DIGITAL COMPETENCES DEVELOPMENT SYSTEM

DCDM – Digital competence development methodology, v.2

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ABBREVIATIONS

Apps: applications

DCDE: Digital competence development environment (Moodle training platform)

DCDM: Digital competence development methodology (content of this document)

DCDS: Digital competence development system (the overall project name)

DESI: Digital economy and society index

F2F: face to face

ICT: information and communication technology

LO: learning objects

LOUT: Learning outcome

LP: Learning path

LU: Learning unit

OER: open educational resources

UX: user experience

Introduction

The DCDS project in a few words

The DCDS project aimed to empower citizens, training providers and policy makers to address in synergy one of the key challenges that Europe is currently facing, namely the lack of basic digital skills, by supporting assessment of adult citizens' learning needs, valorisation of their existing skills, and design and delivery of inviting training opportunities adapted to individual learning needs.

Objectives of the project

- Improve the basic digital and transversal competences of 25+ years old citizens with low digital skills through an integrated system that combines distant learning on an online environment and face-to-face training (blended learning);

- Support non-formal training providers in planning and delivering flexible and modular training offers, aimed at improving basic digital competences of adults, which are mapped to the European Digital competence framework for all citizens DigComp 2.1;[1]

- Empower policy-makers and key stakeholders from different fields in formulating integrated policies for developing and recognising adult citizens' basic digital competences; and

- Collect and analyse evidence to substantiate innovative policies and practices through a field test of the DCDS in five European countries.

Intended recipients and content of this document

This document contains deliverable D9, which is the final version of the Digital competence development methodology (DCDM) of the DCDS project for the design and delivery of digital competence training to adult learners, following a blended learning approach. The methodology and the choices based on it have been tested in pilot training activities carried out in Spring 2019 in five DCDS partner countries (Greece, Italy, Latvia, Romania, and Spain).[2] D9 incorporates the feedback and lessons learnt from the pilots.

The DCDM was written in the first place to guide the DCDS project partners, but in its current version it may be of interest to any expert and practitioner working in adult education for digital competence development and in the implementation of the DigComp framework in this context.

This document presents the following components of the methodology.

Chapter 1 illustrates the steps and results of the DigComp framework implementation process for the purposes of the DCDS project. DCDS focuses exclusively on proficiency levels 1 and 2 (foundation level) across all 21 DigComp competences. The corresponding competence descriptors

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[1] See https://ec.europa.eu/jrc/en/digcomp/digital-competence-framework
[2] The DCDS Piloting report is available at http://www.dcds-project.eu/resources/

were specified into 95 learning outcomes (LOUTs) drawn from or inspired by various sources (Annex 1 lists the 95 LOUTs and Annex 6 all the sources used). These include the Digital Economy and Society Index (DESI) produced by Eurostat, which measures amongst other aspects the level of digital skills in the whole European population.

Chapter 2 explains why and how the DCDS methodology envisages that learners are profiled and take an initial self-assessment test of their digital competence before starting the course.

Chapter 3 illustrates the principles of formal and non-formal adult education adopted in DCDS and the importance of social learning aspects. The second part of the chapter clarifies how blended learning was envisaged in DCDS, by describing the facilitation, tutoring and teaching functions to be performed and briefly presenting the tools to support training delivery: various guides (for learners, trainers and training organisations) and the Digital Competence Development Environment (DCDE), based on a Moodle platform, to support and complement face-to-face training delivery in the premises of the DCDS partners' digital competence centres. The last part of the chapter briefly illustrates how blended learning occurred in the DCDS training pilots and makes some reflections on this experience.

Chapter 4 presents the training offer and instructional elements of DCDS. The training offer is structured into 4 learning paths (LPs), made of a total 65 learning units (LUs) organized into 18 thematic modules, which are designed to achieve all the 95 identified learning outcomes covering the 21 DigComp competence. Given the LPs estimated duration and the DCDS project's time limitations for the training pilots (they should total 60 hours: 40 hours of face-to-face training and 20 hours of online activity), individual participants were offered to take the so-called 'LP Base' plus one of three complementary LPs.

Chapter 5 provides background information on game design concepts, the results of a survey among DCDS partners on the desired gaming features and the prototype of the game developed by partner HOU for the DCDS project.

Finally, chapter 6 presents the evaluation system in DCDS which addresses learning assessment (both formative and summative), competence validation with the issuing of badges and course quality evaluation.

1. The DCDS DigComp implementation: learning outcomes and related transversal competences

1.1 Basic digital competence in the DigComp framework

The DCDS project set up a system for skill assessment, learning offer and validation and recognition, to develop the **basic digital competence** of low digitally-skilled 25+ years old adults in Europe. Basic digital competence is identified in DCDS as that defined at proficiency **level 1 and 2, or foundation level**, of the European Digital competence framework for all citizens known as **DigComp**, 2.1.

DigComp identifies 5 competence areas and 21 specific competences which outline the key components of the digital competence, as illustrated in Table 1 below.

Table 1 – DigComp 2.0 areas and specific competences

Area 1 – Information and data literacy
1.1 Browsing, searching and filtering data, information and digital content
1.2 Evaluating data, information and digital content
1.3 Managing data, information and digital content
Area 2 – Communication and collaboration
2.1 Interacting through digital technologies
2.2 Sharing through digital technologies
2.3 Engaging in citizenship through digital technologies
2.4 Collaborating through digital technologies
2.5 Netiquette
2.6 Managing digital identity
Area 3 – Digital content creation
3.1 Developing digital content
3.2 Integrating and re-elaborating digital content
3.3 Copyright and licenses
3.4 Programming
Area 4 – Safety
4.1 Protecting devices
4.2 Protecting personal data and privacy

4.3 Protecting health and well-being
4.4 Protecting the environment
Area 5 – Problem solving
5.1 Solving technical problems
5.2 Identifying needs and technological responses
5.3 Creatively using digital technologies
5.4 Identifying digital competence gaps

In DigComp, the competence areas 1, 2 and 3 deal with competences that can be retraced in terms of specific activities and uses. Essentially, they address the appropriation of common tools and methods to perform in a critical and correct way digital activities in the respective areas: information, communication and collaboration, and digital content production. Competence areas 4 and 5 are "transversal", as they concern safety issues and problem-solving elements that apply to any type of activity carried out through digital means. They are therefore present across digital competence domains, but two specific areas were defined to highlight the importance of these aspects for the appropriation of technology and safe digital practices.

The DigComp framework identifies also 4 overall and 8 granular proficiency levels of each competence, which reflect the interaction of three dimensions: the complexity of tasks, the autonomy in performing them and the key cognitive domain (according to Bloom's taxonomy) activated and prevailing at each level (see Figure 1).

Figure 1 - 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

Source: DigComp into Action. A user guide to the European Digital Competence Framework

Following the approach summarized in the above figure, DigComp 2.1 provides a description of all 168 competences by proficiency levels (21x8) in the framework and a pair of examples of use,

referring to the work and learning domains, for each of the 21 competences at one of the 8 proficiency levels.[3]

How is digital competence at foundation level -the target of the DCDS project- described in DigComp?

As an example, below we present the description in DigComp 2.1 of competence 1.1 at level 1 and 2 (foundation). We added the next (intermediate) levels to show how proficiency is seen to evolve in these first steps according to DigComp 2.1.

Table 2 - Description of competence 1.1 at foundation and intermediate levels

Information and data literacy			
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.			
Level 1	**Level 2**	**Level 3**	**Level 4**
At basic level and with guidance, I can:	*At basic level and with autonomy and appropriate guidance where needed, I can:*	*On my own and solving straightforward problems, I can:*	*Independently, according to my own needs, and solving well-defined and non-routine problems, I can:*
1.**identify** my information needs,	● **identify** my information needs,	● **explain** my information needs,	● **illustrate** information needs,
2.**find** data, information and content through a simple search in digital environments,	● **find** data, information and content through a simple search in digital environments,	● **perform well-defined and routine** searches to find data, information and content in digital environments	● **organise** the searches of data, information and content in digital environments,
3.**find** how to access these data, information and content and navigate between them.	● **find** how to access these data, information and content and navigate between them.	● **explain** how to access them and navigate between them.	● **describe** how to access to these data, information and content, and navigate between them.
4.**identify** simple personal search strategies.	● **identify** simple personal search strategies.	● **explain well-defined and routine** personal search strategies.	● **organise** personal search strategies.

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[3] Only in one case, for explanatory purposes, DigComp 2.1 provides application examples for all 8 levels of competence 1.1 Browsing, searching and filtering data, information and digital content.

It can be seen that the distinction between level 1 and 2 has to do exclusively with the degree of **autonomy and guidance** needed to perform the tasks. Given that any trainer's goal and learner's desire is to enhance one's autonomy as much and as quickly as possible, we set as the **overarching aim of DCDS to lead learners to the condition where they can do whatever task is involved (see below) with autonomy or "*appropriate guidance where needed".[4]*

Level 3 and 4 show that, besides greater autonomy, proficiency increases with the complexity of the activity's content (in this case and at this stage from "simple" searches to "well-defined and routine" searches) and of the related cognitive processes and other abilities (identify -> explain, organise etc.).

The "I can …" part of DigComp competence descriptions is written in terms of learning outcomes, which tend to be quite general, often abstract. As explained in the DigComp into Action! guide, this was done on purpose, to allow users of the framework to adapt it to diverse needs and conditions, and to make it technology-neutral. Given that digital technology constantly changes, this aimed to protect the framework from rapid obsolescence. However, in order to use the framework for assessment and training purposes as in DCDS, we needed to translate/specify DigComp descriptors in more operational ways.

1.2 The identification of learning outcomes in DCDS

Given our understanding of competence, and specifically of digital competence, as knowledge in action, and the need to set it within an instructional framework, we adopted Robert Mager's view of performance-based learning objectives or learning outcomes, as made of three components:[5]

■ **performance** is an observable behaviour which identifies specifically what the learner should be able to do after the instruction
■ **conditions** under which the learning is to occur
■ **criterion** that describes how well the learner must perform in order to be acceptable

The focus of our work for Digital Competence Development Methodology (DCDM) has been on the performance component, and the goal was to specify one or more LOUTs for each one of DigComp 21 competences, as they are described at foundation level (level 1-2) in DigComp 2.1. Whenever possible, we referred to the LOUTs in bullet points, after the "… I can …" statements of competence description in the tables of section 3 (after p. 23) of DigComp 2.1 report.[6]

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[4] We want to underline the fact that the guidance->autonomy dynamics is a recursive one for most people in the use of digital technology throughout their life. Even when we qualify ourselves as "advanced users", we may end up asking for help/guidance at least the first time that we face some technical novelty or challenge, especially if such help is easily available from a colleague, an IT department, a more experienced friend or relative etc. Learning is always somehow a social process.

[5] Mager, Robert F. (1997). Preparing instructional objectives, a critical tool in the development of effective instruction (3rd ed.). Atlanta, Ga.: Center for Effective Performance. ISBN 1879618036

[6] See Carretero, S., Vuorikari, R, and Punie, Y. (2017) "DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use".

As we have seen in the previous section, in DigComp 2.1 the LOUTs at level 1 and 2 are the same; what changes is the learner's degree of autonomy. For this reason, without distinguishing between the two levels, we looked for and/or defined LOUTs that meet four general criteria:

a.   a performance that concerns what is "**basic**" and hopefully "**simple**" in each specific domain. This might be an unavoidable starting point, a key building block (such as the basic functions of an application, device etc.) or, in a context of multiple opportunities, aspects and dimensions, it might mean selecting only a few (1-2-3) of them;

b.   for which a significant level of **autonomy** can be expected to be reached relatively easily (e.g. through a short training experience like that of the DCDS pilots);

c.   whose attainment, in isolation or along with other LOUTs, entails an interesting, **meaningful learning experience and achievement for the learners**;

d.   with positive **social inclusion** implications, given the target population and general aims of the DCDS project.

We used these criteria to guide our LOUTs identification/definition work, but not all of them could be applied to each item. Besides, it is evident that the above criteria are not objective and the resulting choices are inevitably contestable. In order to mitigate these limitations, the LOUTs identification/definition process was performed as follows:

1.   we started with an accurate analysis of official DigComp reports (in particular DigComp v.1 and 2.1) and related documents and identified a preliminary list of LOUTs. In particular, we looked at the Human capital component of DESI (see section 1.2 below);

2.   we analysed and identified LOUTs (both convergent with those of step 1 and new ones perceived as interesting under the above criteria) from other initiatives which have addressed basic digital competence, by referring to DigComp or similar frameworks (see Annex 6). A provisional long list of LOUTs resulting from these first two steps was presented and discussed in depth at two DCDS partners meeting in May and July 2018;

3.   using the above criteria, we (AECA) "voted" (include/exclude) the finalised long list of LOUTs which emerged from the May meeting and submitted it again to the DCDS WP3 partners. Besides voting it, they were requested to motivate exclusions (or revisions) and any suggestions for additional items;

4.   the short-listed LOUTs were then used for the production of deliverable *D5 Content of self-assessment tool* and for the definition of the training offer illustrated in the DCDMv1 (D6). Both processes revealed some shortcomings in the LOUTs list being used, which was then revised into the current version presented in Annex 1 of this report.

The pilot tests carried out in Spring 2019 highlighted that overall the proposed LOUTs are coherent with a notion of foundation level proficiency, even though some might be considered close to the intermediate level. Most important, they showed that the full set of LOUTs addressed by DCDS is very demanding on learners, given the wide range and number of topics in each DigComp area and in total, and requires a longer training time the initially estimated, especially with weaker learners.

In the next section we illustrate the first step of analysis in LOUTs specification, which considered how digital competence is measured in the DESI human capital indicator.

1.3 DCDS learning outcomes and the EU Digital Economy and Society Index (DESI)

1.3.1 BASIC DIGITAL COMPETENCE IN DESI

The DigComp official reports do not explain what is to be understood as an individual with "basic digital" competence or what developing basic digital competence really means. DigComp 1.0 clearly stated that no one is expected to develop all 21 DigComp specific competences at the highest level and that people ultimately should develop the digital competences that are relevant and needed for their work and everyday life.

A step towards answering to these questions has been made by DG CONNECT and Eurostat with the creation of the EU Digital Economy and Society Index, known as DESI. The level of citizen's digital competence/skills, which is one of DESI's components, is defined by referring to DigComp and is measured from the answers to the annual survey which monitors ICT use by households and individuals.[7] The survey is coordinated by Eurostat and run by national statistical offices of all Member States.

The survey uses as indicators of digital competence the respondent's answers about whether they have done or not given digital activities, in the recent past. The survey pre-dates the publication of DigComp, so existing questions had to be mapped onto the DigComp framework.

The Indicator column in **Table 3** below lists the digital activities mentioned in the survey questions, which were associated with DigComp competences, as highlighted by their number (1.1, 2.1 etc.). The table shows that 4 out 5 DigComp competence areas are covered by some survey questions, while the whole area 4 (Safety) and other specific competences (1.2, 2.3, 2.4, 2.5, 2.6, 3.3, 5.3, 5.4) are missing.[8] The right column shows the criteria used to assign the competence value at area level, based on the respondent's answers (yes/no) to the question: "Have you accomplished in the last three months…?"

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[7] The tables in the text are based on EC DG CONNECT "Digital Skills Indicator – derived from Eurostat survey on ICT usage by Individuals. Methodological note – 2015".

[8] In reality, Eurostat has been addressing other issues, such as online safety, through additional survey modules in specific years. But the list of questions presented here is relatively constant, making it possible to assess the evolution of answers over time.

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Table 3 - Indicators and aggregation method used in DESI for digital competence

Area	Indicator	Criteria to assign competence value for the area
Information	1.1 Finding information about goods or services 1.1 Obtaining information from public authorities services' websites 1.1 Seeking health-related information 1.3 Copying or moving files or folders 1.3 Saving files on Internet storage space	**Basic:** only one item **Above basic:** more than one item
Communication	2.1 Sending/receiving emails 2.1 Telephoning/video calls over the internet 2.1/2.2 Participating in social networks 2.2 Uploading self-created content to any website to be shared	**Basic:** only one item **Above basic:** more than one item
Software skills for content manipulation	**A – Basic** 3.1 Used word processing software 3.1 Used spreadsheet software 3.1 Used software to edit photos, video or audio files **B – Above basic** 3.2 Created presentation or document integrating text, pictures, tables or charts 3.1 Used advanced functions of spreadsheet to organise and analyse data (sorting, filtering, using formulas, creating charts) 3.4 Have written a code in a programming language	**Basic**: at least one item from A and none from B **Above basic**: at least one item from B
Problem solving	**A – Problem solving** 5.1 Transferring files between computers or other devices 5.1 Installing software and applications (apps) 5.1 Changing settings of any software, including operational system or security programs **B – Familiarity with online services** 5.2 Internet banking 5.2 Online purchases (in the last 12m) 5.2 Selling online 5.2 Used online learning resources	**Basic**: one or more items only from A or only from B **Above basic**: at least one item from A <u>and</u> from B

Source: see footnote 7

For the creation of the DESI aggregate indicator, four categories are defined for individuals' skill levels:[9]

"**above basic**" = "above basic" in all 4 domains

"**basic**" = at least "basic" in all 4 domains

"**low**" (missing some type of basic skills) = one or more "none" in one to three domains (accomplished an activity at least in one of the four domains)

individuals with "**no skills**" = four "none" (no items ticked in all four domains, despite declaring having used the Internet at least once during last 3 months) + those persons who used the Internet more than 3 months ago or never used it.

One can see that the level and progress of digital competence, from the DESI perspective, reflects the number of digital activities that an individual can perform and the diversity of competence domains (number of areas) covered. Only within Area 3, dealing with digital content production (lately called "Software skills for content manipulation"), a distinction is explicitly made between simpler (basic) and more complex (above basic) activities.

In Annex 5, we provide the figures about the digital skills of the EU population according to DESI 2018.

1.3.2 DCDS LEARNING OUTCOMES MATCHING DESI ACTIVITIES

In the DigComp specification process that we carried out for DCDS, DESI human capital indicator was considered from the very beginning, as our project was designed by referring explicitly to the about 40% of the EU population that Eurostat found with no or low digital skills. DCDS set as its goal to improve the proficiency of its customers from the no-low skills level at least to the **basic digital skills** level. From the DESI indicator's perspective this entails accomplishing at least one activity in each of the four domains. With this goal in mind, and considering the criteria mentioned in section 1.1, we selected from the DESI list a number of activities to be included among the DCDS learning outcomes. These are listed by the corresponding LOUT number in the right column of **Table 4**.

