Boosting Classes 2.0 for high-quality teaching in adult education

Ref. cod. 2020-1-IT02-KA204-079329

Report on technologies in adult education

Co-funded by the
Erasmus+ Programme
of the European Union

Co-funded by the Erasmus+ Programme of the European Union

Erasmus+ Programme: KA2 – Cooperation for innovation and the exchange of good practices

Ref. no. 2020-1-IT02-KA204-079329

Elaborated by	**CERI (Bulgaria)** **EU-Track (Italy)**
Activity related	**O1/A2** - Identification and mapping of the digital skills required for the integration of the technology into the classes for adult education at the European level. **O1/A3 -** Analyzing and comparing of the assessment and evaluation systems in distance learning (formative and summative) through the specific tools and techniques in Europe. **O1/A4** - Analyzing of the current trends in the use of technology in the classes for adult education.
Deliverable No. and title	**O1 - Framework to integrate new technologies in adult education through project based learning**

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INTRODUCTION

Nowadays, competence requirements have changed with more jobs being subject to automation, technologies playing a bigger role in all areas of work and life, and entrepreneurial, social and civic competences becoming more relevant to ensure resilience and ability to adapt to change.

Digital competencies are increasingly seen nowadays as an important fundament for citizenship. Since digital technology and related services are continuously changing, digital competence needs to be updated accordingly, to reduce the risks of digital exclusion. Indeed, this risk of exclusion is increasingly connected to the lack of competence, while access to digital tools is continuously increasing. For example the penetration of mobile phones, which in 2019 has reached a coverage of 100% in all continents except for Africa that has a penetration rate of 80% (ITU Statistics, 2019). At the same time, digital competencies have become crucial for employability and in the workplace.

Besides the ICT skills for IT specialists and practitioners required in the job market, these competencies are now crucial to successfully search for and get a job, as well as to start a professional activity.

Digital competencies are also important for collaborative work and to perform several job-related functions, depending on information and data management, content production, communication, and so on.

At the same time, international surveys such as the Organisation for Economic Cooperation and Development (OECD) Programme for International Student Assessment (PISA) or the OECD Programme for the International Assessment of Adult Competencies (PIAAC) indicate a constant high share of teenagers and adults with insufficient basic skills.

EU data shows that in 2019 the percentage of people that have at least basic digital skills reached 58% (up from 55% in 2015). A large part of the EU population, however, still lacks basic digital skills, even though most jobs require such skills. (Digital Economy and Society Index Report, 2020).

Consequently, investing in basic skills has become more relevant than ever. High-quality education, including extra-curricular activities and a broad approach to competence development, improves achievement levels in basic skills. Besides, new ways of learning need to be explored for a society that is becoming increasingly mobile and digital. It is formulated as a key priority for all Member States to ensure high-quality inclusive education, training and lifelong learning providing opportunities for all to develop key competencies increasing and improving the level of digital competences at all stages of education and training, across all segments of the population (EU, Council Recommendation on Key Competences for Lifelong Learning, 2006 & 2018).

This document presents an overview of the digital skills and competencies required in adult education nowadays from the European perspective. Special focus is put on the use of the project-based learning delivered via virtual learning environments. The current trends in the introducing of technology into European schools are systematised in the last part of this document.

1. EUROPEAN OVERVIEW ON THE DIGITAL SKILLS REQUIRED IN ADULT EDUCATION

Digital competences appeared for the first time in the new framework of key competences for lifelong learning (EU, Council Recommendation on Key Competences for Lifelong Learning, 2006 & 2018), reflecting an understanding of the digital knowledge which goes beyond the strictly technical and procedural notions characterising previous European approaches.

As opposed to mere ICT skills conceptualisation of the original ECDL (ICDL outside Europe)[1], the digital competences' updated concept now incorporates aspects such as the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital well-being and competencies related to cybersecurity), intellectual property related questions, problem-solving and critical thinking.

1.1 Essential knowledge, skills and attitudes related to the key competencies

Key competences are those which all individuals need for personal fulfilment and development, employability, social inclusion, sustainable lifestyle, successful life in peaceful societies, health-conscious life management and active citizenship.

