. in surveillance systems). (**AI**)
229. Aware that many non-digital artefacts can be created using 3D printer (e.g. to print spare parts for domestic appliances or furniture.
230. Knows technical approaches that can improve the inclusiveness and accessibility of digital content and services, e.g. tools such as magnification or zoom and text-to-voice functionality. (**DA**)
231. Aware that AI-driven speech-based technology enables the use of spoken commands that can enhance the accessibility of digital tools and devices (e.g. for those with mobility or visual limitations, limited cognition, language or learning difficulties), however, languages spoken by smaller populations are often not available, or perform worse, due to commercial prioritisation. (**AI**) (**DA**)

Skills

232. Knows how to use the internet to conduct transactions (e.g. purchasing, selling) and non-commercial ones (e.g. donating, gifting) of goods and services of all kinds.
233. Knows how and when to use machine translation solutions (e.g. Google Translate, DeepL) and simultaneous interpretation apps (e.g. iTranslate) to get a rough understanding of a document or conversation. However, also knows that when the content requires an accurate translation (e.g. in healthcare, commerce or diplomacy), a more precise translation may be needed. (**AI**)
234. Knows how to choose assistive tools to better access information and content online (e.g. screen readers, voice recognition tools), and to take advantage of voice output options to produce speech (e.g. to be used by individuals who have limited or no means to communicate orally). (**DA**)

Attitudes

235. Values the benefits of managing finances and financial transactions through digital means while acknowledging the associated risks.
236. Open to explore and spot opportunities created by digital technologies for one´s personal needs (e.g. seeking hearing aids that pair with one's most-used devices, such as phone, TV, camera, smoke-alarm). Critically aware that exclusive reliance on digital technologies can pose risks too.

DIMENSION 5: USE CASES

Employment Scenario: Use of a digital learning platform to improve my career opportunities

Foundation level 2: with the help of a colleague from the Human Resource department who I can consult whenever I need

- From a list of online courses that the Human Resources department has prepared, I can identify those that fit with my career improvement needs.
- While reading the study material on the screen of my tablet, I can make the font larger to help the readability.

Learning Scenario: UUse of a digital learning platform to improve my math skills

Foundation level 2: in the classroom with my teacher who I can consult whenever I need

- From a list of digital math resources prepared by my teacher, I can choose an educational game that can help me to practice my math skills.
- I can adjust the game's interface to match with my mother tongue.

DIMENSION 1: COMPETENCE AREA

5. PROBLEM SOLVING

DIMENSION 2: COMPETENCE

5.3: CREATIVELY USING DIGITAL TECHNOLOGY

To use digital tools and technologies to create knowledge and to innovate processes and products. To engage individually and collectively in cognitive processing to understand and resolve conceptual problems and problem situations in digital environments.

DIMENSION 3: PROFICIENCY LEVEL

Foundation level 1

At basic level and with guidance, I can:

- **identify simple** digital tools and technologies that can be used to create knowledge and to innovate processes and products.
- **show interest** individually and collectively in **simple** cognitive processing to understand and resolve **simple** conceptual problems and problem situations in digital environments.

Foundation level 2

At basic level and with autonomy and appropriate guidance where needed, I can:

- **identify simple** digital tools and technologies that can be used to create knowledge and to innovate processes and products.
- **follow** individually and collectively **simple** cognitive processing to understand and resolve **simple** conceptual problems and problem situations in digital environments.

Intermediate level 3

On my own and solving straightforward problems, I can:

- **select** digital tools and technologies that can be used to create **well-defined** knowledge and **well-defined** innovative processes and products.
- **engage** individually and collectively in some cognitive processing to understand and resolve **well-defined and routine** conceptual problems and problem situations in digital environments.

Intermediate level 4

Independently, according to my own needs, and solving well-defined and non-routine problems, I can:

- **differentiate** digital tools and technologies that can be used to create knowledge and to innovate processes and products.
- **engage** individually and collectively in cognitive processing to understand and resolve conceptual problems and problem situations in digital environments.

Advanced level 5

As well as guiding others, I can:

- **apply different** digital tools and technologies to create knowledge and innovative processes and products.
- **apply** individually and collectively cognitive processing to resolve **different** conceptual problems and problem situations in digital environments.

Advanced level 6

At advanced level, according to my own needs and those of others, and in complex contexts, I can:

- **adapt the most appropriate** digital tools and technologies to create knowledge and to innovate processes and products.
- **resolve** individually and collectively conceptual problems and problem situations in digital environments.