Table 4 - DESI activities considered for DCDS learning outcomes

Area	Activity in the DESI indicator	DCDS LOUTs n°
Information	1.1 Finding information about goods or services	1.1.5
	1.1 Obtaining information from public authorities/services' websites	2.3.3
	1.1 Seeking health-related information	
	1.3 Copying or moving files or folders	1.3.1, 1.3.4

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[9] See EC DG CONNECT "Digital Skills Indicator – derived from Eurostat survey on ICT usage by Individuals. Methodological note – 2015" available at http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=14342

	1.3 Saving files on Internet storage space	1.3.5
Communi-cation	2.1 Sending/receiving emails	2.1.6, 2.4.1
	2.1 Telephoning/video calls over the internet	2.1.3
	2.1/2.2 Participating in social networks	2.1.5, 2.2.3
	2.2 Uploading self-created content to any website to be shared	2.2.4
Software skills for content manipulation	**A – Basic**	
	3.1 Used word processing software	3.1.2
	3.1 Used spreadsheet software	3.1.3
	3.1 Used software to edit photos, video or audio files	
	B – Above basic	
	3.2 Created presentation or document integrating text, pictures, tables or charts	3.1.4
	3.1 Used advanced functions of spreadsheet to organise and analyse data (sorting, filtering, using formulas, creating charts)	
	3.4 Have written a code in a programming language	3.4.2
Problem solving	**A – Problem solving**	
	5.1 Transferring files between computers or other devices	1.3.5
	5.1 Installing software and applications (apps)	5.1.2
	5.1 Changing settings of any software, including operational system or security programs	5.2.3
	B – Familiarity with online services	
	5.2 Internet banking	
	5.2 Online purchases (in the last 12m)	
	5.2 Selling online	
	5.2 Used online learning resources	5.4.2

Table 4 shows that a few DESI activities were left out of the picture:

■ "seeking health-related information" is not explicitly listed as a DCDS LOUT, because the choice of the online service areas/topics for the training is left to the project partners, as they should reflect the interests of their students and/or local inclusion policy priorities;

■ the "use of software to edit photos, video or audio files" was deemed too complex as an activity for DigComp foundation level;

■ the same consideration holds for the "Use of advanced functions of spreadsheet to organise and analyse data", although sorting and using simple formulas are included in LOUT 3.1.3;

■ the capabilities "to read a flow chart identifying the operations and the order of their execution" and "to create a basic program based on a simple flowchart or algorithm" have been included despite being acknowledged as above basic also in DESI, for two reasons. First, it was identified as the simplest way to address DigComp competence 3.4 Programming, given our project's promise to cover <u>all</u> DigComp competences. Second, it is seen as an opportunity to explore with low digitally-skilled adult learners the viability and

usefulness of some simple training approaches to coding that are used with children and young people (based on Scratch);[10]

■ "Internet banking", "online purchases" and "selling online" are three activities which entail quite complex abilities, typically associated with an intermediate competence level. The "use of online learning resources" may also be seen as quite complex (of course, depending on the type of resources). However, as DCDS is based on a blended learning approach, which entails by definition the use of online learning resources, it de facto contributes to the development of related competences. This ability is also considered very important to sustain digital inclusion.

The coverage of most DESI competence indicator activities and the presence of LOUTs 3.1.4, 3.4.2 and 5.4.2 will make it possible, in principle, for successful DCDS learners to achieve not only the "basic", but also the "above basic" skills level in a DESI perspective (which requires to score "above basic" in all four domains).

Before moving to the work done on other sources, we want to underline that the DESI digital competence indicator itself has undergone an evolution in the past few years, showing the inevitable "instability" of any choice made about specific digital activities and performances. **Table 5** lists the activities that were removed and those added in 2017, compared to the 2014 survey.[11]

Table 5 - Activities removed and added to DESI 2017 for measuring digital skills

Activities removed in 2017	Activities added in 2017
Information	
Reading or downloading online news, newspapers, news magazines	Seeking health-related information Saving files on Internet storage space
Communication	
Posting messages to chat sites	Participating in social networks
Software skills for content manipulation	
Creating websites or blogs	Used software to edit photos, video or audio files Used advanced functions of spreadsheet to organise and analyse data (sorting, filtering, using formulas, creating charts)

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[10] Eventually, this aspect was not tested, as LP Explore, which includes programming aspects, could not be delivered in any DCDS pilot for time constraints.

[11] See EC DG CONNECT "Measuring Digital Skills across the EU: EU wide indicators of Digital Competence", May 2014.

Problem solving	
Connecting and installing new devices	Transferring files between computers or other devices
Familiarity with online services	
Making an appointment with a practitioner via a website	Used online learning resources

1.4 Overview of DCDS learning outcomes

After looking at the DESI human capital indicator, we explored several other sources of inspiration about the LOUTs for DCDS and the result of this process was a long list of about 150 LOUTs. Following the internal verification processes with WP3 partners described in section 1.2, a shorter list of 107 LOUTs was identified. Further streamlining activities produced the current "final" list of 95 LOUTs (see Annex 1), which has been the basis for the design of training and evaluation activities in DCDS.

Table 6 below shows the number of LOUTs that we identified for each DigComp 21 competence and 5 areas. Competences have from only 2 up to 8-9 LOUTs each.

Competences with 2-3 LOUTs tend to be inherently more complex, because they call at play transversal competences (e.g. critical thinking, communication and social skills) and other specific cognitive abilities or content (e.g. computational thinking or understanding of intellectual property issues) which are demanding for and often missing among "weak" learners. As we shall briefly explain in the next section, the development of several digital competences does not only depend on, but can indeed also contribute to the development of transversal competences. Nevertheless, it was difficult to identify meaningful LOUTs for these competences at foundation level.

On the other hand, competences with several LOUTs (6 to 9) are those which address foundation aspects in each area and often include LOUTs which are relevant across different competences and even areas (e.g. 1.1.5 I can find information on the web using well known search engines, or 2.1.5 I can create an account to access and use digital services).

In any case, as the reader of Annex 1 will notice, some LOUTs address single, simpler abilities, whereas others have a more composite, articulate character. When several elements/options are mentioned within a LOUT (often following the words "such as…, or "e.g." and with an open end "…etc."), they are given as examples and the expectation is that teachers and learners will not necessarily deal with all of them.

A specific observation must be made about competence 2.3 Engaging in citizenship through digital technologies and its LOUTs. In our specification process, we decided to put most LOUTs concerning the use of public (and also private) online services under this competence, by referring to the DigComp 2.1 descriptor "To participate in society through the use of public and private digital

services ".[12] We left the LOUTs under 2.3 intentionally open, i.e. we did not specify which services areas or specific services should be addressed, as this is to be decided by training organisations, reflecting trainees' interests and local policy priorities.

Table 6 - Number of DCDS LOUTs by DigComp competences and areas

DigComp competence	LOUTs n°
1.1 Browsing, searching and filtering	8
1.2 Evaluating info and content	3
1.3 Managing info and content	6
sub-total Area 1	**17**
2.1 Interacting	9
2.2 Sharing	4
2.3 Engaging in citizenship	8
2.4 Collaborating	3
2.5 Netiquette	5
2.6 Managing digital identity	4
sub-total Area 2	**33**
3.1 Developing content	6
3.2 Integrating and re-elaborating	4
3.3 Copyright and licenses	3
3.4 Programming	2
sub-total Area 3	**15**
4.1 Protecting devices	7
4.2 Protecting personal data and privacy	6
4.3 Protecting health and well-being	4
4.4 Protecting the environment	2
sub-total Area 4	**19**
5.1 Solving technical problems	4
5.2 Identifying needs and responses	3
5.3 Creatively using	2
5.4 Identifying digital competence gaps	2
sub-total Area 5	**11**
Total LOUTs	**95**

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[12] Other DigComp specifications put LOUTs concerning the use of online services under 5.2 Identifying needs and technological responses, as an ever-wider range of public and private services which address all kinds of people's needs are being moved to digital delivery channels.

1.6 Transversal competences in DCDS

Concerning transversal skills, Annex 6 "Glossary" of DCDS deliverable "Policy influence strategy plan" (D20) refers that these skills:

"*are those typically considered as not specifically related to a particular job, task, academic discipline or area of knowledge, but as skills that can be used in a wide variety of situations and work settings. These skills are increasingly in high demand for learners to successfully adapt to changes and to lead meaningful and productive lives.*
Examples include:
- *Critical and innovative thinking*
- *Inter-personal skills (e.g. presentation and communication skills, organizational skills, teamwork, etc.)*
- *Intra-personal skills (e.g. self-discipline, enthusiasm, perseverance, self-motivation, etc.)*
- *Global citizenship (e.g. tolerance, openness, respect for diversity, intercultural understanding, etc.)*
- *Media and information literacy such as the ability to locate and access information, as well as to analyse and evaluate media content (UNESCO 2014).*"[13]

In the context of DCDS, the following transversal skills have been taken into account:

Transversal skill	How addressed in DCDS
Critical thinking Ability to evaluate a set of data, facts, observable phenomenon etc. (e.g. discriminate between useful and less useful details) in order to make reasoned judgments, solve a problem or make a decision.	Competence 1.2 concerns the ability to evaluate data, information and digital content. In particular, LOUT 1.2.1 addresses the ability to evaluate whether information or content that I find online is or is not reliable (including hoaxes and fake news).
Communication and presentation skills (inter-personal) Ability to transmit and share ideas and information in a clear and concise way with one's interlocutors, to listen to them and to confront them effectively	Area 2 Communication and collaboration competences concern the ability to communicate through digital technologies and some basic "rules" (netiquette) for such communication. LOUTs 4.2.1 and 4.2.3 address the protection of personal data and privacy in this context. LOUT 3.1.4 concerns the ability to use presentation software.

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[13] https://unevoc.unesco.org/go.php?q=TVETipedia+Glossary+A-Z&id=577

Transversal skill	How addressed in DCDS
Team work (inter-personal) Willingness to work and collaborate with others, having the desire to build positive relationships aimed at achieving the task assigned.	The teaching approach of DCDS and the use of the DCDE learning environment will promote collaboration activities among the learners. Competence 2.4 concerns the ability to collaborate using digital technology.
Autonomy (intra-personal) Ability to carry out assigned tasks without the need for continuous supervision using one's own resources	The very aim of DCDS is to bring learners to DigComp level 2, which is essentially a matter of gaining greater autonomy in the simple use of digital tools and services.
Accuracy (intra-personal) It is the attitude to be accurate, diligent and attentive to what you do, taking care of the details towards the final result	Accuracy is encouraged by the use of digital tools and services, as lack of it can prevent the successful achievement of a desired result (when strict procedures are embedded into digital systems) or may cause great damages in highly interconnected environments.
Continuous learning (intra-personal) It is the ability to recognize one's own gaps and areas of improvement, acting to acquire and constantly improve one's own knowledge and skills. This is related to Learning-to-learn ability.	Competence 5.4 addresses specifically the ability of identifying digital competence gaps and finding opportunities for self-improvement. Digital literacy training supported by the DCDE is itself an experience of continuous learning.
Problem Solving (intra-personal) It is an approach to work that, by identifying priorities and critical issues, makes it possible to identify the best possible solutions to problems.	Area 5 Problem solving competences concern the ability to solve simple technical problems with digital technology and to use it to meet personal needs.
Global citizenship Tolerance, openness, respect for diversity, intercultural understanding, etc.	LOUT 2.5.4 concerns the ability to recognise socially/ethically inappropriate online behaviour and communication such as hate speech, flaming, trolling, cyber-bullying, online stalking etc.
Manage information (media and information literacy) Ability to effectively acquire, organise and reformulate data and knowledge from different sources towards a defined goal	Area 1 Information and data literacy competences concern the ability to acquire, evaluate and organise digital data and information found on the Internet and produced in everyday life and work context.

2. Learner profiling and initial competence assessment

The DCDS learning offer presented is designed in a modular and flexible way so that it can be adapted and delivered according to the interests and needs of the highly heterogenous target population, represented by adults 25+ years old with no or low digital competence.

In order to make use of such flexibility, however, training organisations and trainers must acquire sufficient information about the learners' background and motivations for developing digital competence and about their starting level in this competence area. For this purpose, the DCDM envisages that all candidate learners should go through an **initial profiling step** and, except those without any digital experience and skills, should also take a **self-assessment test**.

2.1 Profiling DCDS course participants

In order to be registered to a DCDS training offer and to create an account to access the DCDE learning platform, all potential participants must fill a simple profiling form (either directly or with the help of a facilitator) about the following items:[14]

Items of candidate trainees' profile

- **Personal identity**: first and last name, email, age, city and country, current/last occupation, unemployment status (Y/N);

- **Education and general skills**: education level*, any past digital training experiences (Y/N), any non-digital skills gained from life/work experiences [free text box]

- **Interests & life plans** related to digital skills development:**

  o Leisure and social life

  o Employability

  o Learning about ICT

  o Other [free text box]

* *7 levels from primary school to doctorate or equivalent title*
** *5 answering options from "not important at all" -> "very important"*

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[14] For the specific purposes of the DCDS project pilots, the information collected for the learner registration process on the DCDE platform was complemented by an interview that explored additional aspects (e.g. the availability of digital equipment and internet connectivity at home, expectations about the course and others).

An important aspect also checked at this stage is the presence/absence of foundational digital skills[15] which are needed to access and start using the DCDE platform.

This information feeds into the **DCDS Recommender tool** (see later) and aims also to help facilitators and teachers (who can access learner profiles) better adjust and manage the learning process.

2.2 Self-assessment test and Recommender Tool

Part of the DCDS approach is the request made to the learners to take a self-assessment test (SAT) available on the DCDE platform, before starting the training course. Given that the DCDS target group are adults with no or low digital competence and the DCDS priority goal is to support their digital inclusion, the self-assessment test was designed to identify the training candidates' initial digital competence weaknesses, to be addressed by the blended training offer, rather than to profile their overall digital competence. A proper assessment of learners' digital competence is performed at the end of each module during the training experience (see later).

Potential candidates with no digital skills at all are only asked to provide the personal profiling data seen above and can skip the online self-assessment test on digital competence, as their need for training is self-evident. The so-called 'absolute beginners' must be offered an initial face-to-face training to enable them to start using a computer, perform simple operations with keyboard and mouse and eventually access the DCDE platform.

All other candidates who can access the DCDE platform and use it on their own, or with the help and guidance of a facilitator, are asked to take the test. For the DCDS project training pilots, the SAT was designed and used as illustrated below. Based on the pilots' findings, some changes were made in the way the SAT operates, along with a suggestion about an alternative way to deliver it. These are described later on.

The SAT is structured into 21 modules corresponding to the 21 DigComp competences. The sequence of assessment steps that the user was expected to follow with the first SAT implementation (for the DCDS training pilots) is graphically illustrated in the next page.

In each SAT module, candidates must first answer a (variable) number of **self-assessment questions** (**SA-Qs**) which address all or almost all the LOUTs identified for that competence (in total there are 95 SA-Qs). The module's introduction is always formulated as: "We ask you to evaluate how do you … navigate, collaborate … (*reference to the general competence theme*). We now list some activities below and you have to grade them using the following scale:
1 = I have no skills at all; 2 = my skills are very poor; 3 = I have some skills, but not sufficient to operate on my own; 4 = I have sufficient skills to operate on my own"

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[15] Such skills, also known as "area zero skills" (e.g. in the Unesco Global digital competence framework) are the ability to switch on/off digital devices, use the mouse, touchscreen, keypad, connect to a wireless network and others. If the initial interview shows that such skills are missing, the potential trainee of the DCDS course should be requested, and possibly offered, to take a short introductory digital literacy course to acquire them.

Then, for each LOUT (occasionally for a combination of LOUTs) a self-assessment statement is provided "My ability to … *text drawn from the LOUT* … is:…" and the respondent must select a number/answer from the above scale. In the first SAT version, depending on the answer, the test continued along two paths.
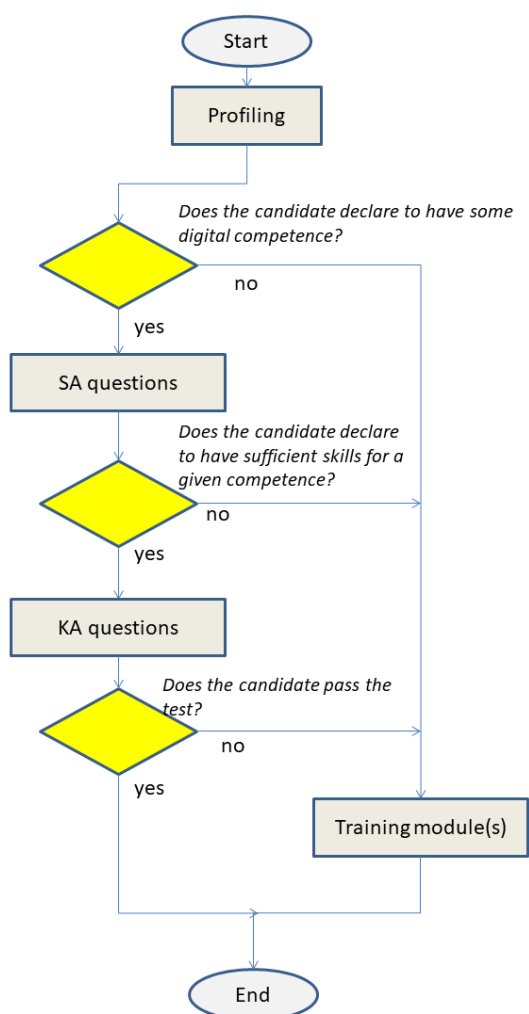
If the answers to all SA-Qs of a given module was 1 or 2 (showing a clear need for training) the learner was requested to move on to the next module, without answering to the KA-Qs. Behind this rule, there was also the intention to shorten and simplify test-taking for the weaker candidates.

If the answer to any of the SA-Qs in a module was 3 or 4, the SAT submitted to the candidate additional **knowledge & ability questions** (**KA-Qs**, 41 in total). These are designed to test the actual conceptual or operational knowledge of the respondent on a sub-set of key LOUTs of the given competence (including, but not necessarily, the LOUTs that got the 3-4 score). These key LOUTs were selected to check the presence/absence of crucial components of each competence: if respondents fail on the related questions, this highlights a serious competence weakness.[16]

If the answer to any KA-Q is wrong, the respondent gets a feedback message encouraging him/her to take some training on that competence. If the answers to all KA-Qs of the module are correct, the respondent is informed about this result and told to continue with the SAT.

As explained below, the above conditional rule to move from SA-Qs to KA-Qs was eventually removed.

In the DCDS training pilots, learners were expected to go through all the modules of the SAT and the corresponding results are recorded by the system. Learners can monitor their progress visually through two different progress bars (one for SA-Qs and one for KA-Qs) and access a report where they can view their performance separately for the two types of questions, with percentages achieved in each case. See **Figure 2** next page (the Range column shows the number of SA and KA questions in each module).

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[16] Deliverable *D5 Contents of the self-assessment tool* illustrates how the key LOUTs for KA-Qs were selected and the related questions created (see http://www.dcds-project.eu/resources/)

Figure 2 - Example of SAT results presentation

Grade item	Grade	Range
📁 **Self-Assessment Tool EN**		
☑ SA "Browsing, Searching and Filtering"	1 (13 %)	0–8
☑ KA "Browsing, Searching and Filtering"	0 (0 %)	0–5
☑ SA "Evaluating data and information"	1 (25 %)	0–4
☑ KA "Evaluating data and information"	2 (100 %)	0–2
☑ SA "Managing data, information and digital content"	0 (0 %)	0–4
☑ KA "Managing data, information and digital content"	0 (0 %)	0–2
☑ SA "Interacting through digital technologies"	0 (0 %)	0–9
☑ KA "Interacting through digital technologies"	-	0–4
☑ SA "Sharing through digital technologies"	0 (0 %)	0–4
☑ KA "Sharing through digital technologies"	-	0–2

Following the DCDS project plan, a **Recommender Tool** was developed to provide suggestions to the teacher (expressed as a % priority, top priority =100%) on which learning path/s of the DCDS training offer each learner should follow, after taking the SAT.

The Recommender Tool provides facilitator-tutor and/or teachers with information about SAT completion for each learner (completed, not completed)[17] and, next to it, the percentage recommendations on the four learning paths that the learner may follow. These percentages come out of a specific algorithm that receives input from the SAT results and learner's profile, especially answers about his/her interests & life plans.

Once the learner has completed the self-assessment test, the facilitator-tutor and/or teachers may discuss with him/her the test results and enroll the learner to the learning path/s that best suit his/her profile and expectations. Teachers can force SAT completion for a learner, by a simple click in the Recommender tool. This allows the teacher to enroll the learner to any learning path regardless of SAT results and completion. If they want or need to (see next section), learners can go back to the SAT at any time and take the modules they did not take before (but they are not allowed to take a module for a second time). More details about the Recommender Tool are available in the DCDE Teacher Guide (see http://www.dcds-project.eu/resources/).

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[17] A related function of the Recommender Tool is represented by the Progress tool, which shows the learner's progress and results in all SAT modules.

2.3 Revised self-assessment test and flexible delivery scenario

As previously anticipated, by allowing SAT respondents to skip the KA-Qs when they state that they have no/low abilities in all LOUTs of a module, the intention was also to shorten and simplify test taking. However, in the training pilots, respondents soon discovered that by answering 3-4 to any SA-Q they could access the related KA-Qs, which were perceived as being more "real" and fun. Almost all respondents therefore ended up answering to all KA-Qs, making the test very long to complete also for weak learners. As a result, partners decided to remove the conditional restriction in the second version of the SAT, found under DCDE v.2.