Key competences are developed from a lifelong learning perspective. The eight key competences for life-long learning from early childhood throughout adult life, and through formal, non-formal and informal learning in all contexts, including family, school, workplace, neighbourhood and other communities are defined in the EU as "a combination of knowledge, skills and attitudes that are adequate to the context" (EU, Council Recommendation on Key Competences for Lifelong Learning, 2006 & 2018) and provide a common reference framework destined to the decision-makers, educators, social partners and the students themselves. Ultimately, these are the set of knowledge, skills and strategies needed by a person to solve any obstacle found in the Society of Knowledge itself. At the European level the following key competencies were outlined:

- Literacy competence;
- Multilingual competence;
- Mathematical competence and competence in science, technology and engineering;

[1] ECDL became ICDL outside of Europe. ICDL has transformed from a European certification available across the world to a global certification of digital literacy in over 100 countries across 6 continents, with European roots. https://www.icdleurope.org/policy-and-publications/icdl-for-europe/

- Digital competence;
- Personal, social and learning to learn competence;
- Citizenship competence;
- Entrepreneurship competence;
- Cultural awareness and expression competence.

These competencies are all considered equally important. Each of them contributes to a successful life in society. These competencies can be applied in many different contexts and in a variety of combinations where the aspects essential to one domain support competence in another domain.

The updated concept of digital competences as one of the key competences is related to the necessity that the individuals should understand how digital technologies can support communication, creativity and innovation, and be aware of their opportunities, limitations, effects and risks. They should understand the general principles, mechanisms and logic underlying evolving digital technologies and know the basic function and use of different devices, software, and networks. Individuals should take a critical approach to the validity, reliability and impact of information and data made available by digital means and be aware of the legal and ethical principles involved in engaging with digital technologies.

Individuals should be able to use digital technologies to support their active citizenship and social inclusion, collaboration with others, and creativity towards personal, social or commercial goals.

The digital skills include the ability to use, access, filter, evaluate, create, program and share digital content. Individuals should be able to manage and protect information, content, data, and digital identities, as well as recognise and effectively engage with software, devices, artificial intelligence or robots.

Regarding the attitudes, the engagement with digital technologies and content requires a reflective and critical, yet curious, open-minded and forward-looking attitude to their evolution. It also requires an ethical, safe and responsible approach to the use of these tools.

1.2 Digital Competence Framework

To understand what the key elements of digital competence are and how to assess it, the European Commission developed a Digital Competence Framework for Citizens.

The Digital Competence Framework for Citizens, also known by its acronym DIGCOMP, was first published in 2013 by the European Commission, and then revised and updated. Its latest version, DIGCOMP 2.1, dates back to 2017.

DIGCOMP aimed to be a fundamental tool to tackle the challenge of the digital transformation, to improve citizens' digital competence, to help policymakers to formulate policies that support digital competence

building, and to plan education and training initiatives to improve the digital competence of specific target groups.

DIGCOMP also provides a common language on how to identify and describe the key areas of digital competence and is the main reference in Europe today for the development and strategic planning of digital competence initiatives[2]. Furthermore, new frameworks have been derived from DIGCOMP for new contexts where digital competence is needed. In collaboration with the Directorate-General for Justice and Consumers and the Joint Research Centre (JRC) additionally has been developed related competence frameworks in the fields of education and training, employment and lifelong learning. Examples of this work include the Digital Competence of Educators (DigCompEdu) (Redecker,2017), the Entrepreneurship Competence Framework (EntreComp[3]) and the European Framework for Digitally-Competent Educational Organisations (DigCompOrg[4]).

The DIGCOMP describes the competencies that are necessary today to use digital technologies in a confident, critical, collaborative and creative way for carrying out activities and achieving goals related to work, learning, leisure, inclusion and participation in our digital society.

Since its inception, the DIGCOMP framework has been well received and taken up by various stakeholders. This versatile instrument is used for various purposes as follows:

- Policy formulation and support - is one of the purposes of DIGCOMP use at the national and regional level. To help policymakers to obtain a macro-level view of citizens' digital competence, the European Commission has developed a Digital Skills Index (DESI).
- Instructional planning for education, training and employment
- Assessment and certification

In an attempt to share practices and offer opportunities for peer learning around the implementation of DIGCOMP, in 2015 an "Implementation Gallery" was launched on the JRC Science Hub website5.

The latest version of the Digital Competence Framework for Citizens (version 2.1) is structured in five dimensions (competence areas).