Highly Specialised level 7

At highly specialised level, I can:

- **create solutions to complex problems with limited definition** using digital tools and technologies.
- **integrate** my knowledge **to contribute to professional practice and knowledge and guide others** in creatively using digital technologies.

Highly Specialised level 8

At the most advanced and specialised level, I can:

- **create solutions to solve complex problems with many interacting factors** using digital tools and technologies.
- **propose new** ideas and processes to the field.

DIMENSION 4: EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES

Knowledge

237. Knows that engaging in solving problems collaboratively, online or off-screen, means that one can take advantage of the variety of knowledge, perspectives and experiences from others which can lead to better outcomes.
238. Knows that digital technologies and electronic devices can be used as a tool to support the innovation of new processes and products, in order to create social, cultural and/or economic value (e.g. social innovation). Aware that what creates economic value might endanger or enhance social or cultural value.
239. Knows that applications of Internet of Things (IoT) technology have the potential to be used in many different sectors (e.g. healthcare, agriculture, industry, automobiles, citizen science activities).

Skills

240. Knows how to use digital technologies to help turn one's idea into action (e.g. master video making to open a channel to share recipes and nutrition tips for a specific dietary style).
241. Can identify online platforms that can be used to design, develop and test IoT technologies and mobile apps.
242. Knows how to plan a strategy using multiple IoT and mobile devices to implement a task (e.g. use a smartphone to optimise energy consumption in a room by setting the intensity of the lights based on the time of day and ambient light).
243. Knows how to engage in resolving social problems through digital, hybrid and non-digital solutions for the problem (e.g. envisioning and planning online time banks, public reporting systems, resource sharing platforms).-

Attitudes

244. Willing to take part in challenges and contests aimed at solving intellectual, social or practical problems through digital technologies (e.g. hackathons, ideations, grants, joint initiation of projects).
245. Motivated to co-design and co-create new products and services using digital devices (i.e. end-user development) to create economic or social value for others (e.g. in makerspaces and other collective spaces).
246. Open to engage in collaborative processes to co-design and co-create new products and services based on AI systems to support and enhance citizens' participation in society. (**AI**)

DIMENSION 5: USE CASES

Employment Scenario: Use of a digital learning platform to improve my career opportunities

Interpediate level 3: by myself

- I can use a MOOC's forum to ask for well-defined information on the course I am following and I can use its tools (e.g. blog, wiki) to create a new entry for exchanging more information.
- I can engage in a collaborative exercise with other students using the mind map tool of the MOOC in order to understand a concrete issue in a new way.
- I can fix problems such as identifying that I am introducing a question or comment in the wrong place.

Learning Scenario: Use of a digital learning platform to improve my math skills

Interpediate level 3: by myself

- I can use the MOOC's forum to ask for well-defined information on the course I am following, and I can use their tools (e.g. blog, wiki) to create a new entry for exchanging more information.
- I can engage in exercises of the MOOC that use simulations to practice a math problem that I failed to solve correctly at school. Discussing the exercises in chat with other students helped me to approach the problem differently and improve my skills.
- I can fix problems such as identifying that I am introducing a question or comment in the wrong place.

DIMENSION 1: COMPETENCE AREA

5. PROBLEM SOLVING

DIMENSION 2: COMPETENCE

5.4: IDENTIFYING DIGITAL COMPETENCE GAPS

To understand where one's own digital competence needs to be improved or updated. To be able to support others with their digital competence development. To seek opportunities for self-development and to keep up-to-date with the digital evolution.

DIMENSION 3: PROFICIENCY LEVEL

Foundation level 1

At basic level and with guidance, I can:

- **recognise** where my own digital competence needs to be improved or updated.
- **identify** where to seek opportunities for self-developments and to keep up-to-date with the digital evolution.

Foundation level 2

At basic level and with autonomy and appropriate guidance where needed, I can:

- **recognise** where my own digital competence needs to be improved or updated,
- **identify** where to seek opportunities for self-developments and to keep up-to-date with the digital evolution.

Intermediate level 3

On my own and solving straightforward problems, I can:

- **explain** where my digital competence needs to be improved or updated,
- **indicate** where to seek well-defined opportunities for self-developments and to keep up-to-date with the digital evolution.

Intermediate level 4

Independently, according to my own needs, and solving well-defined and non-routine problems, I can:

- **discuss** on where my digital competence needs to be improved or updated,
- **indicate** how to support others to develop their digital competence.
- **indicate** where to seek opportunities for self-developments and to keep up-to-date with the digital evolution.