As also mentioned earleir, in the DCDS training pilots, course participants were requested to take all 21 SAT modules together before enrolling them to the learning paths (LPs) on the DCDE platform and starting the proper course. The pilots experience showed that this procedure is too demanding for some learners and, in other circumstances, may not be necessary.

On the one hand, going through all the modules and taking 95 SA-Qs and 41 KA-Qs is cognitively challenging and tiring, and may require a lot of time. This is especially true for 'weak' learners (e.g. people with a lower educational background, migrants with low L2 proficiency and others) and those with limited digital experience (as the DCDE platform is a somewhat complex digital environment).[18] On the other hand, if for any reason training organizations decide not to use the Recommender tool and to register learners to any LP on some other ground, the SAT may be delivered in batches rather than all together, at the start of the selected LPs.[19] Taking the SAT modules related to the learning modules of a LP before studying it, is an opportunity for the learner to get an initial idea of the topics that will be developed by the teacher and of his/her initial competence level in those topics. The teacher, in turn, get a general overview of where the students stand on those topics, before starting teaching them.

Annex 4 provides three tables to help managing a flexible SAT delivery: Table 16 shows the correspondence between the current four DCDS LPs and the related SAT modules; Table 17 the correspondence between a revised LP structure (with LP BASE split into three shorter LPs as in Figure 10) and the related SAT modules, and Table 18 the correspondence between learning modules and SAT modules.

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[18] In the pilots, a few classes made of very weak learners took up to 2-3 hour to complete the SAT.
[19] It is recommended to associate SAT delivery with LPs, rather than learning modules because, due to the way SAT modules were created, 5 learning modules are not addressed by any SAT module. Besides, the SAT delivery process would become fragmented over 14 learning modules.

3. Adult education and blended learning in DCDS

3.1 Non-formal and formal learning

The DCDS training offer integrates both formal and non-formal learning. In the field of adult education there is no preferred option: depending on the target group and the context in which the training takes place, it may be useful to focus more on the first or second type. Therefore, on a case by case basis, the training activity may be characterized by a fully non-formal approach, by a variable combination of formal and non-formal parts, or it may be characterized by a fully formal approach.

For example, specific user needs may require a completely non-formal approach, in which the participant works alongside a facilitator who helps him/her in solving specific problems, by providing him/her with various resources to be used in presence and at a distance (exercises, advice, procedures, tasks, checks, readings, applications, etc..). The solution of specific problems will represent, in this case, the development of the underlying skills. Moving towards greater formality, we may have an alternation between individual support moments and learning activities structured by interest groups. Finally, there will be completely formal situations: a classroom group will be formed which will follow a blended course having as its object one or more learning paths and will see the intervention, in addition to the facilitator, also of the e-learning tutor and the teacher (see section 3.3). The latter solution is the one adopted in the DCDS training pilots.

3.2 About adult education and social learning

The DCDS training offer is aimed at adults, generally older than 25 years. They are people with a low level of digital skills and often (albeit not always) this also reflects a low level of education.

The main aims to enhance digital skills in this segment of the population can be assumed to be:

1) avoiding social exclusion
2) avoiding professional exclusion
3) overcoming practical limitations caused by poor digital skills (access to services, exercise of rights...).

A further motivation may be a specific interest in the digital world, but this reason is likely to be less relevant than the previous ones. In these conditions, the motivation to undertake and continue the training will be mainly linked to the visibility of the final objective. Participants will be motivated by how close they see the solution to their personal problems.

In this perspective, the DCDS training offer is inspired by the principles of adult education and in particular, by Malcolm Knowles' "Andragogy", whose principles are summarised in Figure 3.

Figure 3 - Knowles' 4 principles of andragogy
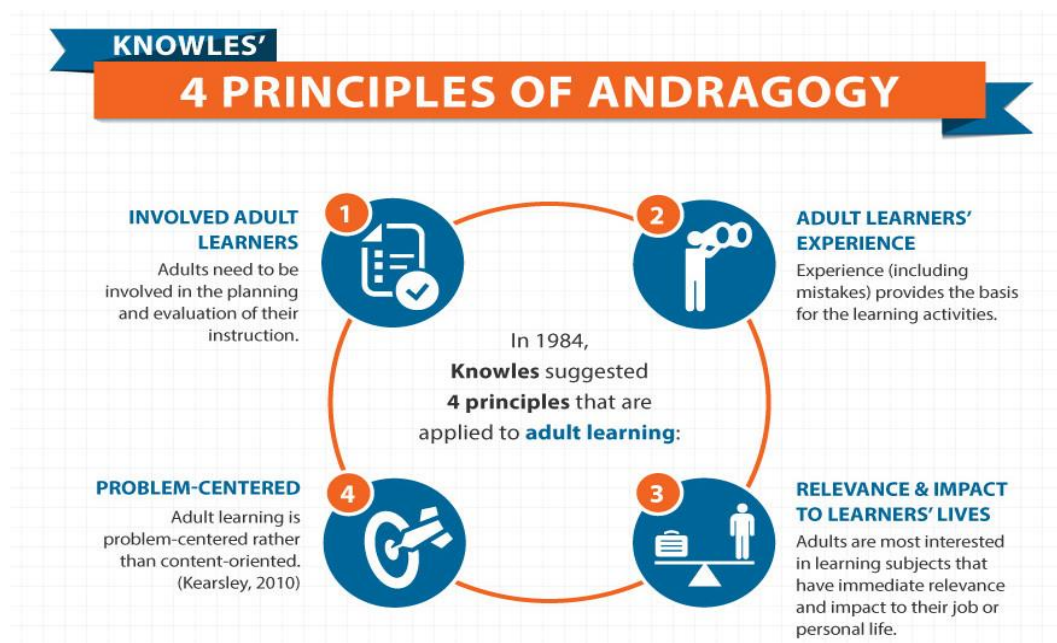
1 - **Involved adult learners**: adults remain motivated to learn if they are aware of the objectives set and the methods to achieve them. In our case, the participants, after the self-assessment, will negotiate the training path with the facilitators. In addition, the teachers, tutors and Learners Guides published on the e-learning platform will explain the details of the learning paths and the units that make them up. This first principle calls upon the role of the facilitator who should assess the skills of the participant, motivate him/her to the training and agree with him/her a training path.

2 – **Adult learners' experience**: as adults are attached to their life experiences, the learning process must consider the experience of the participants. This second principle is satisfied by the following factors. 1) The detailed profiling of the participants will allow teachers and tutors to customize learning activities and their interventions. 2) The blended course is sufficiently open to allow to link the classroom teaching and the possible e-activities at a distance with the experience of the participants. 3) The platform will systematically collect feedback from participants (mostly through a standard 'student report' to be filled after performing a practical exercise). Tutors and teachers can then review activities, methods and examples based on the feedback obtained. The second principle involves the roles of tutor and teacher, who are responsible for the educational quality of the activities and try to enhance the experience of the participants.

3 – **Relevance and impact on the learners' lives**: the training must have an impact on the participants' lives. Participants remain motivated to learn if they address personally significant issues in the training. The profiling of the participants (point 2) will help to map their main interests and orient the teaching towards exploiting and valuing them. The third principle involves the whole provider organisation, because all roles should contribute to make the training experience relevant for the life of the participants.

4 – **Problem centred**: adults learn better if the teaching is focused on problems to be solved rather than content to be memorised. The main task of the 40 hours of classroom teaching in the DCDS pilots will be to propose practical problems and ways to solve them to the participants. The fourth principle also involves the three main roles: the facilitator because he/she selects the learning path based on the priorities and problems that the participant wants to address; the tutor and the teacher as they activate teaching resources more or less directly aimed at addressing these priorities and problems.

This approach to adult education is strengthened in a social learning key, by exploiting the exchange of ideas and resources within the learning community developed in the classroom. Participants are encouraged to work together in pairs and in small groups (no more than 4 participants per group), with the main purpose of stimulating peer tutoring and peer review processes. Whereas class groups should be as homogeneous as possible in terms of participants' pre-existing digital skills (to avoid having learners who 'run' too fast or to slow compared to the others), within each group it might is useful to mix learners with different gender, age and education background, but similar interests and motivations to develop digital skills.

3.3 Blended learning in DCDS

The potential users of DCDS are people with low levels of digital skills and often (not always) also low education. With these users, it is advisable to take an approach that gradually exposes them to the use of digital tools and services, as their autonomy progresses (see Figure 4). For this reason, the project opted for a blended path, in which activities in presence and at a distance alternate, maintaining a strong integration between them. The training offer is thus divided into learning units that contain activities that can be carried out both in presence and at a distance (see chapter 4).

Figure 4 - Evolution of face-to face vs. distant learning activities during the course
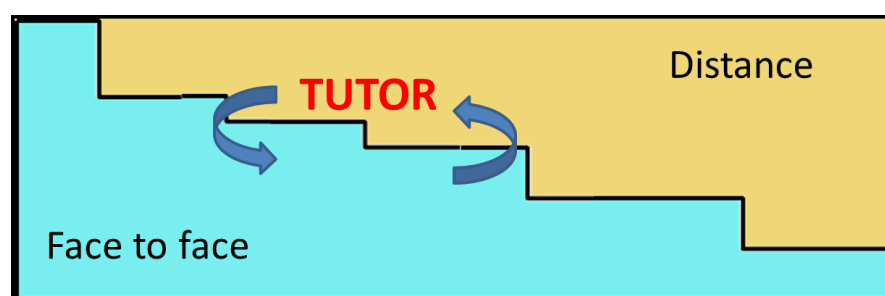
The main task of the tutor and teacher will be to monitor the development of the activities, so that the part of learning in presence and the remote part proceed in an integrated and harmonious way.

The blended learning methodological option is general and invariant to any other choice. This means that each blended training path, formal or non-formal, individualized or personalized, consists of an alternation of activities in presence and at a distance.

Blended learning paths are such, because presence and distant activities not only alternate in time, but also because these activities are integrated. For example, during a lesson in presence some exercises are presented to be done at a distance and their solutions are then discussed in a forum. The observations made in the forum are later presented in the classroom, where the next lesson takes its cue from the conclusions of the forum, etc. This sequence of activities is integrated, because it is not possible to extrapolate any single activity without losing its meaningfulness.

The order and alternation within the blended learning activities are defined in the training programme agreed between the facilitator and the participant and can be modified by the teacher and the tutor, in agreement with the participant.

The activities and resources designed for the distance learning part of training are available on the Digital Competence Development Environment (DCDE) platform based on Moodle, which provides teachers, tutors and participants with content and pre-defined tools, illustrated in chapter 4.

FUNCTIONS TO BE PERFORMED IN INITIAL RECRUITMENT AND BLENDED LEARNING

Facilitation and tutoring

As we have seen in chapter 2, participants to DCDS courses are expected to be profiled and to take a self-assessment test before starting the learning process. The users of DCDS resources may therefore need to be supported in these initial activities and in the choice of the training path. This entails the following steps:

1) interviewing the participant by collecting the set of personal data listed in chapter 2.1 (needed also to register the user on the DCDE platform), checking his/her self-perceived digital competence and trying to understand what improvements he/she expects/aims to obtain, and for which purposes;
2) explaining to the participant how the DCDS/DCDE resources can help him/her obtain the results discussed in the previous step, starting from the use of the SAT;
3) explaining to the participant the SAT and, if needed, helping him/her start and carry out the self-assessment process;
4) examining with the participant the SAT results, including by comparing it with the participant's own perception of the his/her capabilities (see step 1) and showing the training priorities suggested by the Recommender tool (see chapter 2.2);
5) discussing with the participant the available and advisable training options, and comparing them with the results he/she wants to obtain;
6) helping the participant choose explicitly and consciously the learning paths in which to engage and discussing any doubts. This activity ends with the registration of the participant to one or more learning paths that he/she will follow.

Tutoring continues the facilitation activity within the learning path chosen by the participant. This is the reason why facilitation and tutoring can be effectively performed by the same person.

The most challenging tutoring goal in a blended learning path is the integration of activities performed in presence and at a distance, in order to obtain the desired results.

Tutoring should be done at three levels:

a) individual participants

b) groups of participants

c) the learning path

Working with **individual participants** should build upon the knowledge and relationship developed with them in the initial facilitation stage. The tutor supports the participant by facilitating the use of online resources and classroom activities; helps him/her to reflect on the experiences made; helps him/her to connect the new contents learned with his/her previous experience (this scaffolding action is crucial with adult learners); facilitates the participant's relations with the peer group; and finally, the tutor is the natural interface with the organisation that provides the training.

When working with **groups**, tutoring should accelerate the transformation of the group's participants into a learning community. In a social learning perspective, tutoring promotes collaboration among the participants and facilitates the development of peer consulting and peer support relationships among them. The tutor also controls and encourages participation in distance activities involving peer sharing and collaboration.

In the delivery of the **training course**, the tutor collaborates in the didactic planning; gives his/her opinion on contents and verification tests; guarantees the usability of the resources dedicated to distance learning, and manages the transition from presence to distance.

Teaching

Teaching is the didactic-specialist function of delivering technical disciplinary content.

In a blended learning context designed by the DCDS project, teaching entails delivering lessons in presence and at a distance by using the online resources available on the DCDE platform, but also preparing or overviewing the production of additional digital learning materials such as learning objects (LOs), conditional Moodle lessons, readings, exercises. Teachers also overview and adapt when needed the assessment tests, promote and monitor their delivery and assess their outcomes.

The functions described above are contiguous and complementary. In short, facilitation starts the dialogue with and support process of the participant; tutoring continues this process and oversees the whole didactic process; teaching is devoted to content delivery and assessment. In almost all the DCDS training pilots, also due to project budget constraints, one person eventually acted on all three functions.

TECHNICAL AND OTHER SUPPORT TOOLS FOR BLENDED LEARNING

As already anticipated, the main technological resource in DCDS is the DCDE Moodle platform that allows to manage and deliver a range of online resources and activities designed to be carried out at a distance or in the classroom, at individual and group level, in both synchronous and asynchronous modes.

Participants access the platform with rights that allow them, as they acquire the needed ability, to participate in the educational activities by reading content on the lessons' key topics, carrying out practical exercises, uploading files when requested, responding to learning quizzes, writing on the forums and other tasks. The platform has been designed to offer a "gym" to develop digital skills through the use of the platform itself during classroom time and at a distance. Obviously, participants are also involved in online activities which go beyond the platform itself (e.g. internet navigation).

Facilitators, tutors and teachers have access to the DCDE with rights that allow them to register participants, add and edit activities and resources, compose and manage work groups, prepare and manage assessment tests and register.

To support the use of the DCDE platform for the delivery of DCDS blended courses, several tools have been developed besides this very document (all available at http://www.dcds-project.eu/resources/):

- **DCDE Teacher Guide** and **DCDE Learner Guide**, which provide explanations and instructions about registration and use of the DCDE platform respectively to facilitator-tutors and teachers and to the learners;

- **DCDS Trainer Handbook**, which summarizes the key features of the DCDM and illustrates more in details (also through several annexes) the learning materials on the DCDE platform, along with the DCDS training, learning assessment and validation approaches;

- **Teacher tips**, a document complementing the Trainer Handbook (it is Annex 8) which suggests for each learning module and its learning units (see chapter 4) the content items to be addressed, a list of supporting materials (tools and useful links) and additional learning activities and practical tasks to be done with/by the learners (besides those available on the DCDE platform).

THE BLENDED LEARNING EXPERIENCE IN THE DCDS PILOTS

In the context of the DCDS project pilots, the distance learning component of the blended learning course was practiced on a limited scale and only by some participants. The availability of the DCDE platform to support learning was welcome as an interesting novelty by almost all those who registered to the DCDS training pilots. However, learning to use the platform turned out more difficult than expected for most of them and the proposal by the teachers to use the DCDE for independent 'homework' activity was accepted only by a minority of participants.

The reasons for this, based on pilots evaluation results, are: the limited (sometimes very limited) digital capacity of the trainees; the difficulty for many of them to work/study on their own without constant support; and a clear preference among most participants for a learning setting rich of direct social interaction opportunities with peers and teachers. Also, the DCDE was available in its full functionality for a limited time (DCDS courses themselves involved only 40 hours of classroom-based activity), so it is difficult to tell how its uptake by low-digitally skilled adult learners might have developed, along with growing familiarity, over a longer period of time.

In any case, the DCDE platform was very much used in the pilots, but for most participants almost exclusively during classroom time. Teachers presented and explained in each lesson the related content on the platform and, sometimes, demonstrated the tasks to be performed on it. In this way, learners could count on the immediate availability of face-to-face support from the teacher and also from peers. Therefore, use of the DCDE turned out essentially as an experience of digitally-supported training/learning with teacher/tutor presence. This was very much appreciated by the teachers – and for similar reasons also by learners- for the support and scaffolding of classroom work provided by the DCDE platform, and for the increased flexibility and individualisation of activities in the learning process afforded by it. For instance, teachers can ask quicker learners to carry out some tasks on the platform while they take time to explain something to other learners.

4. Training offer and instructional elements

In this chapter, we illustrate the overall structure of the DCDS training offer and the characteristics of its basic building block, the learning unit (LU), with some examples of its content.

4.1 Learning paths, modules, units and outcomes

The architecture of the DCDS training offer is illustrated in **Figure 5** below which in the upper part refers to Learning Path Base and its first module.

Figure 5 - Structure of DCDS training offer
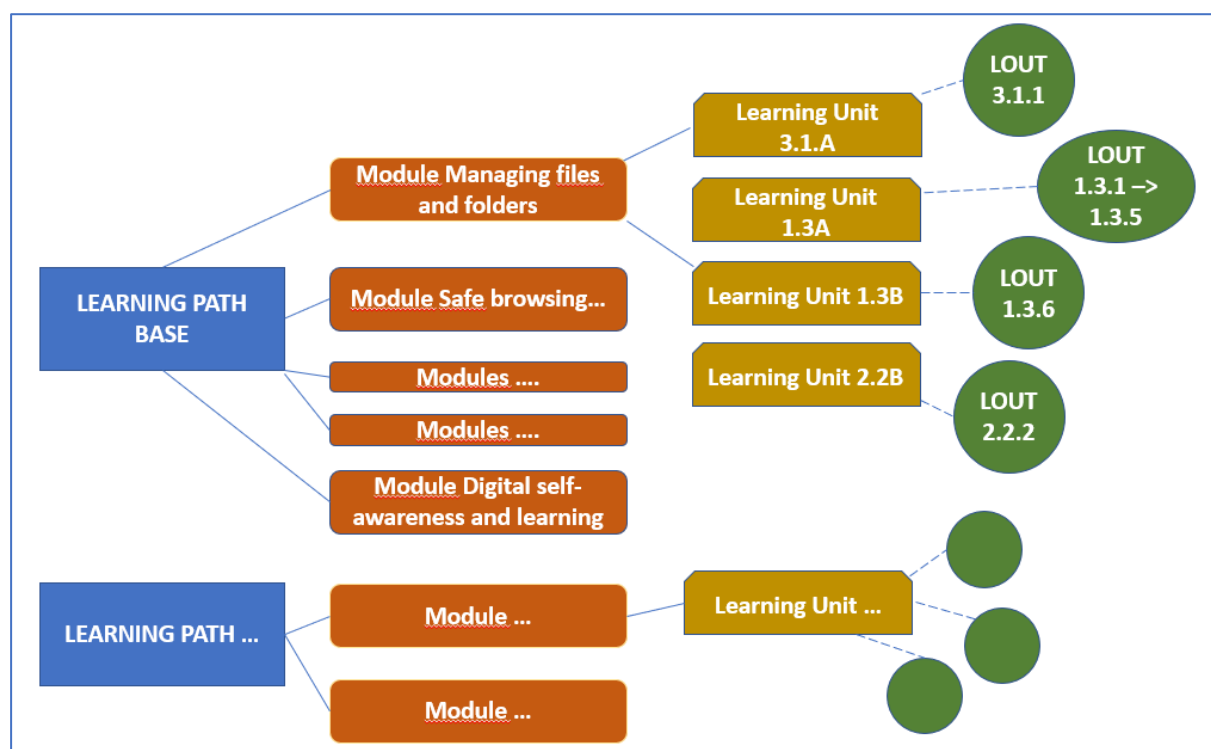
As we saw in chapter 1, each of the DigComp 21 competences has been articulated in a sequence of **learning outcomes** (LOUTs) associated with DigComp's foundation level, for a total of 95 LOUTs (see Annex 1). LOUTs are the performance counterpart of competences: each competence is identified with the performances expressed by the set of LOUTs that derive from it. Therefore, the LOUTs guarantee the connection between the DigComp framework and the didactic activities intended to produce the competences: they are the didactic objectives of those activities.