Five Competence areas currently are identified to be part of digital competence: 1) Information and data literacy; 2) Communication and collaboration; 3) Digital content creation; 4) Safety; 5) Problem-solving. Competence areas 1, 2 and 3 deal with competencies that can be retraced in terms of specific activities and uses. Competence areas 4 and 5 are "transversal" as they apply to any type of activity carried out through digital means. Problem-solving elements, in particular, are present in all competence areas, but a specific area was

[2] https://ec.europa.eu/jrc/en/digcomp
[3] https://ec.europa.eu/jrc/en/entrecomp/
[4] https://ec.europa.eu/jrc/en/digcomporg
[5] https://ec.europa.eu/jrc/digcomp/implementation

defined to highlight the importance of this aspect for the appropriation of technology and digital practices. Please, see Figure 1.

Figure 1 DIGCOMP Competence areas

- Dimension 1: Areas identified to be part of the digital competence
- Dimension 2: Competence that is pertinent to each area (21) with their title and descriptors.
- Dimension 3: Eight Proficiency levels for each competence, that is; Foundation > Level 1 & Level 2; Intermediate > Level 3 & Level 4; Advanced > Level 5 & Level 6; Highly specialised > Level 7 & Level 8.
- Dimension 4: Knowledge, skills and attitudes applicable to each competence
- Dimension 5: Examples of use, on the applicability of the competence to different purposes.

The process of updating DIGCOMP is advancing in two phases (Please see the next Figure).

- Phase 1: the update of the “conceptual reference model” - in other words, updating the competence areas, the competence descriptors and their titles.

- Phase 2: the update of the "framework", i.e. the proficiency levels related to the competences as well as the knowledge, skills and attitudes applicable.

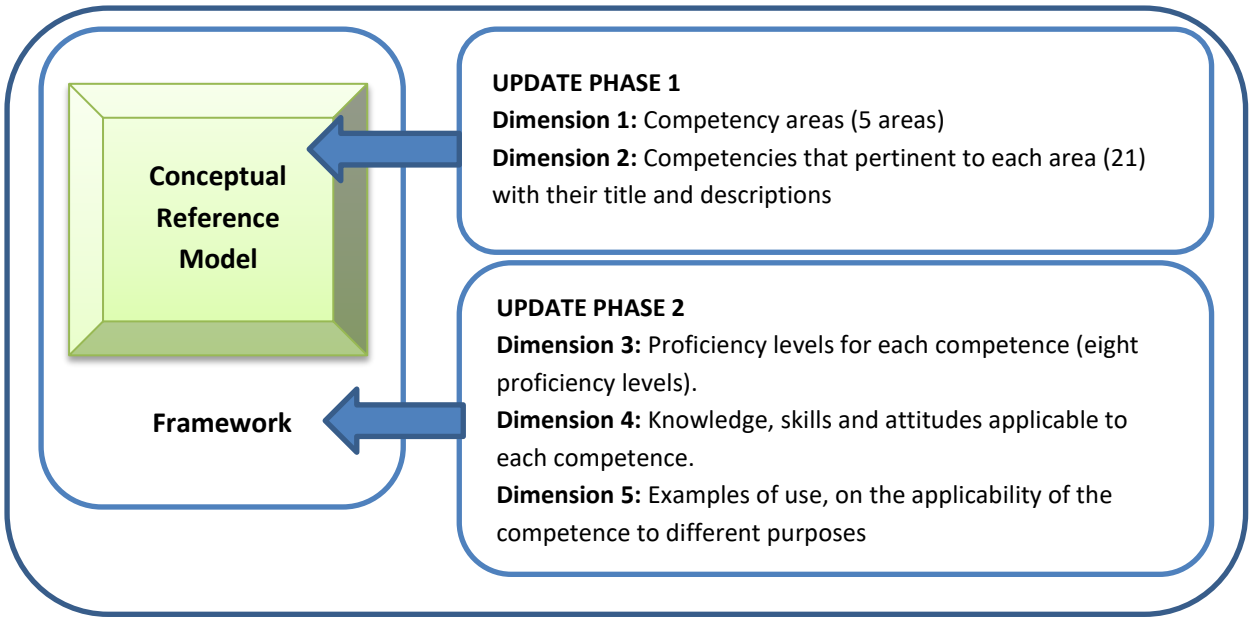

Figure 2 DIGCOMP Framework update phases (Our own adaptation[6])

Table 1 presents the DIGCOMP dimensions 1 and 2 according to DIGCOMP 2.1. and the interconnection between them.