Advanced level 5

As well as guiding others, I can:

- **demonstrate** where my own digital competence needs to be improved or updated,
- **illustrate different** ways to support others in the development of their digital competence.
- **propose different** opportunities found for self-development and to keep up-to-date with the digital evolution.

Advanced level 6

At advanced level, according to my own needs and those of others, and in complex contexts, I can:

- **decide** which are the **most appropriate** ways to improve or update one's own digital competence needs,
- **assess** the development of others' digital competence.
- **choose** the **most appropriate** opportunities for self-development and to keep up-to date with new developments.

Highly Specialised level 7

At highly specialised level, I can:

- **create solutions to complex problems with limited definition** that are related to improving digital competence, and to find opportunities for self-development and to keep up-to-date with new developments.
- **integrate** my knowledge **to contribute to professional practice and knowledge and to guide others** in identifying digital competence gaps.

Highly Specialised level 8

At the most advanced and specialised level, I can:

- **create solutions to solve complex problems with many interacting factors** that are related to improving digital competence, and to find opportunities for self-development and to keep up-to-date with the digital evolution.
- **propose new** ideas and processes to the field.

DIMENSION 4: EXAMPLES OF KNOWLEDGE, SKILLS AND ATTITUDES

Knowledge

247. Aware that being digitally competent entails the confident, critical and responsible use of digital technologies to achieve goals related to work, learning, leisure, inclusion and participation in society.
248. Aware that difficulties experienced while interacting with digital technologies may be due to technical issues, lack of confidence, one's own competence gap or inadequate choice of digital tool to solve the problem in question.
249. Aware that digital tools can be used to help identify one's learning interests and setting personal goals in life (e.g. learning pathways).
250. Knows that online learning can offer opportunities (e.g. video-tutorials, online-seminars, blended-learning-courses, Massive Open Online Courses) to keep up-to-date with developments in digital technologies and to develop new digital skills. Some online learning opportunities also accredit the learning outcomes (e.g. through micro-credentials, certifications).
251. Aware that AI is a constantly-evolving field, whose development and impact is still very unclear. (**AI**)

Skills

252. Knows how to get reliable feedback on digital competence through self-assessment tools, digital skills testing and certification.
253. Capable of reflecting on one's level of competence, and to make plans and take action to upskill (e.g. by joining the municipality training course on digital competence).
254. Knows how to talk about the importance of recognising "fake news" to others (e.g. elders, youngsters) by showing examples of reliable news sources, and how to differentiate between the two.

Attitudes

255. Has a disposition to keep learning, to educate oneself and stay informed about AI (e.g. to understand how AI algorithms work; to understand how automatic decision-making can be biased; to distinguish between realistic and unrealistic AI; and to understand the difference between Artificial Narrow Intelligence, i.e. today's AI capable of narrow tasks such as game playing, and Artificial General Intelligence, i.e. AI that surpasses human intelligence, which still remains science fiction). (**AI**)
256. Open to ask to be taught how to use an application (e.g. how to book a doctor's appointment on the internet) rather than delegating the task to someone else.
257. Willing to help others to improve their digital competencies, building on their strengths and mitigating their weaknesses.
258. Does not get discouraged by the fast pace of technological changes but believes that one can always learn more about how technology can be used in today's society.
259. Readiness to value one's own potential, as well as others´ potential, to continuously learn using digital technologies as a lifelong process that requires openness, curiosity and determination.

DIMENSION 5: USE CASES

Employment Scenario: Use of a digital learning platform to improve my career opportunities

Intermediate level 4

- I can discuss the digital competence I need to be able to use MOOCs for my professional career with an employment adviser.
- I can tell her where I find and use MOOCs to develop and update my proficiency level of digital competences to improve my professional career.
- I can deal with any issue while I am doing these activities, e.g. I can evaluate whether new digital environments that I find while surfing are appropriate means of improving my digital competence' proficiency level.

Learning Scenario: Use of a digital learning platform to improve my math skills

Intermediate level 4

- I can discuss with a friend the digital competence I need to use the tools of a MOOC for my studies in math.
- I can show my teacher where I find and use MOOCs according to my learning needs.
- I can tell her which digital activities and pages I surf in order to keep my digital competence updated so that I can profit the most from digital learning platforms for my learning needs.
- I can deal with any issue while I am doing these activities, such as evaluate whether new digital environments that appear while surfing are appropriate for improving my digital competence and getting the most profit from the MOOC.

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