The **learning unit** (LU) is the set of educational activities sufficient to generate the performance of one or several LOUTs connected and belonging to a given competence. It is the same to assert that

one or more LOUTs are the didactic objective of their LU. According to this principle, all DigComp competences have one or more LUs designed to generate them (in DCDS, at foundation level). Annex 2 illustrates the 21 DigComp competences and 65 LUs designed to address them at foundation level. The structure of a LU is described later in chapter 4.2.

LUs are organised for didactic purposes into 18 thematic learning **modules**.[20] Learning modules therefore comprise a set of LUs belonging to a relevant/coherent range of digital activities (e.g. all the units related to Files and folders management) that from a didactic point of view are better addressed together in a proposed sequence. As illustrated in Annex 3, Modules have a variable number of LUs and duration, including 5 modules which have only one LU each. As explained later, Summative assessment in DCDS courses is carried out at the end of each Module.

Modules in turn are aggregated into 4 sequences called learning paths. Annex 3 illustrates the LUs, their modules and the LOUTs covered by each LP. A **learning path** (LP) is a complete training offer whose purpose is to develop sufficient skills to manage a digital environment or scenario. To clarify this concept, we present below the learning paths proposed for the DCDS pilots (the sum of LUs is 66, because one is duplicated in two LPs):

- **BASE** (37 LUs): at the end of this LP, participants should be able, at a basic level, to safely surf the Internet, receive and send emails, manage data and digital content, find and make a simple, initial use of online public and private services. This LP addresses basic skills which are crucial to begin taking advantage of the digital world and for digital inclusion. Participants who successfully complete this LP also meet the "DESI requirement" as they would be able to carry out at least one DESI activity (see Table 4) in each of the four areas considered.

- **Communication and social media** (17 LUs): this LP addresses a **leisure/social life scenario**, where participants can develop skills for online digital communication, collaboration and sharing, and the use of social networks.

- **Digital content creation** (8 LUs): in this LP participants can develop digital skills for the creation of digital content (text documents, spreadsheets and presentations) which are particularly relevant in an **employability scenario**.

- **Exploring ICT** (4 LUs): this LP addresses elements such as programming, environmental protection, creative use of ICT, the solution of technical problems which can be viewed as the first steps of an **ICT exploration scenario**.

The above LPs have been designed taking into account the time constraints/goals set for the DCDS pilots (40 hours of training split between 40 hours of face-to-face training and 20 hours of distant learning) and with the idea of providing a common LP (BASE) to all participants followed by one of the main complementary LPs and eventually LP Explore ICT. A visual representation of the DCDS training offer is provided in Figure 6.

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[20] In terms of content, the Modules are 18. However, one of them, devoted to Copyright and licences, is offered twice, in two complementary learning paths (Communication and social media and Digital content creation). The total number of Modules counted in the DCDS courses is therefore 19.

Figure 6 - Articulation and duration of DCDS training offer
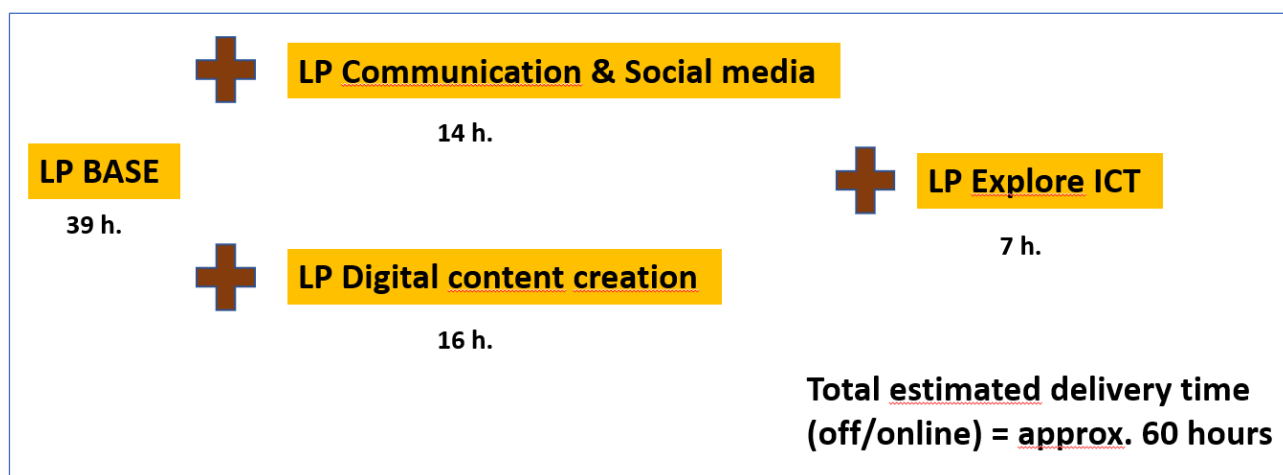
The DCDS pilots experience showed that the time needed to deliver the envisaged training content depended very much on some key learners' features -especially, previous experience with digital technology and training, level of general education, familiarity with autonomous learning and proficiency in the course language (for foreign learners)- but that it was overall underestimated. In particular, in some pilots, LP BASE took almost the entire classroom time available. In future implementations of the DCDM, DCDS partners therefore recommend to plan course duration in a flexible way, depending on target groups, and possibly to manage the delivery of LP BASE in a modular way, by breaking it down into three parts, as illustrated in Annex 4.[21]

The LPs identified above often cross different DigComp competences in order to provide a meaningful learning experience for participants. Each of the four LPs contains and develops, or contributes to developing, only certain DigComp competences.

It is important to underline that by taking different LPs, participants enhance their digital competence by extending "horizontally" their knowledge and the range of digital skills that they can master across a growing number of DigComp competences. However, in terms of DigComp's "vertical perspective" of 8 proficiency levels for each competence, the DCDS LPs contribute to develop digital competence only at the foundation level (1-2). In a few words, this means managing simple digital and cognitive tasks related to the use of digital tools and services with substantial autonomy, and some guidance only when needed.

The tables in the next pages show, for each LP, the LUs which are included and which competences they allow to complete. The grey cells in Table 7 highlight that finishing LP BASE allows participants to develop a rich range of skills and to complete 7 out of 21 DigComp competences. But in order to complete other competences, participants need to take the complementary LPs. On the other hand,

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[21] The revised LP BASE structure takes into account, in particular, the fact that more and more adult learners today develop already some competence in simple online information searches and basic e-mail communication by using their smartphone, and may therefore start a DCDS course from LP BASE2.

Table 7 - Learning path: Base

Learning Units	DigComp competence completed
1.1A Browsing	1.1 Browsing, searching and filtering data, information and digital content
1.1B Searching	
1.1C Maps and localization services	
1.1D Download and save	
1.2A Evaluating data, information and digital content	1.2 Evaluating data, information and digital content
1.3A Managing data, information and digital content	1.3 Managing data, information and digital content
1.3B Compressed files/folders	
2.1B Creating and saving contacts	
2.1E Creating an account	
2.1F Sending receiving email	
2.2A Sharing files	
2.2B Sharing folders	
2.3A Public online services	2.3 Engaging in citizenship through digital technologies
2.3B Private online services	
2.3C Recognizing information and interactive online services	
2.3D Filling an online form	
2.3E Interacting with services	
2.4A Mails to multiple recipients	
2.5A Basic email and online writing netiquette	
3.1A Software overview	
3.1B Basic word processing	
3.1F Taking screenshots	
4.1A Hardware risk	4.1 Protecting devices
4.1B Software risks and protection	
4.1C Update and backup	
4.1D Password	
4.1E Suspicious messages	
4.2B Private navigation	
4.3A Preventing physical and psychological risk	
4.3C Entertainment	
5.1B Downloading and installing Apps	
5.1C Support online	
5.1D Support tools on device	
5.2A Choosing digital tools	5.2 Identifying needs and technological responses
5.2B Customizing digital tools	
5.4A Identifying competence gaps	5.4 Identifying digital competence gaps
5.4B Learning solutions	

in the complementary LPs (Tables 8, 9 and 10), one can see how the completion of many competences requires to have done before LP BASE, possibly just by passing the summative tests of its modules, in case the learner has already enough competence in those topics.

Table 8 and Table 9 show that competence 3.3 Copyright and licences (at its corresponding module) is present in two LPs. This is because this competence is important both when sharing online digital content, especially when produced by others (LP Communication and social media), and when re-

using somebody's digital content within one's own digital artefact, such as a citation in a text or an image in a presentation (LP Digital content creation).

Table 8 - Learning path: Communication and social media

Learning Units	DigComp competence completed
2.1A Synchronous and asynchronous 2.1C Video calls 2.1D Checking calls and messages 2.1G Sending receiving SMS 2.1H Instant messaging 2.1I Forum and blog	2.1 Interacting through digital technologies *after completing LP Base (2.1B, E, F)*
2.2C Sharing via social media 2.2D Uploading content	2.2 Sharing through digital technologies *after completing LP Base (2.2A, B)*
2.4B Managing a videocall 2.4C WhatsApp groups	2.4 Collaborating through digital technologies *after completing LP Base (2.4A)*
2.5C Social media netiquette 2.5D Inappropriate behaviour	2.5 Netiquette *after completing LP Base (2.5A)*
2.6A Safe personal account management 2.6B Managing reputation	2.6 Managing digital identity
3.3A Copyright and licenses	3.3 Copyright and licenses
4.2A Protecting personal data	4.2 Protecting personal data and privacy *after completing LP Base (4.2B)*
4.3B Protecting children	4.3 Protecting health and well-being *after completing LP Base (4.3A, C)*

Table 9 - Learning path: Digital content creation

Learning Units	DigComp competence completed
3.1C Basic spreadsheet 3.1D Basic presentation 3.1E Taking videos and pictures	3.1 Developing digital content *after completing LP Base (3.1A, B, F)*
3.2A Editable and uneditable files 3.2B Text editing 3.2C Spreadsheet editing 3.2D Presentation editing	3.2 Integrating and re-elaborating digital content
3.3A Copyright and licenses	3.3 Copyright and licenses

Table 10 - Learning path: Exploring ICT

Learning Units	DigComp competence completed
3.4A Programming	3.4 Programming
4.4A Protecting the environment	4.4 Protecting the environment
5.1A Identifying technical problems	5.1 Solving technical problems *after completing LP Base (5.1B, C, D)*
5.3A Opportunities for creative digital use	5.3 Creatively using digital technology

Table 11 provides a synthetic view of the learning paths' contribution (either full or partial) to the achievement of each competence.

Table 11 - Contribution of learning paths to achieving DigComp competences

DigComp competence	LP Base	LP Comm. & social media	LP Digital content creation	LP Exploring ICT
1.1 Browsing, searching and filtering data, information and digital content	Full			
1.2 Evaluating data, information and digital content	Full			
1.3 Managing data, information and digital content	Full			
2.1 Interacting through digital technologies	Partial	Partial		
2.2 Sharing through digital technologies	Partial	Partial		
2.3 Engaging in citizenship through digital technologies	Full			
2.4 Collaborating through digital technologies	Partial	Partial		
2.5 Netiquette	Partial	Partial		
2.6 Managing digital identity		Full		
3.1 Developing digital content	Partial		Partial	
3.2 Integrating and re-elaborating digital content			Full	
3.3 Copyright and licenses		Full	Full	
3.4 Programming				Full
4.1 Protecting devices	Full			
4.2 Protecting personal data and privacy	Partial	Partial		
4.3 Protecting health and well-being	Partial	Partial		
4.4 Protecting the environment				Full
5.1 Solving technical problems	Partial			Partial
5.2 Identifying needs and technological responses	Full			
5.3 Creatively using digital technology				Full
5.4 Identifying digital competence gaps	Full			
Estimated duration (hours)	39	14	16	7

As mentioned before, in the DCDS pilots, participants were required to attend LP Base (estimated duration 39 hours counting both face-to-face and distance learning), then to choose one of the two main alternative LPs and, if interested and with some time left, take also the Exploring ICT LP. A course to cover all 21 competences has an estimated duration of 76 hours, hence it was not compatible with the DCDS pilots' time limit of 60 hours.

4.2 The structure of a Learning Unit

For each LU, a course is available on the Moodle platform with the structure visualised in Figure 7.

Figure 7 - Content of an exemplary DCDS learning unit on Moodle

Managing Data, Information and Content

After studying this material, you will be able to

1. Create, locate, open, copy, move, rename and delete files in my digital device
2. Identify file types based on their extension
3. Organise (create, delete, copy, name) folders to store files on my digital device
4. View and sort files inside a folder in different ways
5. Create, open, copy, move, delete files and folders on a) external/portable storage device (hard disk, USB memory, memory card, CD), b) cloud storage service

Online Learning

Key concepts for Managing data, information and digital content

Exercises

Learning Quiz: Recognize file extensions

Practical Exercise: Manage files and folders

Student report "Manage files and folders"

The first section is the **Introduction** and contains:

- Title of the LU (in red)
- Set of learning objectives (LOUTs) addressed by the LU

The second section **Online learning** contains:

- An interactive e-book (1-2 pages long) briefly presenting the key concepts of the particular LU and providing links to additional useful materials on the web. This is common reading

material (called 'core content' in DCDS) which has been translated in the languages of all project partners

▪ (optional) Additional learning material (called 'auxiliary content' in DCDS) made available by the teacher, typically in national language, related to the topics and activities of the LU. [22] Such materials might be presentations used in the classroom lesson, tutorials, reading materials, audio-video screen captures, podcasts and so on.

The third section **Exercises** contains the interactive content of the LU to be used in classroom activities and at a distance:

▪ learning quizzes (similar, sometimes identical to KA-Qs of the SAT). Most learning quizzes provide automatic formative feedback in case of a wrong answer

▪ practical exercises, which are tasks assigned by the platform (again part of the core content), very often with a degree of content customization/localization to be performed by the teacher

▪ (optional) other types of exercises that require interaction with the platform and that might be prepared on purpose by the teacher.

LUs are accessed from within the learning Module they belong to, by selecting the appropriate number (which will be indicated by the teacher or by clicking on the Module's LU buttons) as below:

The last button in the Module's content bar gives access to the Module's Summative test (see chapter 6).

On the DCDE platform, learners can access any LU belonging to a LP and Module they are registered to. There is no constraint about which sequence to follow and the teacher may decide to use/suggest a different order than that proposed on the platform, which was created based on the partners' past teaching experience. If needed, the teacher may also ask learners to take a LU which is in another Module and then go back to the current Module.

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[22] There are in fact two ways to make available auxiliary content to learners on the DCDE platform. The main option is for teachers to upload any content into the DCDE OER repository and then post a link to the relevant resources into the Forum of the LU's Module. Alternatively (or as a complementary option), if the additional resources are to be shared also with other teachers, they can be uploaded directly to the Online learning section of the LU.

5. Gamification in DCDS

5.1 Background information on game design concepts

5.1.1 TYPES OF GAME AND PLAY

The distinction between game and play is often overlooked, but it is fundamental to our understanding of gamification, as it showcases the duality of rigid and fluid structures. According to Roger Caillois,[23] a game (which he calls *ludus*) is a goal-directed activity with specific rules set in a specified context. In contrast, play (called *paidia*) is much more subjectively defined, less rigid, and relies more on sensory elements; being much less formal than a game, it does not require a clearly demarcated or precisely defined context. With that distinction in mind, Caillois defined the four fundamental types of games and play[24]:

1. ***Agôn:*** competition is the main motive (need to prove skill and superiority over opponents)
2. ***Alea:*** based on chance – largely unrelated to skill
3. ***Mimesis:*** the main interest lies in acting out / role-playing
4. ***Ilinx:*** relies on sensory stimulation, especially the kinaesthetic and proprioceptive aspects (bodily / physical dimension of playfulness)

In the context of a gamified educational app, it would be prudent to de-emphasize #2 (*alea*), since it has no direct relation to the learners' skills and abilities. Type #1 (*agôn*) is at the forefront of such a design, since learning is a methodical process through which the learner improves in tangible and less tangible ways, proving his/her mastery over the learning material. But even elements belonging to types #3 (*mimesis*) and #4 (*ilinx*) can be incorporated. Mimetic paradigms fit in well with narrative structures and the control of fictional characters. Ilinx is arguably more difficult to incorporate in its original form, which is greatly dependent on bodily activity as a means of playfulness, but it can be abstracted away as sensory stimulation in general.

Player categories and typologies

A very basic distinction of player types revolves around commitment. Hard-core or dedicated players commit much more time and resources (e.g. money) to gaming compared to casual players (for whom a casual game on their smartphone during a bus ride is usually enough). As evidenced by the multitude of game genres (e.g. role-playing, strategy, simulation, arcade, adventure, first-person shooters, etc.), not all games appeal to all players. Consequently, not all gamification mechanisms

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[23] Caillois, R. (1958/2001). Man, Play, and Games. Urbana and Chicago: University of Illinois Press
[24] Of course, quite often playful activity incorporates elements from all these types – but these may be regarded as the "archetypes" – or (if a quasi-mathematical approach is desired) a basis of the space defined by the game vs. play continuum.

and techniques will be equally appealing and/or effective to all types of learners. This is where player typologies come into play. Bateman and Boon[25] have proposed four fundamental player types:

- **Conqueror:** highly competitive, seeks to dominate opponents in every way possible; enjoys feeling of domination and the "bragging rights" that come along with it
- **Manager:** mainly interested in personal efficiency, seeks to know every single aspect of the game
- **Wanderer:** seeks out new experiences, enjoys exploration of the game world, is less competitive than the previous gamer types
- **Participant:** mostly interested in the social aspects of gaming.

Combining these categories with the different types of playful activity as proposed by Caillois, one may arrive at a potential cross-tabulation of these constructs with the aim of highlighting which types of playful activity would be appreciated the most by each player type.

	Agôn	*Alea*	*Mimesis*	*Ilinx*
CONQUEROR	+			
MANAGER	+	–	+	–
WANDERER	No particular preference – possibly ilinx, in the form of sensory / intellectual stimulation			
PARTICIPANT			+	+

The concept of flow

An important question when designing both games and educational material is the mapping between learner skills and task difficulty. Whether a task is difficult or easy is largely dependent on the learner's existing abilities and skills. If he/she is not challenged adequately, he/she will feel bored with the task and he/she will lose interest quickly. If, on the other hand, the task is too difficult, it will be perceived as a stumbling block and lead to frustration and, ultimately, withdrawal from the activity. However, if the task is slightly more difficult than the users' skills would warrant, it can lead to a contest of mastery and to a deeply immersive state termed *flow* by Csikszentmihalyi.[26] This ideal challenge level is not constant; it changes over time as the players' skills evolve. It is important, therefore, to ensure that the learning material's difficulty scales appropriately so that the learner is kept within the desired zone termed "flow channel". Personalization of the material is required for this to occur, and it should be flexible; in other words, it needs to be a constant adaptive process, not simply a checklist to be completed prior to the learner starting to use the educational platform.