Competence areas (Dimension 1)	Competences (Dimension 2)
1. 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.* 1.2 Evaluating data, information and digital content *To analyse, compare and critically evaluate the credibility and reliability of sources of data, information and digital content. To analyse, interpret and critically evaluate the data, information and digital content.* 1.3 Managing data, information and digital content *To organise, store and retrieve data, information and content in digital environments. To organise and process them in a structured environment.*
2. Communication	2.1 Interacting through digital technologies

[6] https://publications.jrc.ec.europa.eu/repository/bitstream/JRC101254/jrc101254_digcomp%202.0%20the%20digital%20competence%20framework%20for%20citizens.%20update%20phase%201.pdf

and collaboration	*To interact through a variety of digital technologies and to understand appropriate digital communication means for a given context.* 2.2 Sharing through digital technologies *To share data, information and digital content with others through appropriate digital technologies. To act as an intermediary, to know about referencing and attribution practices.* 2.3 Engaging in citizenship through digital technologies *To participate in society through the use of public and private digital services. To seek opportunities for self-empowerment and participatory citizenship through appropriate digital technologies.* 2.4 Collaborating through digital technologies *To use digital tools and technologies for collaborative processes, and co-construction and co-creation of resources and knowledge.* 2.5 Netiquette *To be aware of behavioural norms and know-how while using digital technologies and interacting in digital environments. To adapt communication strategies to the specific audience and to be aware of cultural and generational diversity in digital environments.* 2.6 Managing digital identity *To create and manage one or multiple digital identities, to be able to protect one's own reputation, to deal with the data that one produces through several digital tools, environments and services.*
3. Digital content creation	3.1 Developing digital content *To create and edit digital content in different formats, to express oneself through digital means.* 3.2 Integrating and re-elaborating digital content *To modify, refine, improve, and integrate information and content into an existing body of knowledge to create new, original and relevant content and knowledge.* 3.3 Copyright and licenses *To understand how copyright and licenses apply to data, information and digital content.* 3.4 Programming *To plan and develop a sequence of understandable instructions for a computing system to solve a given problem or perform a specific task.*
4. Safety	4.1 Protecting devices *To protect devices and digital content, and to understand risks and threats in digital environments. To know about safety and security measures and to have due regard to reliability and privacy.* 4.2 Protecting personal data and privacy *To protect personal data and privacy in digital environments. To understand how to use and share personally identifiable information while being able to protect oneself and others from damages. To understand that digital services*

	use a "Privacy policy" to inform how personal data is used. 4.3 Protecting health and well-being *To be able to avoid health-risks and threats to physical and psychological well-being while using digital technologies. To be able to protect oneself and others from possible dangers in digital environments (e.g. cyberbullying). To be aware of digital technologies for social wellbeing and social inclusion.* 4.4 Protecting the environment *To be aware of the environmental impact of digital technologies and their use.*
5. Problem solving	5.1 Solving technical problems *To identify technical problems when operating devices and using digital environments, and to solve them (from troubleshooting to solving more complex problems).* 5.2 Identifying needs and technological responses *To assess needs and to identify, evaluate, select and use digital tools and possible* *technological responses to solve them. To adjust and customize digital environments to* *personal needs (e.g. accessibility).* 5.3 Creatively using digital technologies *To use digital tools and technologies to create knowledge and to innovate processes and products. To engage individually and collectively in cognitive processing to understand and resolve conceptual problems and problem situations in digital environments.* 5.4 Identifying digital competence gaps *To understand where one's own digital competence needs to be improved or updated. To be able to support others with their digital competence development. To seek opportunities for self-development and to keep up-to-date with the digital evolution.*

Table 1 DigiComp Conceptual Reference Model

Regarding the proficiency levels, DIGCOMP 1.0 Framework (2013) had three proficiency levels in Dimension 3 (foundation, intermediate and advanced). DIGCOMP 2.0 Framework (2016) maps out 4 broad proficiency levels (foundation, intermediate, advanced, highly specialised). These have been increased to eight levels in DIGCOMP 2.1 (2017). A wider and more detailed range of proficiency levels supports the development of learning and training materials. It also helps in the design of instruments for assessing the development of citizens' competence, career guidance and promotion at work.

The eight levels provide the granularity needed to develop learning materials, assess and recognise learning progression, and describe tasks and competences in detail.

Each of these eight levels' descriptions represents the steps of the learners in the following three domains:

- The acquisition of knowledge of the competence;

- The complexity of the tasks they can handle;
- Their autonomy in completing the task.

Eight proficiency levels for each competence have been defined through learning outcomes (using action verbs, following Bloom's taxonomy) and inspired by the structure and vocabulary of the European Qualification Framework (EQF). Please see the 4 overall as well as the eight granular proficiency levels and their descriptions in the table below.