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[25] Bateman, C. & Boon, R. (2005). 21st Century Game Design. Rockland, MA: Charles River Media, Inc.
[26] Csikszentmihalyi, M. (1991). Flow: The Psychology of Ultimate Experience – Steps Toward Enhancing the Quality of Life. New York: HarperPerennial.
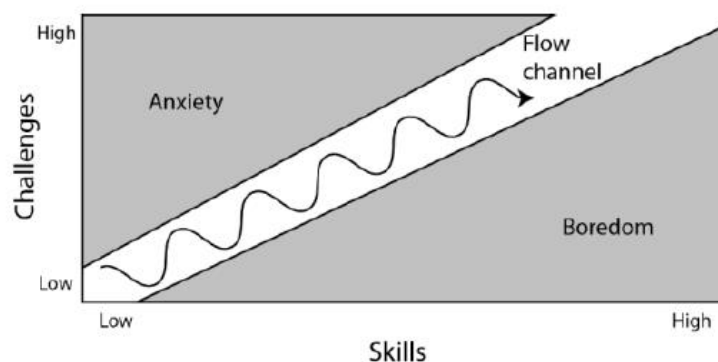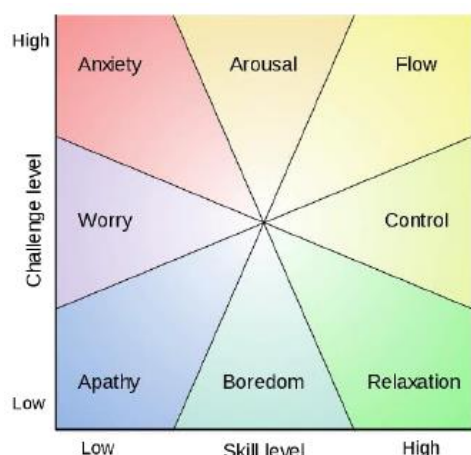
5.1.3 WIDELY USED GAMIFICATION MECHANISMS

The triad of points, badges, and leaderboards is probably the most widely used gamification technique.

Points are the basic 'currency' in a game, and their appeal is directly tied to their usefulness – in other words, "what can you do with the accumulated points?". Thus, it is important to tie points to other gamification mechanisms. When awarding points, the amount awarded should match the difficulty of the task. Extra points can be awarded upon reaching predetermined milestones (e.g. completing one learning step).

Badges represent "honour patches" commemorating particular achievements (whether these are onetime events or recurrent) and are often seen as more tangible and specific than points. Thus, players tend to be more motivated to gather badges than points (unless, of course, points can be utilized to greater effect, e.g. as tokens or currency). Regardless, badges are more conducive to the social aspects of gaming – they are easier to showcase and carry more 'weight', akin to virtual 'graffiti' or 'medals'. The desirability of badges can be improved by proper aesthetics.

Planned challenges usually form the evaluation of the learner's command over the material. Also, they are a source of rewards (e.g. the learner's grade can be converted to points, so that the greater the grade, the greater the reward, thus benefiting the learner who does not simply aim for a simple "pass"). **Impromptu challenges** occurring at somewhat irregular intervals give learners the opportunity to test their skills and gain extra rewards that had not been planned for. These can be associated with special badges or other rewards, which the learner could showcase (e.g. in leaderboards, see below). Challenges of any kind can be part of a narrative structure. In a gamified application, story elements could be woven in, equating the learner's journey to the journey of a fictional character the learner could identify with (→ avatar personalization). Such challenges are often called *quests*, and form subplots which lead into the main plot, their goals acting as stepping stones towards the completion of the main story goals. In the context of a gamified educational application, assuming a persona (fictional character) and exploring a fictional environment can be

expected to appeal to those learners who are stimulus-seeking and favour exploratory behaviour. Ideally, storylines will be meaningful to the learners and intimately linked to the learning material (as a type of formative assessment).

As alluded to earlier, **leaderboards** are a prime vehicle for socially-inspired motivation, showcasing the learner's achievements for all to see. They can be expected to appeal to more competitively-oriented learners. They can incorporate quantifiable rewards – e.g. points, badges, achievements, number of lessons completed, etc. Also, leaderboards can be applied irrespective of linguistic issues, provided that the material to be covered is consistently presented in all of the languages involved (in case it will be decided not to separate learners according to their language / origin).

Levels can complement points in providing an overall categorization of learners that, being a single number, is concise and easy to communicate. A learner's level can act as a 'filter' in determining the tasks he/she can engage in; as is often implemented, the greater the task difficulty, the greater the level required. Level progression can be related to points (for maintaining consistency). Additionally, levels can be tied to avatar personalization in an attempt to lend some intrinsic value (by means of reinforcing learner self-image, as projected outward to the community).

Redeemable rewards may be seen as a natural extension of points and badges. The term refers to an in-game economy where players use in-game currency to purchase goods. In an educational context, these rewards may be access to bonus (e.g. additional) learning material. Any badge can be assigned a monetary value and converted by the player to "currency". Such a system based on redeemable rewards is usually optional and must be justified by the complexity of the design (i.e. for a simple implementation, an extra layer of economy-related mechanics may not be warranted).

Optimized segmentation of material. It is important to break up the learning material sufficiently so as to allow for casual learning interactions – e.g. during a 15-minute break, a learner could maybe complete one "chunk" of the learning material and gain one "reward" (points, badge). Generally, it may be better to segment the material into many smaller chunks than fewer but bigger chunks[27]. In such a situation, the benefit for the learner is threefold: (i) better time management, as even "dead" time intervals could potentially be filled with meaningful activities, (ii) more frequent rewards – albeit of smaller "magnitude", and (iii) greater motivation to continue, as the next possible reward is sufficiently close (but, at the same time, sufficiently far away). Proper segmentation is vital when it comes to implementing a streak mechanic, i.e. encouraging the learner to engage in repeated interactions with the educational platform. The mechanics relies on rewarding the user on a daily basis, provided he/she has completed at least some part of the learning activities (the desired amount could also be set by the users themselves). The longer a streak is sustained, meaning that the learner has been engaging with the platform for several days on end, the more committed the learner typically is; thus, long streaks should be encouraged and appropriately rewarded.

Avatar personalization is often employed so as to allow players to shape their in-game representation (the avatar) according to their desired projected self-image; in other words, players

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[27] If each chunk requires one hour, this has implications on the context of use – one needs to use the platform from a suitable location for an extended amount of time. In contrast, if each chunk can be completed in 10-15 minutes, one does not necessarily have to be situated in an enclosed environment (e.g. office, home); accessing the platform from one's smartphone while on the go could be enough.

shape their avatars in order to project to others the image of themselves they would like to project. Additionally, avatars could evolve over time according to the level / progression of the learner along a learning path. From a wider perspective, personalization is a key component of appropriation (e.g. when entering a new space, people tend to slowly change it to fit their needs, both in terms of functionality and in terms of aesthetics). Similarly, in an interactive environment that supports social interaction, personalization is an act of nonverbal communication and can create one more attachment between the user and the system – the user invests time and is therefore less likely to 'drop out'. IF a more game-like turn is desired, avatars could be tied to specific game-like mechanics (e.g. it could function like a "character class" – where avatars will have unique advantages and disadvantages in terms of their in-game function).

Self-contained games are small-scale games interspersed within the normal workflow of the educational platform. They can act as diversions/distractions, and even as 'experiential' rewards (e.g. "well done, you made it this far, so now you get to play this little game for extra points if you'd like"). They can be deliberately incorporated in a gamified educational app to provide a break from the usual format. Additionally, such games can be an effective way to provide narrative structure (e.g. characters, story arcs, a plausible universe, etc.) or advance the storyline. Thus, self-contained games can effectively frame the actual learning activity. It should also be noted that such games can appeal to most player types (depending on the genre of the games in question); they could be particularly oriented towards "conquerors" (who aim to prove their superiority) or "wanderers" (who appreciate variety of content and media forms). Participation in a narrative structure is an intrinsic motivator; thus, it is less likely to wear off after a while.

5.2 Implementation of game-based learning and assessment application

In the context of DCDS, a series of gamification characteristics, traditional (Moodle-offered) games and a web-based prototype of a gamified application for assisting and assessing the learning process and the progress of the participants with respect to the educational materials were designed and developed. The preceding sections provided a substantial theoretical grounding of gamification as a design strategy to facilitate learning. This section describes the design and development of the aforementioned functional prototype.

THE EDUCATOR'S PERCEPTION OF THE TARGET GROUP

In an attempt to further flesh out the particular characteristics of the primary target group to be taken into account in the design of DCDS gaming functionality, a survey was undertaken of the educators' perception of what the learners would find motivating, appealing, or troublesome. The respondents of the survey were 9 educators and experts in the domain from the project partners. The sample size was small and thus precluded any conclusions drawn from the questionnaires from being regarded as methodologically sound; nonetheless, some patterns could be observed and certain broad

guidelines could be derived. In this section, the results of this survey are presented and briefly discussed.

Question #1

With the particular characteristics of the learners (age, low digital skills) in mind, please group the following gamification mechanisms and techniques in three categories ("must have", "nice to have", "better avoid"): .Points, Badges, Leaderboards, Skill trees, Levels, Self-contained games, Virtual economy, Unplanned challenges, planned challenges, Avatar personalization.

According to the replies, points, badges, and levels are closer to the "must-have" end of the spectrum. Skill trees are generally considered "nice to have", whereas leaderboards and unplanned challenges are best avoided. Results regarding the rest of the techniques were less clear.

Question #2

With the particular characteristics of the learners in mind, please rate the gamification techniques listed (Points, Badges, Leaderboards, Skill trees, Levels, Self-contained games, Virtual economy, Unplanned challenges, planned challenges, Avatar personalization) according to the dimensions described in the other columns.

a) **Order of preference**

The most preferred techniques were badges, levels, points, avatar personalization, and skill trees. The least preferred ones were leaderboards and unplanned challenges

NOTE: *Planned challenges* cannot be excluded; any evaluation after having completed a learning unit can be considered a planned challenge.

b) **Feasibility**

The aim of this question was to obtain a rough estimation of whether the listed techniques would be a viable option for the learner population. Most techniques are considered feasible (easy or normal feasibility). Those that are not considered very easy to implement (mainly virtual economies and unplanned challenges) happen to not score very high on desirability indices (e.g. other questions).

c) **Risk**

Most techniques are considered to be of low to medium risk (< 2). The most risky gamification technique is "unplanned challenges". Perhaps it is regarded as too unpredictable – and thus stressful – for the learner population of interest.

d) **Predicted appeal to learners**

Points, badges, levels, and avatar personalization were perceived as the most appealing techniques. On the other hand, leaderboards, self-contained games, virtual economies, and unplanned challenges were thought to be less appealing. There is a mostly good matching between projected appeal and preference ranking (Q1)

a) How would you feel if this technique was *present / absent*?

In this question, Kano's taxomony was used, as presented below:

"Present" Question	"Absent" Question	Like	Expect	Neutral	Live with	Dislike
	Like	Q	D	D	D	L
	Expect	R	I	I	I	M
	Neutral	R	I	I	I	M
	Live with	R	I	I	I	M
	Dislike	R	R	R	R	Q

M	= Must-have
L	= Linear
D	= Delighter
I	= Indifferent
R	= Reverse (try asking the opposite way)
Q	= Questionable (not a valid response)

According to this methodology, respondents are asked how they would feel if a certain aspect of a design were present, and then they are asked again how they would feel if that aspect were absent. The replies are compared against each other (see matrix above).

Briefly, **must-have** features are the most basic features of a design – they must be there. **Linear** features are attributes whose benefit increases linearly (e.g. speed of shipping a product, discount percentage, etc.) – generally, "the more the better". **Delighters** are features that are functionally not necessary, but the users are expected to be pleasantly surprised by them.

Kano's framework does not seem very helpful in its aggregated form in this case, possibly due to the low sample size, which magnifies the effects of inconsistent replies across present / absent features. Thus, it is advisable to fall back to the two questions that lead to the Kano categorization – i.e. the questions as stated in the questionnaire.

How would you feel if X feature was present / absent?:

- Points are expected; they are the most basic gamification technique available.

- Badges are perceived as more appealing, less "standard", than points.

- Levels are considered a simple gamification technique, and are thus more or less expected.

- Standalone games are best avoided according to the responses to this question; they may be considered to have no meaningful impact in this application scenario.

- Predictably, planned challenges are viewed as the primary evaluation mechanism (and are thus expected).

- Regarding leaderboards, opinions were divided, but leaning towards "avoid".

Question #3

According to the typology of Baterman & Boon, learners can be categorized to four types of players (not necessarily exclusive). How likely is it to identify each of the four types of players among the learners?

	Conqueror	Manager	Wanderer	Participant
Not very likely	6		1	3
Somewhat likely	2	4	1	
Very likely	1	3	7	2
Almost certain		2		4
REMARKS	Not very interested in proving superiority over other learners, so too much focus on competition will likely not pay off	Managing for efficiency is more prevalent in strategy games, not educational platforms. Nonetheless, features such as shortcuts and suggestions as to how to proceed next (in case of non-linear educational flow) may be appreciated	Lots of room for variety, exploration of different content etc. They will want to see more than just one or two "games"	Tendency towards social aspects; they may appreciate cooperation (given lack of competitiveness / "conqueror" characteristics)

Question #4

Based on your experience, please indicate to what extent learners exhibit the characteristics of each personality trait (according to the Five-Factor model of personality)

	Neuroticism	Extraversion	Openness	Agreeableness	Conscientiousness
Very low				1	1
Low	4		1		
Average	4	8	2	1	4
High	1	1	3	7	3

Very high			3		
REMARKS	Low to average; low propensity for stressful reactions etc.	[Average score]	Higher than average; they will appreciate variety	This may mean a positive predisposition towards the platform	Average to high; learners will probably not quit *too* easily

Question #5

Please indicate the relative weights of each of the following concepts / themes in the final version of the platform (use numbers – the sum of all values needs to be 100).

Mechanism	M	Md	SD	Min	Max	[ranking]
Skill tests and evaluation	32.22	35	6.67	20	40	1
Story and narrative	13.89	15	4.86	10	25	5
Cooperation	17.78	20	5.65	10	25	3
Competition	15.56	15	8.46	5	25	4
Social interaction	18.33	20	4.33	10	25	2

As expected, the focus of the platform will be on skill tests and evaluation, given that this is an educational tool. Other aspects take second stage. However, there seems to be a contradiction when it comes to the weight of story and narrative and the player types (the most prevalent of which relies exactly on story and narrative); given this situation, it was decided not to reject story and narrative from the final design.

Overall insights

- Based on necessity, **points**, **badges**, **levels**, and **avatar personalization** were evaluated as the most necessary features and **skill trees** as a nice-to-have feature. These were also the most preferable techniques based on preference ranking, albeit in a slightly different order. Looking at perceived appeal, **levels** can also be added to the list of necessary features.

- Virtual **economies** are best avoided, since they are perceived as difficult to implement and may be too complicated for the intended audience. Also, the intended audience is not perceived to be overly competitive, so **leaderboards** may not be fully appreciated if implemented without due consideration to ways of increasing their appeal (see relevant section to follow).

- Unplanned challenges were perceived as risky or not very beneficial. If implemented, they were to be given low priority.

- Learners were perceived as more likely to belong to the *wanderer* type, which would point toward aspects such as exploration of storylines, variety of sensory stimuli, etc. This is also consistent with their perceived openness to experience, which is mostly above average.

DESCRIPTION OF PRIMARY GAME CHARACTERISTICS

The underlying logic of the DCDS game prototype is loosely based on traditional point and click adventure games, in which the player is asked to advance a storyline by performing the correct actions in the correct order. Progression can be linear (most often) or non-linear. Point and click adventures largely consist of picking up items, combining items, talking to other in-game (non-player) characters, etc. Games of this genre have been traditionally single-player, as their strong selling point would be the storyline; additionally, in many cases the main character (representing the player) could not die in the game.

In the context of the DCDS project, this game and interaction style was favoured for a number of reasons. The primary target group consists of adults with low digital competencies; thus, they tend to be closer to the "casual" gamer category (not fitting the "dedicated gamer" stereotype, which is typically associated with younger ages and a large investment of time and money to gaming and associated activities and objects – e.g. merchandise, participation in tournaments, etc.). As such, complex game mechanics and story arcs typically found in AAA commercial games would run the risk of being considered overwhelming. The web platform used for hosting the educational material also imposed technical limitations, and integration of the game prototype with the rest of the DCDS "ecosystem" was of high priority.

Furthermore, as indicated by the survey, the learners were more likely to fall under the "Wanderer" player typology. Story-driven implementations typically cater to players of this category. It is hoped that the need to see how the story unfolds may act as a motivating factor to learners.

Apart from the "Wanderer", the "Conqueror" category is relevant to the current implementation, albeit indirectly. Strategies and mechanisms alluding to competition (the simplest of which is awarding points for successful actions) are often the cornerstone of any game. This is also the case in the current version of the prototype (see description in the following sections).

SCENARIO AND GAME STRUCTURE

The complete game (of which the existing prototype offers a glimpse) is envisioned to follow an episodic structure, where each episode revolves around an IT-related concept. The first episode has been implemented in the prototype. The main idea of the episode is that the user's character is asked by his/her fictional supervisor if he/she would be interested in attending a summer school for beginners to computer programming. In attempting to secure a place and perform various other actions associated with his/her attendance of this event (see Annex 7), his/her grasp of IT-related skills is tested.

The player is presented with a series of still images, onto which some hotspots are marked by means of red dots, as shown in the image below.

Also present is a small figure with a question mark; hovering on this will produce instructions about what the user needs to do.

DIGITAL COMPETENCES DEVELOPMENT SYSTEM

Upon hovering the mouse cursor over the dots, a menu with relevant actions appears - e.g. in the image below, the user chooses whether to perform the action of placing his/her laptop on the designated surface or not. If it is a suitable surface, the user gains points and the step is considered to have been successfully completed. At present, every correct answer is worth one point, but in future versions, different versions can be assigned varying point values to reflect their relative difficulty.
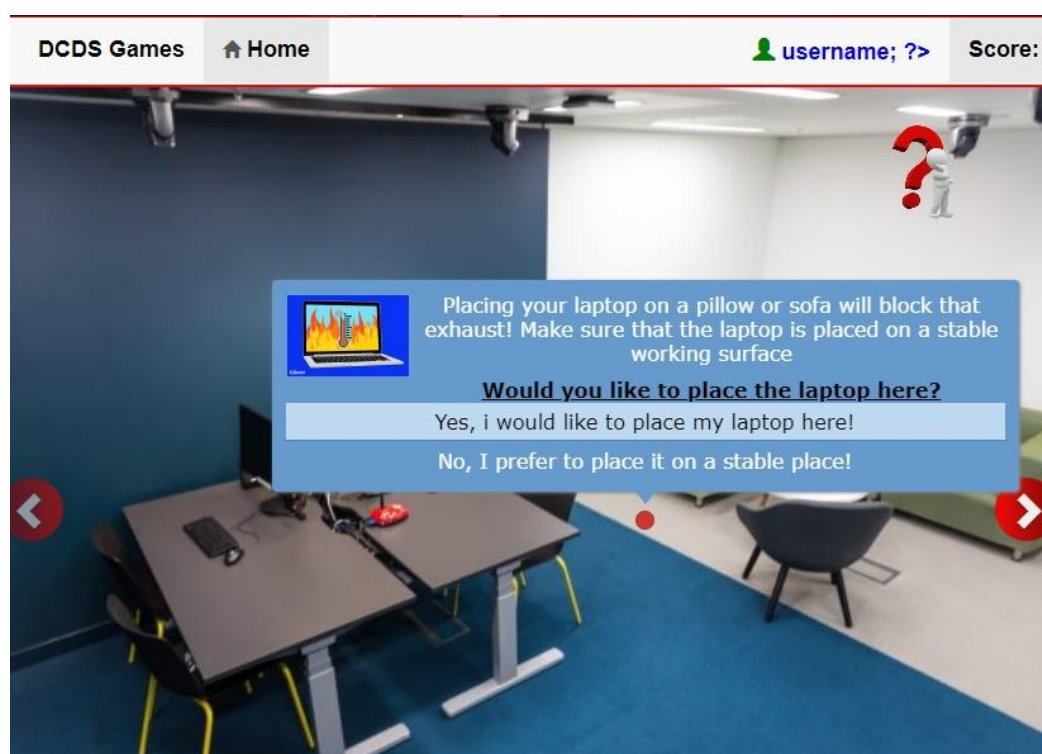
In another example, the user needs to use a spreadsheet application, and is presented with three different functions while being asked to choose the one that will allow him/her to calculate the total cost of certain items. The correct choice (in this case SUM) results in points being rewarded.

In any case, upon selecting an action, a window pops up to inform the user about their choice (see image below).
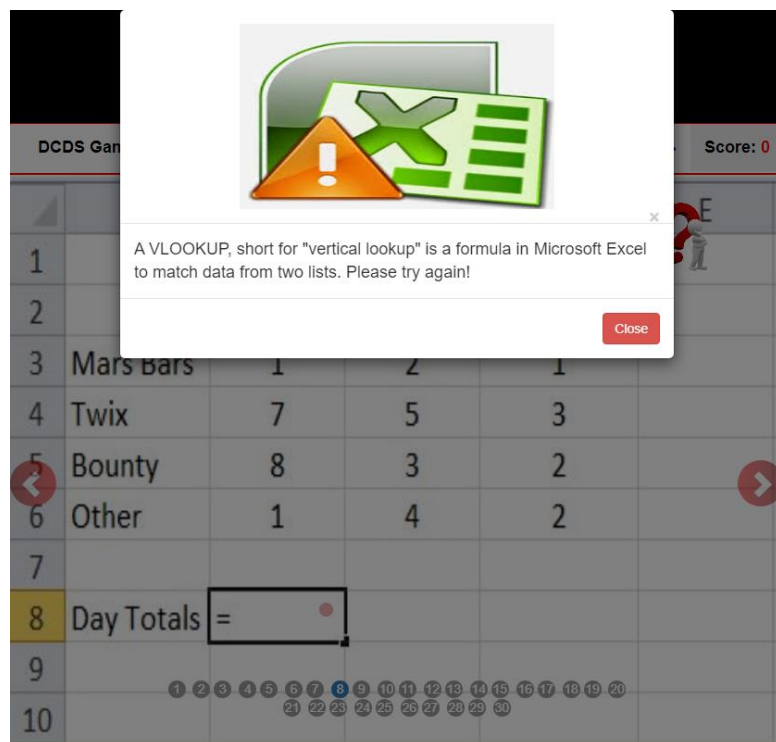
In future versions of the application, the red dots may not be present in an attempt to entice the users to engage in an exploratory behaviour; this would also encourage them to approach the problem at hand more critically (relying on active processing and recall) as opposed to simply pointing the mouse cursor to the red dots (thus relying on preattentive processing and recognition).

The user is informed about points awarded via a pop-up at the bottom right corner of the screen:
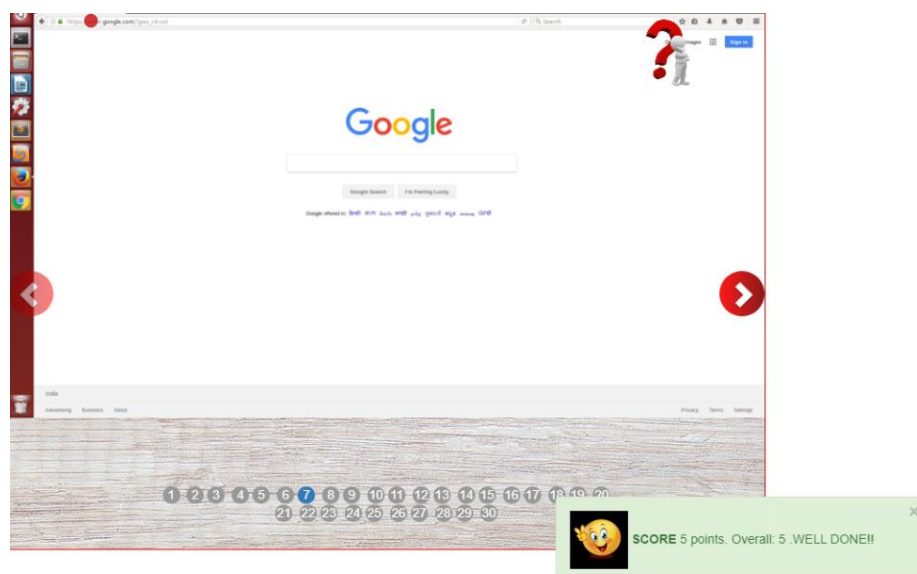
The user can be informed about what is expected of him/her by hovering on an icon shaped like a question mark ("?"), usually at the top right corner of the game window:
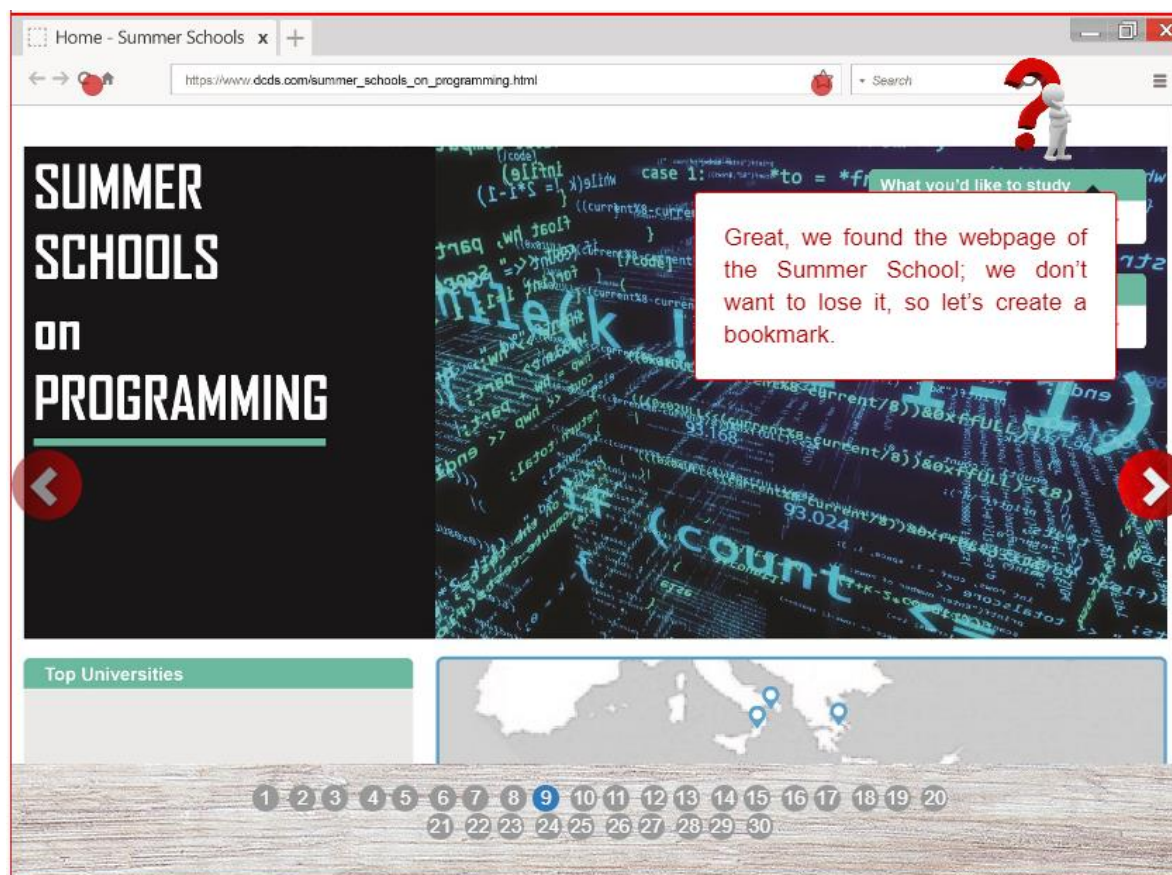
Given that the current implementation is only a prototype, it relies substantially on points; however, since points are often the starting point for more elaborate gamification mechanisms, a number of such mechanisms (whose logic is described in detail in section 5.1) can be easily implemented in upcoming versions:

Badges

The DCDE platform supports the management of badges to learners which are issued after passing summative tests at the end of each learning module (see chapter 6). Badges and other achievements can be stored in the learners' profile. Additional and different badges (as they would be generated outside of a summative assessment process) may be awarded to learners upon successfully completing an entire game episode, and also intermittently, for instance upon completing a particularly significant step (e.g. the programming exercise in the scenario featured in the prototype). Other opportunities to award badges arise if time-related aspects are taken into account. Examples include:

▪ Successfully completing a set number of steps in a set time period
▪ Being logged in and actively engaged in the material for a set time period

- Repeat usage per unit of time (typically, one day). This is referred to as a "streak" and is regarded as a very effective motivator (for an indicative implementation of the "streak" mechanic, see *DuoLingo*).

Leaderboards

Though the survey of partners' educators indicated that leaderboards would not be among the most desirable features of the final application, their implementation would be easy (since points are already used). If correctly implemented, leaderboards can increase learner motivation and encourage repeat usage in conjunction with the "streak" mechanic described above. In the case of DCDS, a "correct" implementation of leaderboards would require a non-rigid structure, so that all learners can hope to reach the top position. One effective way of achieving this flexibility would be to renew the ranking on a daily or weekly basis.

Levels

A player level number is a very simple way of providing an approximate ranking of learner status (e.g. as in proper, mainstream games, a "level 5" learner is generally perceived as "better" overall than a "level 3" learner). The basis for implementing levels in a future version is already part of the prototype; points are awarded for correct answers, and the episodic structure divides the entire storyline into smaller parts, numbered sequentially (even though in the prototype only episode #1 is implemented). Indicatively, levels can be directly tied to points gained (e.g. 1 level per X amount of points, per X amount of consecutive correct answers, etc.).

Avatar personalization

In future versions of the prototype it is planned to allow learners to select their avatar among a predetermined set of avatars (initially) and/or upload their own avatar (subject to requirements regarding dimensions and content).

Unplanned challenges

One type of unplanned challenge is already present in the current implementation of the prototype in the form of a time limit in one of the steps. Other ways to provide unplanned challenges may include interjecting a more 'traditional' game in the flow of the scenario (but making sure that this interjection is plausible, otherwise it may detract from the immersion), or interjecting an additional, non-necessary step at various points at random (this extra step would act as a "bonus" stage, with no penalties in case of a mistake or wrong action selection).

ADDITIONAL GAMIFICATION CHARACTERISTICS AND LEARNING GAMES

Apart from the prototype game described above, DCDE includes also additional gamification characteristics and short (Moodle-offered) games. First and foremost, DCDE employs **points** and **levels** that were evaluated as necessary for the target group of interest. The learners conduct learning activities such as answering to quizzes and doing practical exercises and earn points from them, helping them to advance levels. This characteristic enhances the intrinsic motivation of the learners empowering their learning experience.

Moreover, as illustrated in the net chapter, DCDE delivers **badges** to the learners when they finish successfully a Learning Path, a Module or a Competence. The learners can transfer the acquired badges from DCDS to other services, using the appropriate functionality of the DCDE (backpack).

Following also their suggestions, the **avatar personalization** is also enabled. This feature allows them to present more things about themselves in a visual way by uploading a custom image as their own representation on the platform, if they so wish.

6. Evaluation of learning, attendance and competence validation

6.1 The evaluation system in DCDS

The entire training process in DCDS is subject to evaluation. The evaluation has four main purposes:

1) to ensure that the results of the training process are in line with the objectives set
2) to ensure that those delivering training receive regular feedback on the motivation of the participants
3) to allow those delivering training to validate the competences acquired by the participants
4) to document the results achieved by the participants

The above aims of the evaluation system are achieved by specific functions and activities that are:

a) the **assessment of learning**, which pursues aims 1 and 3
b) **quality evaluation**, which pursues goal 2
c) the issuance of **badges**, which pursues aim 4

6.2 Learning assessment

Learning assessment determines whether and how much learning has taken place, and also gives the result a quality judgment. Learning assessment is formative if it aims to help students in difficulty, it is summative if it aims to recognize and validate the final result.

FORMATIVE ASSESSMENT

Formative assessment can be formal or non-formal. The questions a teacher asks students randomly during a frontal lesson are an example of non-formal formative assessment. On the other hand, a knowledge test given to the whole group of students followed by personalised feedback on how to fill in gaps and continue the activity, is an example of a formal formative assessment (as long as the outcome of the test does not condition the continuation of the training activity).

As seen in chapter 4, the Exercises section of each LU may contain:

a) one or more self-supporting learning quizzes with formative feedback;[28]

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[28] When providing an automatic formative feedback is too complex -e.g. because the possible number and range of mistakes from answering combinations was large- the learner gets a feedback message to a wrong answer, suggesting to ask for explanations to the teacher.

b) one or more scaffolded practical exercises, i.e. with a complete work track (often to be completed by the teacher) and, sometimes, a rubric containing evaluation criteria and parameters.

Figure 8 - Example of knowledge quiz with formative feedback (type a)

You want to send a short message to a friend of yours, you send it:

Select one:

○ by WhatsApp

○ by WeTransfer

⦿ by Google Drive   Wrong: with Google Drive you can share folders and files, not exchange messages.

Your answer is incorrect.

Figure 9 - Example of scaffolded exercise with assessment rubric (type b)

Find some web pages

You have to find the following 5 web pages using a search engine.

1) The official web page of the city council of....

2) The official web page of the healthcare service of.....

3) The official web page of the company.....

4) The web page of the service...... to buy a railway ticket.

5) The web page of the airport of......

When you have found the requested web pages, click on the button Add Submission here below. A box will open up and please: 1) for each web page that you found, write in the box the keywords that you used on the search engine and 2) use the text editor to copy and paste in the box the URLs of the web pages that you found.

Add submission

Relevance of K-words for web page	Not relevant at all	Partly relevant	Relevant
Successful retrieving of the wep page	Unsuccessfull		Successfull

Each LU has at least one activity of type a) or type b). The more complex LUs have several activities of both types.

In the case of a practical exercise, the learner is asked to fill a Student report for the exercise. This report is in fact a standard form which asks learners whether they performed the task on their own, with some help from the teacher or a peer learner, entirely guided/supported by someone else. Any formative feedback on practical exercises is to be provided by the teacher.

SUMMATIVE ASSESSMENT

Summative assessment is formal and establishes the achievement of a didactic objective. The outcome of a summative assessment test conditions the issuing of badges (see later) and, depending of training organisation/teacher's decision, it may restrict continuation of the course, i.e. the student continues only if he/she passes the test.

Summative tests in DCDS are made, as the Exercises (which are designed to prepare learners for the summative tests), of learning quizzes and practical exercises. Learning quizzes are assigned a given score for the correct answer; practical exercises are to be assessed by the teacher using a rubric which identifies the evaluation criteria (e.g. successful email exchange) and the score of each possible option (e.g. 'email not sent'= 0; 'email sent without attachment'= 10; 'email sent with attachment'=20).

Students who attend the DCDS training offer must pass summative assessment tests (overall test score = 60% or above) when completing an LP Module, i.e. a significant and enabling part of a learning path. In each summative test,

Summative assessment tests are available for all DCDS modules (in parenthesis, the DigComp competences which are fully gained through the LUs of that module):

For the Learning Path BASE

- Managing files and folders (1.3)
- Safe browsing and aware info search (1.1, 1.2)
- Creating an account and using e-mail safely and correctly
- Learning about public and private online service (2.3)
- Protecting devices, data, health and well-being (4.1)
- Basic ICT operations (5.2)
- Digital self-awareness and learning (5.4)

For Learning Path Communication&Social media

- Communication services

■ Social media (2.6)

■ Copyright and licences (3.3)

For Learning Path Digital content creation

■ Documents

■ Spreadsheets

■ Presentations

■ Photos and videos

■ Copyright and licences (3.3)

For Learning Path Explore ICT

■ Programming (3.4)

■ Environment (4.4)

■ Technical problems

■ ICT tools (5.3)

6.3 Competence validation and badges

VALIDATION OF DIGCOMP COMPETENCES

According to the DCDS training structure, the 21 DigComp competences are validated after passing the summative tests of the Module/s which include the LUs related to each competence, without additional assessment activities. Some competences start being developed in LP Base, but they are completed by the Modules belonging to the complementary LPs. For this reason, when completing each of the following LPs participants will be validated the following DigComp competences:

at the end of LP BASE

1.1 Browsing, searching and filtering data, information and digital content

1.2 Evaluating data, information and digital content

1.3 Managing data, information and digital content

2.3 Engaging in citizenship through digital technologies

4.1 Protecting devices

5.2 Identifying needs and technological responses

5.4 Identifying digital competence gaps

at the end of LP Communication&Social media

2.1 Interacting through digital technologies

2.2 Sharing through digital technologies

2.4 Collaborating through digital technologies

2.5 Netiquette

2.6 Managing digital identity

3.3 Copyright and licenses

4.2 Protecting personal data and privacy

4.3 Protecting health and well-being

at the end of LP Digital content creation

3.1 Developing digital content

3.2 Integrating and re-elaborating digital content

3.3 Copyright and licenses

at the end of LP Explore ICT

3.4 Programming

4.4 Protecting the environment

5.1 Solving technical problems

5.3 Creatively using digital technology

ISSUING BADGES

The DCDE platform issues three types of badges:

- **Module badge** is issued subject to the outcome of the Summative evaluation test of the specific Module attended

- **Learning Path badge** is issued after all the Summative tests of the Modules belonging to the LP have been passed

■ **Competence badge** is issued after the validation of the specific competence.

The release of all three types of badges is automatic, one meeting the conditions to be issued.

5.4 Course quality evaluation

The quality evaluation of the DCDS courses consists of two distinct actions:

a) collection of feedback from participants describing their perception of the didactics and course organisation

b) monitoring of participants' attendance to the didactic activities, both in presence and at a distance.

Action type a) was carried out in the DCDS pilots through an ad hoc survey at the end of the course. In future DCDS-based courses, training organisations may look at *Annex 21 Exit (post-training) questionnaire for trainees* of the *DCDS Piloting and evaluation report* (see http://www.dcds-project.eu/resources/) for inspiration.

Action type b) was conducted by the DCDS pilot training teachers by: 1) registration of learners' attendance to classroom lessons and 2) tracking of activities performed by the participants on the DCDE platform as part of the formative evaluation process during course delivery (checking Student reports and results of learning quizzes). These activities allow the tutor or teacher to intervene if participants start skipping classes or do not carry out the remote activities they are expected to.

Annex 1 - Learning outcomes (LOUTs) for basic digital competence

DigComp 2.1 competence	DigComp 2.1 – FOUNDATION LEVEL *At basic level and with guidance -> At basic level and with autonomy and appropriate guidance where needed,*	LOUT n°	Proposed LEARNING OUTCOMES (LOUTs) - expected performance at foundation level and in an inclusion perspective	Learning Unit Code (see Annex 2 for LU titles)
1.1 Browsing, searching and filtering data, information and digital content	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	1.1.1	I can locate the browser icon on my device, open the browser and use the toolbar buttons (e.g. back, forward, refresh, home, close)	1.1A
		1.1.2	I can navigate web pages (inside a website or across websites) using hyperlinks and menus	1.1A
		1.1.3	I can save web addresses in my browser favourites/bookmarks	1.1A
		1.1.4	I can retrieve a previously visited web page from my browser's history or from the bookmarks	1.1A
		1.1.5	I can find information on the web using well-known search engines (Google, Bing, Yahoo!...)	1.1B
		1.1.6	I can find images, videos, games and other multimedia content on the Internet	1.1B
		1.1.7	I can use online maps and localization services (implications for privacy!)	1.1C
		1.1.8	I can download and save files from the internet	1.1D

1.2 Evaluating data, information and digital content	I can: ● detect the credibility and reliability of common sources of data, information and their digital content.	1.2.1	I can evaluate whether information or content that I find online is or is not reliable (including hoaxes and fake news), by looking at author and references, date of production/publishing and other evaluation criteria	1.2A
		1.2.2	I can differentiate the official website of a service or product provider from other non-official websites, by checking URL, website owner and other aspects	1.2A
		1.2.3	I can differentiate advertised digital content and non-advertised content on the Internet	1.2A
1.3 Managing data, information and digital content	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	1.3.1	I can organise (create, delete, copy, name) folders to store files on my digital device	1.3A
		1.3.2	I can identify file types based on their extension	1.3A
		1.3.3	I can view and sort files inside a folder in different ways	1.3A
		1.3.4	I can create, locate, open, copy, move, rename and delete files in my digital device	1.3A
		1.3.5	I can create, open, copy, move, delete files and folders on a) external/portable storage device (hard disk, memory card, USB memory), b) cloud storage service	1.3A
		1.3.6	I can compress or extract on my PC compressed files/folders (zip, rar …)	1.3B
2.1 Interacting through digital technologies	I can: ● select simple digital technologies to interact, and ● identify appropriate simple communication means for a given context	2.1.1	I can distinguish between synchronous and asynchronous communication media and choose between them the most appropriate to the communication I want to make	2.1A
		2.1.2	I can create and save contacts in my digital devices	2.1B
		2.1.3	I can make video calls over the Internet	2.1C
		2.1.4	I can find and view the latest calls and messages made and received	2.1D
		2.1.5	I can create an account to access and use online digital services (e-mail, social media, other interactive public and private services … beware privacy!)	2.1E
		2.1.6	I can send and receive e-mails (send, reply, forward)	2.1F
		2.1.7	I can use SMS to send and receive messages through my phone	2.1G

		2.1.8	I can send text messages via instant messaging applications (WhatsApp, Messenger, Skype ...).	2.1H
		2.1.9	I can post messages on a forum and/or a blog	2.1I
2.2 Sharing through digital technologies	I can: ● recognise simple appropriate digital technologies to share data, information and digital content ● identify simple referencing and attribution practices	2.2.1	I can share files as attachments by email and other asynchronous communication services	2.2A
		2.2.2	I can share folders on the cloud	2.2B
		2.2.3	I can share files, videos, audio, photos, locations, and contacts via social media and instant messaging software (WhatsApp, Messenger, Skype and others), also by using the "share" function	2.2C
		2.2.4	I can upload self-created content (e.g. a photo) to be shared on websites that request it and/or that give this possibility (social media)	2.2D
2.3 Engaging in citizenship through digital technologies	I can: ● identify simple digital services in order to participate in society ● I can recognise simple appropriate digital technologies to empower myself and to participate in society as a citizen	2.3.1	I can find the official websites and Apps of government bodies and other public organizations in my country at national and local level in areas of my interest (employment, health, education, taxes, etc.)	2.3A
		2.3.2	I can find the official websites and Apps of private service providers of my interest (transport & travel, utilities, etc.)	2.3B
		2.3.3	I can get information from (public/private) services websites or Apps to carry out procedures in person (health, employment, social security, transport ...)	2.3C
		2.3.4	I can identify the interactive services offered by (public/private) services websites or Apps	2.3C
		2.3.5	I can fill an online form also using a dropdown list, check box, radio button, calendar and other functions	2.3D
		2.3.6	I can respond to authentication requests, if that is needed to access (public/private) services websites	2.3E

		2.3.7	I can explain what "strong authentication" is, and why it is needed in order to use a range of online services	2.3E
		2.3.8	I can upload documents and photographs when this is required to complete an online transaction	2.3E
2.4 Collaborating through digital technologies	I can: ● choose simple digital tools and technologies for collaborative processes	2.4.1	I can send and receive e-mails with multiple recipients (and "answer to all") to support group communication	2.4A
		2.4.2	I can add a participant to or join a videocall	2.4B
		2.4.3	I can create a WhatsApp group and add members to it	2.4C
2.5 Netiquette	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	2.5.1	I can apply the basics of email etiquette (e.g. use of BCC, forwarding etc.)	2.5A
		2.5.2	I can apply the basic online writing rules (not to use capital letters, to take care of spelling, to refer to others through their nicks or nicknames....) and I can use appropriately emoticons when communicating via the Internet	2.5A
		2.5.3	I can recognize appropriate behaviours to adopt on social media ... such as asking permission before publishing/sharing photos of other people (especially when children are concerned); avoiding spamming (e.g. by sending invitations or other messages to everyone); using carefully sarcasm, irony or words that may be misunderstood by others	2.5B
		2.5.4	I can recognise socially/ethically inappropriate online behaviour and communication such as hate speech, flaming, trolling, cyber-bullying, online stalking etc.	2.5C

		2.5.5	I use basic ways to contrast negative interactions online (signalling posts to service owners, postal police etc.)	2.5C
2.6 Managing digital identity	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	2.6.1	I can create an online account and related personal profile and log in and out of it safely (including changing and protecting passwords to prevent identity theft). I can delete my account if I want to quit.	2.6A
		2.6.2	I can give examples of footprints that I willingly leave online using different communication applications (e.g. posts in forums, blogs, "likes", published/shared photos and video etc.) and identify those that may damage my reputation	2.6B
		2.6.3	I can look up and view information about myself and others online	2.6B
		2.6.4	I can adjust my online profile depending on the potential audience (formal-informal, professional, official, thematic etc.)	2.6B
3.1 Developing digital content	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	3.1.1	I can identify (through their icons) and describe the purpose/basic functionality of commonly used software applications	3.1A
		3.1.2	I can use basic features of word processing software (using desktop or cloud computing software) to write simple text and apply formats	3.1B
		3.1.3	I can use basic features of spreadsheet software (using desktop or cloud computing software) to organize data and use simple formulas	3.1C
		3.1.4	I can use basic features of presentation software (using desktop or cloud computing software) to prepare a simple presentation	3.1D
		3.1.5	I can take pictures and videos with mobile devices	3.1E
		3.1.6	I can take a screenshot on my devices (computer, mobile phone …)	3.1F

3.2 Integrating and re-elaborating digital content	I can: ● select ways to modify, refine, improve and integrate simple items of new content and information to create new and original ones	3.2.1	I can distinguish between editable documents and non-editable ones due to PDF format and file protection	3.2A
		3.2.2	I can make simple changes (add text, make spelling corrections, change formats) to a document produced by another person using desktop or cloud computing software	3.2B
		3.2.3	I can make simple changes (change/add numbers, change rows sequence by a new ordering criterium) to a spreadsheet created by another person using desktop or cloud computing software	3.2C
		3.2.4	I can make simple changes to a presentation created by another person using desktop or cloud computing software	3.2D
3.3 Copyright and licenses	I can: ● identify simple rules of copyright and licenses that apply to data, digital information and content	3.3.1	I can recognise the kind of copyright protection associated with online digital content	3.3A
		3.3.2	I can adapt my use of online digital content depending on its copyright status and licences	3.3A
		3.3.3	I can find and quote the source and/or author of online digital content before sharing it online	3.3A
3.4 Programming	I can: ● list simple instructions for a computing system to solve a simple problem or perform a simple task	3.4.1	I can read a flow chart identifying the operations and the order of their execution	3.4A
		3.4.2	I can create a basic program based on a simple flowchart or algorithm	3.4A
4.1 Protecting devices		4.1.1	I can describe risks and threats for my digital device (hardware breakdown, physical impacts, human error etc.) and their potential consequences	4.1A

		4.1.2	I can recognise suspicious emails, messages, pop ups that can cause data loss or misuse on my digital device (by clicking on them or downloading unfamiliar attachments)	4.1E
	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	4.1.3	I can install/activate on my devices protection software and functions (malware detectors, antivirus antispam, pop-up blockers on the web browser, protection from theft, locking the screen etc.) and I know how to scan a device (USB, hard disk, etc.)	4.1B
		4.1.4	I update regularly my computer's operating system, security software and other applications (when prompted or by setting up automatic updates), to prevent security issues	4.1C
		4.1.5	I make frequent backups of information or content I care for, by making a copy and storing it separately either in the cloud or on an external storage device	4.1C
		4.1.6	I can create and use strong passwords according to existing guidelines (e.g. using three random words or with at least 8 characters, using lower- and upper-case letters, numbers and symbols)	4.1D
		4.1.7	I keep the information I use to access my devices and online accounts secure (including passwords), using different and secure passwords for websites and accounts (e.g. to prevent identity theft and its consequences)	4.1D
4.2 Protecting personal data and privacy	I can: ● select simple ways to protect my personal data and privacy in digital environments, and ● identify simple ways to use and share personally identifiable information while protecting	4.2.1	I can provide a list of personal data, indicating those that should not be shared/ made visible on the Internet	4.2A
		4.2.2	I can mention the citizens' rights defined in the new European General Data Protection Regulation (GDPR)	4.2A
		4.2.3	I can adapt the personal information that I provide depending on the context and its security features (social networks, forums...)	4.2A

	myself and others from damages. ● identify simple privacy policy statements of how personal data is used in digital services.	4.2.4	I can set privacy settings on my devices and on the applications I use (social media and others) -> e.g. apply privacy settings to Facebook to ensure only friends can see posts and shared content	4.2A
		4.2.5	I can view, modify and delete the cookies and navigation history in the browser	4.2B
		4.2.6	I can use the "incognito" (anonymous) surfing function offered by most browsers	4.2B
4.3 Protecting health and well-being	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.	4.3.1	I can identify ergonomic and physical risks resulting from prolonged and inappropriate use of digital devices (backache, visual impairment, traffic hazards when using mobile phones, risks of using headphones while walking, bicycling, driving etc.) and take measures to minimize / alleviate these negative effects	4.3A
		4.3.2	I can identify the main symptoms of Internet/digital addiction (tiredness, being unable to stop an activity, less sleep, decline of social connections, losing the sense of reality etc.) and take measures to protect myself and/or my children.	4.3A
		4.3.3	I can take measures to protect myself and my children against cyberbullying, grooming and sexting	4.3B
		4.3.4	I can find useful/entertaining games, music, concerts, museum-visiting, arts, films, interesting articles, news, travelling, cultures, languages, friends, colleagues etc. in the digital environment	4.3C
4.4 Protecting the environment	I can: ● recognise simple environmental impacts of digital technologies and their use.	4.4.1	I can identify the basic measures to save energy and environmental resources (e.g. avoid unnecessary printing on paper, turn off equipment/devices after use, do not leave chargers connected without a mobile phone, etc.)	4.4A
		4.4.2	I can identify where to deposit obsolete and/or worn out ICT elements (electronic or computer components, batteries, toners, etc.) to minimise their wasting impact	4.4A

	I can:	5.1.1	I can identify simple technical problems when operating devices and using digital environments	5.1A
5.1 Solving technical problems	● identify simple technical problems when operating devices and using digital environments, and ● identify simple solutions to solve them.	5.1.2	I can find, install, update and remove software and applications (apps), downloaded from safe sources	5.1B
		5.1.3	I can use common problem-solving support tools which are available in my device and applications (e.g. configuration guide, help function, set-up commands, etc.)	5.1D
		5.1.4	I can search for support online using community forums, blogs, video other types of tutorials	5.1C
5.2 Identifying needs and technological responses	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.	5.2.1	I can list the most common digital devices (computer, printer, scanner, tablet, smartphone, ebook reader). I can differentiate them by their function (what they can be used for)	5.2A
		5.2.2	I can choose the most appropriate digital devices and Apps for my activities, personal needs and habits.	5.2A
		5.2.3	I can customize some basic display and other features of my device (font size, screen background, power management etc.)	5.2B
5.3 Creatively using digital technology	I can: ● identify simple digital tools and technologies that can be used to create knowledge and to innovate processes & products. ● show interest individually and collectively in simple cognitive processing to understand and resolve simple conceptual problems and problem situations	5.3.1	I can explain what are simple tools such as: calendars, maps & navigators and Wikipedia	5.3A
		5.3.2	I can simply explain what are new tools and services such as: online collaboration environments, augmented/virtual reality, robots, voice commands, intelligent assistants, drones, 3D printing, internet of things	5.3A

		in digital environments.			
5.4 Identifying digital competence gaps		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	5.4.1	I can find and use tools to identify my digital competence gaps	5.4A
			5.4.2	I can identify available solutions for learning online: video tutorials, e-learning courses, online guides and other educational materials	5.4B

Annex 2 - Digital competence, learning units and paths

DigComp Competence	Learning Unit	Learning Path
1.1 Browsing, searching and filtering data, information and digital content	1.1A Browsing	Base
	1.1B Searching	Base
	1.1C Maps and localization services	Base
	1.1D Download and save	Base
1.2 Evaluating data, information and digital content	1.2A Evaluating data, information and digital content	Base
1.3 Managing data, information and digital content	1.3A Managing data, information and digital content	Base
	1.3B Compressed files/folders	Base
2.1 Interacting through digital technologies	2.1A Synchronous and asynchronous	COM_general
	2.1B Creating and saving contacts	Base
	2.1C Video calls	COM_general
	2.1D Checking calls and messages	COM_general
	2.1E Creating an account	Base
	2.1F Sending receiving email	Base
	2.1G Sending receiving SMS	COM_general
	2.1H Instant messaging	COM_general
	2.1I Forum and blog	COM_general
2.2 Sharing through digital technologies	2.2A Sharing files	Base
	2.2B Sharing folders	Base
	2.2C Sharing via social media	COM_general
	2.2D Uploading content	COM_general
2.3 Engaging in citizenship through digital technologies	2.3A Public online services	Base
	2.3B Private online services	Base
	2.3C Recognizing information and interactive online services	Base
	2.3D Filling an online form	Base

	2.3E Interacting with services	Base
2.4 Collaborating through digital technologies	2.4A Mails to multiple recipients	Base
	2.4B Managing a videocall	COM_general
	2.4C WhatsApp groups	COM_general
2.5 Netiquette	2.5A Basic email and online writing netiquette	Base
	2.5B Social media netiquette	Communication&social media
	2.5C Inappropriate behaviour	Communication&social media
2.6 Managing digital identity	2.6A Safe personal account management	Communication&social media
	2.6B Managing reputation	Communication&social media
3.1 Developing digital content	3.1A Software overview	Base
	3.1B Basic word processing	Base
	3.1C Basic spreadsheet	Digital Content
	3.1D Basic presentation	Digital Content
	3.1E Taking videos and pictures	Digital Content
	3.1F Taking screenshots	Base
3.2 Integrating and re-elaborating digital content	3.2A Editable and uneditable files	Digital Content
	3.2B Text editing	Digital Content
	3.2C Spreadsheet editing	Digital Content
	3.2D Presentation editing	Digital Content
3.3 Copyright and licenses	3.3A Copyright and licenses	Digital Content/ Communication&social media
3.4 Programming	3.4A Programming	Explore ICT
4.1 Protecting devices	4.1A Hardware risk	Base
	4.1B Software risks and protection	Base
	4.1C Update and backup	Base
	4.1D Password	Base
	4.1E Suspicious messages	Base

4.2 Protecting personal data and privacy	4.2A Protecting personal data	Communication&social media
	4.2B Private navigation	Base
4.3 Protecting health and well-being	4.3A Preventing physical and psychological risk	Base
	4.3B Protecting children	COM-Social media
	4.3C Entertainment	Base
4.4 Protecting the environment	4.4A Protecting the environment	Explore ICT
5.1 Solving technical problems	5.1A Identifying technical problems	Explore ICT
	5.1B Downloading and installing Apps	Base
	5.1C Support online	Base
	5.1D Support tools on device	Base
5.2 Identifying needs and technological responses	5.2A Choosing digital tools	Base
	5.2B Customizing digital tools	Base
5.3 Creatively using digital technology	5.3A Opportunities for creative digital use	Explore ICT
5.4 Identifying digital competence gaps	5.4A Identifying competence gaps	Base
	5.4B Learning solutions	Base

Annex 3 – Didactic sequence of units in modules and learning paths

Table 12 - Sequence of LUs and modules in the Learning Path BASE

LOUT n°	LOUT description	Learning Unit	Module
3.1.1	I can identify (through their icons) and describe the purpose/basic functionality of commonly used software applications	3.1A Software overview	Managing files and folders
1.3.4	I can create, locate, open, copy, move, rename and delete files in my digital device	1.3A Managing data, information and digital content	
1.3.2	I can identify file types based on their extension		
1.3.1	I can organise (create, delete, copy, name) folders to store files on my digital device		
1.3.3	I can view and sort files inside a folder in different ways		
1.3.5	I can create, open, copy, move, delete files and folders on a) external/portable storage device (hard disk, USB memory, memory card, CD), b) cloud storage service		
1.3.6	I can compress or extract on my PC compressed files/folders (zip, rar …)	1.3B Compressed files/folders	
2.2.2	I can share folders on the cloud	2.2B Sharing folders	
1.1.1	I can locate the browser icon on my device, open the browser and use the toolbar buttons (e.g. back, forward, refresh, home, close)	1.1A Browsing	Safe browsing and aware info search
1.1.2	I can navigate web pages (inside a website or across websites) using hyperlinks and menus		
1.1.3	I can save web addresses in my browser favorites/bookmarks		
1.1.4	I can retrieve a previously visited web page from my browser's history or from the bookmarks		
4.2.5	I can view, modify and delete the cookies and navigation history in the browser	4.2B Private navigation	
4.2.6	I can use the "incognito" (anonymous) surfing function offered by most browsers		

1.1.5	I can find information on the web using well-known search engines (Google, Bing, Yahoo!...)	1.1B Searching	
1.1.6	I can find images, videos, games and other multimedia content on the Internet		
1.1.8	I can download and save files from the internet	1.1D Download and save	
4.3.4	I can find useful/entertaining games, music, concerts, museum-visiting, arts, films, interesting articles, news, travelling, cultures, languages, friends, colleagues etc. in the digital environment	4.3C Entertainment	
1.2.1	I can evaluate whether information or content that I find online is or is not reliable (including hoaxes and fake news), by looking at author and references, date of production/publishing and other evaluation criteria	1.2A Evaluating data, information and digital content	
1.2.2	I can differentiate the official website of a service or product provider from other non-official websites, by checking URL, website owner and other aspects		
1.2.3	I can differentiate promoted/advertised digital content and non-advertised content on the Internet		
1.1.7	I can use online maps and localization services (implications for privacy!)	1.1C Maps and localization services	
2.1.5	I can create an account to access and use online digital services (e-mail, social media, other interactive public and private services … beware privacy!)	2.1E Creating an account	
2.1.2	I can create and save contacts in my digital devices	2.1B Creating and saving contacts	
2.1.6	I can send and receive e-mails (send, reply, forward)	2.1F Sending receiving email	Creating an account and using e-mail safely and correctly
2.2.1	I can share files as attachments by email and other asynchronous communication services	2.2A Sharing files	
2.4.1	I can send and receive e-mails with multiple recipients (and "answer to all") to support group communication	2.4A Mails to multiple recipients	
2.5.1	I can apply the basics of email etiquette (e.g. use of BCC, forwarding etc.)	2.5A Basic email and online writing netiquette	
2.5.2	I can apply the basic online writing rules (not to use capital letters, to take care of spelling, to refer to others through their nicks or nicknames....) and I can use appropriately emoticons when communicating via the Internet		

4.1.2	I can recognise suspicious emails, messages, pop ups that can cause data loss or misuse on my digital device (by clicking on them or downloading unfamiliar attachments)	4.1E Suspicious messages	
2.3.1	I can find the official websites and Apps of government bodies and other public organizations in my country at national and local level in areas of my interest (employment, health, education, taxes, etc.)	2.3A Public online services	Learning about public and private online service
2.3.2	I can find the official websites and Apps of private service providers of my interest (transport & travel, utilities, etc.)	2.3B Private online services	
2.3.3	I can get information from (public/private) services websites or Apps to carry out procedures in person (health, employment, social security, transport ...)	2.3C Recognizing information and interactive online services	
2.3.4	I can identify the interactive services offered by (public/private) services websites or Apps		
2.3.5	I can fill an online form also using a dropdown list, check box, radio button, calendar and other functions	2.3D Filling an online form	
2.3.6	I can respond to authentication requests, if that is needed to access (public/private) services websites	2.3E Interacting with services	
2.3.7	I can explain what "strong authentication" is, and why it is needed in order to use a range of online services		
2.3.8	I can upload documents and photographs when this is required to complete an online transaction		
4.1.1	I can describe risks and threats for my digital device (hardware breakdown, physical impacts, human error etc.) and their potential consequences	4.1A Hardware risk	Protecting devices, data, health and well-being
4.1.3	I can install/activate on my devices protection software and functions (antivirus, malware detectors, antispam, pop-up blockers on the web browser, protection from theft, locking the screen etc.) and I know how to scan a device (USB, hard disk, etc.)	4.1B Software risks and protection	
4.1.4	I update regularly my computer's operating system, security software and other applications (when prompted or by setting up automatic updates), to prevent security issues	4.1C Update and backup	

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4.1.5	I make frequent backups of information or content I care for, by making a copy and storing it separately either in the cloud or on an external storage device		
4.1.6	I can create and use strong passwords according to existing guidelines (e.g. using three random words or with at least 8 characters, using lower- and upper-case letters, numbers and symbols)	4.1D Passwords	
4.1.7	I keep the information I use to access my devices and online accounts secure (including passwords), using different and secure passwords for websites and accounts (e.g. to prevent identity theft and its consequences)		
4.3.1	I can identify ergonomic and physical risks resulting from prolonged and inappropriate use of digital devices (backache, visual impairment, traffic hazards when using mobile phones, risks of using headphones while walking, bicycling, driving etc.) and take measures to minimize / alleviate these negative effects	4.3A Preventing physical and psychological risk	
4.3.2	I can identify the main symptoms of Internet/digital addiction (tiredness, being unable to stop an activity, less sleep, decline of social connections, losing the sense of reality etc.) and take measures to protect myself and/or my children.		
5.2.1	I can list the most common digital devices (computer, printer, scanner, tablet, smartphone, ebook reader). I can differentiate them by their function (what they can be used for)	5.2A Choosing digital tools	Basic ICT operations
5.2.2	I can choose the most appropriate digital devices and Apps for my activities, personal needs and habits		
5.1.2	I can find, install, update and remove software and applications (apps), downloaded from safe sources	5.1B Downloading and installing Apps	
5.2.3	I can customize some basic display and other features of my device (font size, screen background, power management etc.)	5.2B Customizing digital tools	
3.1.6	I can take a screenshot on my devices (computer, mobile phone …)	3.1F Taking screenshots	
3.1.2	I can use basic features of word processing software (using desktop or cloud computing software) to write simple text and apply formats	3.1B Basic word processing	
5.1.3	I can use common problem-solving support tools which are available in my device and applications (e.g. configuration guide, help function, set-up commands, etc.)	5.1D Support tools on device	

5.1.4	I can search for support online using community forums, blogs, video other types of tutorials	5.1C Support online	
5.4.1	I can find and use tools to identify my digital competence gaps	5.4A Identifying competence gaps	Digital self-awareness and learning
5.4.2	I can identify available solutions for learning online: video tutorials, e-learning courses, online guides and other educational materials	5.4B Learning solutions	

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Table 13 - Sequence of LUs and modules in the Learning Path Communication and social media

LOUT n°	LOUT description	Learning Unit	Module
2.1.1	I can distinguish between synchronous and asynchronous communication media and choose between them the most appropriate to the communication I want to make	2.1A Synchronous and asynchronous	Communication services
2.1.3	I can make video calls over the Internet	2.1C Video calls	
2.4.2	I can add a participant to or join a videocall	2.4B Managing a videocall	
2.1.4	I can find and view the latest calls and messages made and received	2.1D Checking calls and messages	
2.1.7	I can send and receive SMS through my phone	2.1G Sending receiving SMS	
2.1.8	I can send text messages via instant messaging applications (WhatsApp, Messenger, Skype ...).	2.1H Instant messaging	
2.4.3	I can create a WhatsApp group and add members to it	2.4C WhatsApp groups	
2.1.9	I can post messages on a forum and/or a blog	2.1I Forum and blog	
2.6.1	I can create an online account and related personal profile and log in and out of it safely (including changing and protecting passwords to prevent identity theft). I can delete my account if I want to quit.	2.6A Safe personal account management	Social media
2.6.2	I can give examples of footprints that I willingly leave online using different communication applications (e.g. posts in forums, blogs, "likes", published/shared photos and video etc.) and identify those that may damage my reputation	2.6B Managing reputation	
2.6.3	I can look up and view information about myself and others online		
2.6.4	I can adjust my online profile depending on the potential audience (formal-informal, professional, official, thematic etc.)		
4.2.1	I can provide a list of personal data, indicating those that should not be shared/ made visible on the Internet	4.2A Protecting personal data	
4.2.2	I can mention the citizens' rights defined in the new European General Data Protection Regulation (GDPR)		
4.2.3	I can adapt the personal information that I provide depending on the context and its security features (social networks, forums...)		

4.2.4	I can set privacy settings on my devices and on the applications I use (social media and others) -> e.g apply privacy settings to Facebook to ensure only friends can see posts and shared content		
2.2.3	I can share files, videos, audio, photos, locations, and contacts via social media and instant messaging software (WhatsApp, Messenger, Skype and others), also by using the "share" function	2.2C Sharing via social media	
2.2.4	I can upload self-created content (e.g. a photo) to be shared on websites that request it and/or that give this possibility (social media)	2.2D Uploading content	
2.5.3	I can recognize appropriate behaviours to adopt on social media ... such as asking permission before publishing/sharing photos of other people (especially when children are concerned); avoiding spamming (e.g. by sending invitations or other messages to everyone); using carefully sarcasm, irony or words that may be misunderstood by others	2.5B Social media netiquette	
2.5.4	I can recognise socially/ethically inappropriate online behaviour and communication such as hate speech, flaming, trolling, cyber-bullying, online stalking etc.	2.5C Inappropriate behaviour	
2.5.5	I use basic ways to contrast negative interactions online (signalling posts to service owners, postal police etc.)		
4.3.3	I can take measures to protect myself and my children against cyberbullying, grooming and sexting	4.3B Protecting children	
3.3.1	I can recognise the kind of copyright protection associated with online digital content	3.3A Copyright and licenses	Copyright and licences
3.3.2	I can adapt my use of online digital content depending on its copyright status and licences		
3.3.3	I can find and quote the source and/or author of online digital content before sharing it online		

Table 14 - Sequence of LUs and modules in the Learning Path Digital content creation

LOUT n°	LOUT description	Learning Unit	Module
3.2.1	I can distinguish between editable documents and uneditable ones due to PDF format and file protection	3.2A Editable and uneditable files	Documents
3.2.2	I can make simple changes (add text, make spelling corrections, change formats) to a document produced by another person using desktop or cloud computing software	3.2B Text editing	
3.1.3	I can use basic features of **spreadsheet** software (using desktop or cloud computing software) to organize data and use simple formulas	3.1C Basic spreadsheet	Spreadsheets
3.2.3	I can make simple changes (change/add numbers, change rows sequence by a new ordering criterium) to a spreadsheet created by another person using desktop or cloud computing software	3.2C Spreadsheet editing	
3.1.4	I can use basic features of **presentation** software (using desktop or cloud computing software) to prepare a simple presentation	3.1D Basic presentation	Presentations
3.2.4	I can make simple changes to a presentation created by another person using desktop or cloud computing software	3.2D Presentation editing	
3.1.5	I can take pictures and videos with mobile devices	3.1E Taking videos and pictures	Photos and videos
3.3.1	I can recognise the kind of copyright protection associated with online digital content	3.3A Copyright and licenses	Copyright and licences
3.3.2	I can adapt my use of online digital content depending on its copyright status and licences		
3.3.3	I can find and quote the source and/or author of online digital content before sharing it online		

Table 15 - Sequence of LUs and modules in the Learning Path Explore ICT

LOUT n°	LOUT description	Learning Unit	Module
3.4.1	I can read a flow chart identifying the operations and the order of their execution	3.4A Programming	Programming
3.4.2	I can create a basic program based on a simple flowchart or algorithm		
4.4.1	I can identify the basic measures to save energy and environmental resources (e.g. avoid unnecessary printing on paper, turn off equipment/devices after use, do not leave chargers connected without a mobile phone, etc.)	4.4A Protecting the environment	Environment
4.4.2	I can identify where to deposit obsolete and/or worn out ICT elements (electronic or computer components, batteries, toners, etc.) to minimise their wasting impact		
5.1.1	I can identify simple technical problems when operating devices and using digital environments	5.1A Identifying technical problems	Technical problems
5.3.1	I can explain what are simple tools such as: calendars, maps & navigators and Wikipedia	5.3A Opportunities for creative digital use	ICT tools
5.3.2	I can simply explain what are new tools and services such as: online collaboration environments, augmented/virtual reality, robots, voice commands, intelligent assistants, drones, 3D printing, internet of things		

Annex 4 – Learning paths and SAT modules

The DCDS self-assessment test (SAT) and LP BASE (the largest training block) can be delivered in a more flexible way than what was done in the DCDS training pilots.

Table 16 shows which SAT modules should be taken before starting each of the current DCDS learning paths, in case the training organisation decides to deliver the SAT in a modular way and forgo the use of the Recommender tool. Table 17 gives the same information, but with LP BASE segmented into three shorter learning paths.

Table 16 - Correspondence between current learning paths (LPs) and self-assessment test (SAT) modules

LPs	SAT modules
BASE	1.1, 1.2, 1.3 2.1, 2.2, 2.3, 2.4 4.1, 4.3 5.1, 5.2, 5.4
COM&Social media	2.5, 2.6, 3.3, 4.2
CREATE	3.1, 3.2, 3.3
EXPLORE	3.4, 4.4, 5.3

Table 17 - Correspondence between revised learning paths (LPs) and self-assessment test (SAT) modules

LPs	SAT modules
BASE1*	1.1, 1.2, 2.1, 2.2, 2.4
BASE2*	1.3, 2.3, 4.1, 4.3
BASE3*	5.1, 5.2, 5.4
COM & SOCIAL MEDIA	2.5, 2.6, 3.3, 4.2
CREATE	3.1, 3.2, 3.3
EXPLORE	3.4, 4.4, 5.3

* The revised LP BASE in terms of learning modules is illustrated below and in Figure 10:

BASE1
Safe browsing and aware info search
Creating an account and using e-mail safely and correctly

BASE2
Managing files and folders
Learning about public and private online service
Protecting devices, data, health and well-being

BASE3
Basic ICT operations
Digital self-awareness and learning

Figure 10 shows an alternative DCDS course structure with LP BASE segmented into three shorter learning paths.

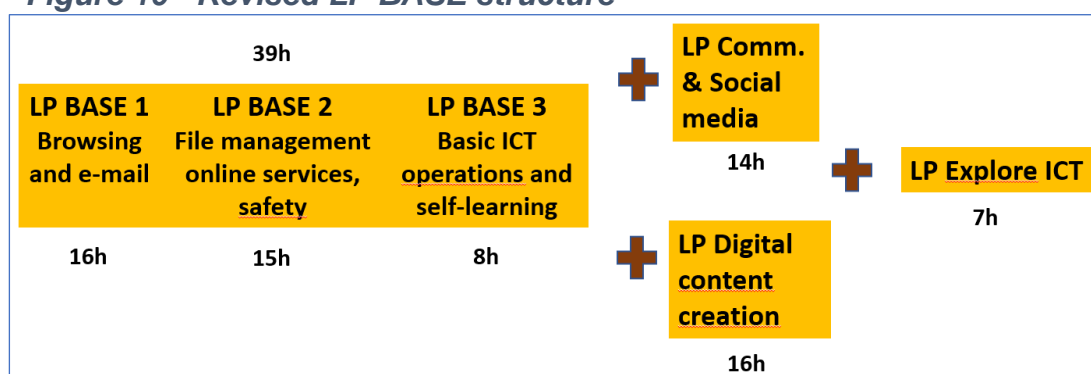*Figure 10 - Revised LP BASE structure*

Table 18 - Correspondence between learning modules and SAT modules

Learning modules	SAT modules
BASE Safe browsing and aware info search	1.1, 1.2
BASE Creating an account and using e-mail safely and correctly	2.1, 2.2, 2.4
BASE Managing files and folders	1.3
BASE Learning about public and private online service	2.3
BASE Protecting devices, data, health and well-being	4.1, 4.3
BASE Basic ICT operations	5.1, 5.2
BASE Digital self-awareness and learning	5.4
COM Social media	2.5, 2.6, 4.2
CREATE Documents	3.1, 3.2
COM/CREATE Copyright and licences	3.3
EXPLORE Programming	3.4
EXPLORE Environment	4.4
EXPLORE ICT tools	5.3

Annex 5 - Digital skills of the EU population based on DESI 2018

According to the DESI 2018 Human capital report,[29] **43% of the EU population in 2017** could be considered as lacking sufficient digital skills insofar, as they had either **low** (26% of respondents) **or no digital skills** (17% did not use the internet or did so only seldom).

Figure 11 - Digital skills of the EU population, 2017 (% of individuals by skills level)
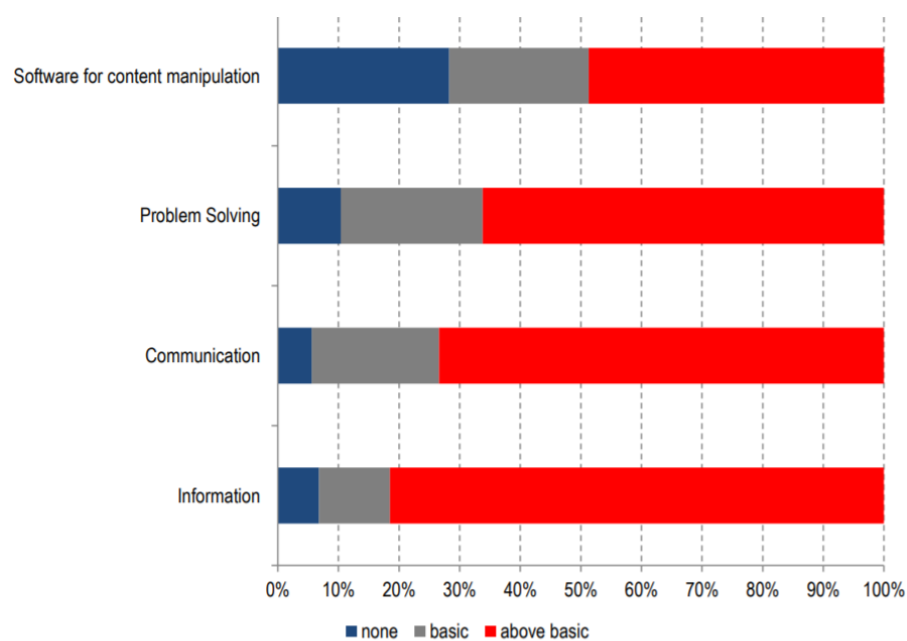

Source: Eurostat
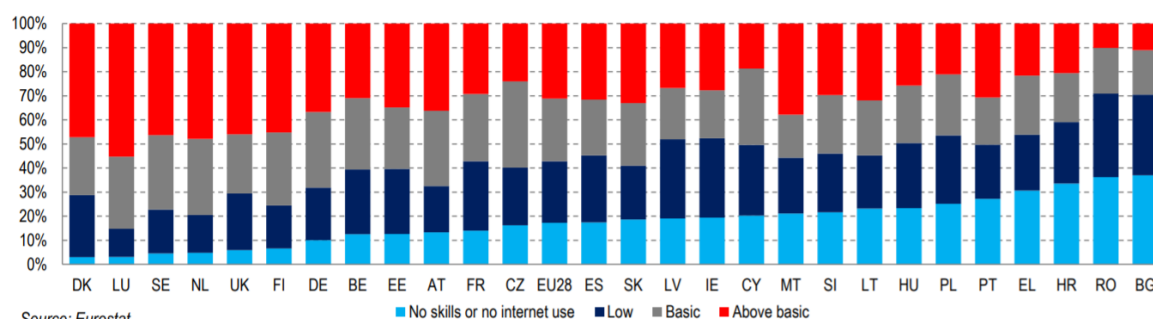
The share of no skills/no users in the EU **labour force** is lower (10%) than in the overall population (17%), but that of low skilled users is roughly similar (below 30%).

Figure 12 next page illustrates the level of digital skills of Internet users (not the whole population), by referring to the four competence dimensions identified from DigComp.

According to the DESI 2018 report: "Across competence dimensions, the largest skills deficit, both among the active labour force and the population at large, relates to the use of software for content manipulation. Almost one in three internet users in the EU has no skills in this area (i.e. they declared to not to have carried out any of the activities considered under this dimension, which range from relatively basic text treatment and spreadsheet-based work to video editing and coding). By type of activity, only about 7% and 30% of EU internet users had, respectively, written code and used spreadsheet advanced functions. In contrast, 82% and 73% can be considered to have above basic skills in, respectively the information and communication dimensions".

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[29] See http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=52247

Figure 12 - Digital skills, by competence dimension and level, 2017 (% of internet users)

Source: Eurostat

Annex 6 - Sources analysed to identify DCDS learning outcomes

Besides the DESI human capital indicator, we explored several sources that could be useful for the identification of the LOUTs to be included in the DCDM:

▋ DigComp v.1 provides examples of knowledge, skills and attitudes (dimension 4 of the framework) for all 21 competences, but without referring to proficiency levels. On the other hand, DigComp 2.1 provides examples of competence use, referring to the work and learning domains, at foundation level, for competences 1.1, 1.2, 1.3, 3.1, 3.2, 5.1 and 5.2. These examples inspired several DCDS LOUTs.

▋ the curricula of the Pane e Internet courses level 1 and 2, which mostly address foundation level digital competences in Italy;

▋ the online platform of the Flanders Adult Education system devoted to ICT courses, in particular the competence items and interpretations in the 2 modules of the "Start with ICT" course;

▋ the digital competence framework behind the PIX platform developed by the French Ministry of education;

▋ the descriptions in the teacher digital competence framework at foundation level 1 and 2, developed by INTEF in Spain;

▋ the digital competence descriptions at foundation level used in the certification system developed by the Castilla Y Leon government in Spain

Other resources analysed although not explicitly referred to DigComp are:

▋ the UK Essential Digital Skills framework articulated by life and work domains, but without proficiency levels;

▋ the online training platforms Les Bons Clics in France and Learn My Way in the UK;

▋ the "The Importance of Digital Literacy" chapter of the Canadian Language Benchmarks: ESL for Adult Literacy Learners (ALL)

Annex 7 – List of steps in the DCDS game Episode 1

In the table that follows, the steps that comprise episode #1 of the DCDS game are listed, along with the topic they pertain to in the context of DCDS[30].

No.	Action requested	Associated topic / subject area
3	Click to open an incoming email	Mail
4	Place a laptop on a suitable surface	Safety / Health
5	Figure out why laptop is not working; connect a power cable	Technical problems
6	Update the virus definitions of an antivirus software	Safety / Health
7	Navigate to a webpage by selecting the proper URL format	Navigate
8	Calculate totals in a spreadsheet	Spreadsheets
9-10	Bookmark a page	Navigate
11	Send a reply email to a higher-ranking executive using proper netiquette	Mail
12	Select the correct flowchart for an algorithm	Programming
13	Book a flight (choose the most cost-effective solution)	Navigate, Services
14	Download your boarding pass	Navigate, Documents
15	Scan downloaded file for viruses	Safety / Health
17	Install an app on a smartphone	Navigate, Services
18	Plug the phone to prevent it from turning off	Technical problems

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[30] Please note that transitional actions are used simply to propel the narrative forward and are thus not associated with any such area; therefore, they are omitted (e.g. the first step listed in the table is #3).

No.	Action requested	Associated topic / subject area
20-21	Make an online purchase of a programming-related book	Navigate, Services
22	Choose HTTP or HTTPS to pay online using a credit card	Safety / Health, Services
23	Download files (use batch download)	Documents, Data management
24	Extract compressed files	Documents, Data management
25	Store some files online (cloud service)	Data management, Services
26	Print a document (and figure out why the printer won't work)	Data management, Documents, Technical problems
27-28	Properly close the browser	Navigate
29	Shut down the computer properly	Safety / Health, Navigate