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

Figure 3 DIGCOMP 2.1 proficiency levels [7]

[7] Source: https://publications.jrc.ec.europa.eu/repository/bitstream/JRC110624/dc_guide_may18.pdf

DIGCOMP framework is flexible enough to be used in different sectors, where digital competence is increasingly important as follows:

- Education and training: digital competence is relevant at all levels of the educational system (including school and higher education) for several reasons, ranging from active citizenship to using ICT for learning purposes, to job search.
- Life-long learning and social inclusion: digital competence is also important in everyday life and the lack of digital competence can increase the risk of social exclusion of already disadvantaged people (e.g., disabled people, migrants, older people etc.).
- Employment and workplace: digital competence is necessary today in the workplace, at different (more general or more specialised) levels, since an increasing number of job profiles requires the mastering of digital skills.

In these fields, DIGCOMP has been used with a variety of purposes that are of interest for understanding its role in adult education, namely:

- as a tool to analyse the digital skills requirements of various jobs and to define the related professional digital profiles;
- as a tool to assess and certify the digital skills levels;
- as a tool to design, develop and deliver digital competence training programmes.

The following sections of this report discuss the issues related to life-long learning and inclusion as well as on employment, looking at how the acquisition of digital competence has come into play in the lives of adults, whether they are at risk of social exclusion or workers needing to update their skills.

1.3 Digital competencies and social inclusion

A relevant field of interest for adult education trainers in the area of digital competence focuses on adults at risk of social exclusion, particularly people on the margins, and older people who need to develop digital skills to keep their social relations and train their cognitive skills in a digital world.

According to Eurostat data[8], people with low education levels or low incomes continue to be at risk of digital exclusion, while the number of people with a low level of digital skills increases with age. For example, while 96% of 16-24 year-olds living in the EU-28 use the Internet at least once a week, only 57% of people aged 55-74 do it. Some progress has been made in recent years, but the situation still needs to be improved to

[8] https://ec.europa.eu/eurostat/web/digital-economy-and-society/overview

support and encourage citizens' participation in the social, political and economic life of contemporary societies. As underlined in several EU documents digital competence is a driving force for the social promotion of subjects at risk of marginalisation. The EU has undertaken several initiatives in the related area of e-inclusion, a term referring to actions aimed at creating "an information society for all". In the Digital Agenda for Europe 2010-2020, digital inclusion – or e-inclusion – has been seen as a necessary condition to ensure equity and social justice: the lack of access to digital information resources and opportunities in the information society represents heavy discrimination factor.

In 2019 the Directorate-General for Employment, Social Affairs and Inclusion (European Commission) has published Inspirational practices for tomorrow's inclusive digital world (EC, 2019) where good practices in the area of "digital skills for all" are described. The provided examples are related to the co-production of digital and inclusive public services for all as well as to the training of specific population's segments, including older people, migrants, youth with disabilities and NEETs (Neither in Employment nor in Education or Training), to make them digitally literate. Focusing on training, the following different target groups are addressed for diverse reasons (why) on partially similar contents (what) in different ways (how);

- Older people.

One of the main risks for digitally unskilled older people is to be disconnected with severe implications for their civil and social relationships (why). If they are not able to communicate with their digital devices, even well-educated older subjects are at risk to become isolated, unable to carry out everyday tasks such as online banking, interacting with official forms, and losing contacts with their families. Training addressing older people is mostly concerned with the very basic notions of digital competence associated with communication (what) and some good practices are leveraged on "peer tutoring" where the tutor is the younger and the tutored the older (how). In this way, it is not only digital skills that are promoted but also the intergenerational link.

- Migrants

There are many reasons why migrants need to be digitally competent, from the search for a job to requesting a document for accessing language courses (why). The ownership of basic digital skills related to information and communication (what) is crucial for them to be part of the country they reached. Language may be an obstacle in the digital training of migrant people: therefore, modelling and coaching (how) are essential strategies for effective training.

- Youth with disabilities

In general, ICT may increase the opportunities for young adults with disabilities to access training and learning, to participate in a community of interest, to find jobs (why). For these purposes, they need to develop from basic to advanced digital competences (what), but a condition is required (how): the

requirement of accessibility (mostly but not exclusively web-accessibility) must be met, thus ensuring that ICTs are enablers and not obstacles to the digital participation of these young adults. Again, modelling, tutoring and coaching are crucial in supporting them to the point that they can become the protagonists of their digital environments as digital workers checking for web accessibility.

- Youth at risk of social exclusion.

For young people at risk of social exclusion, school and more generally the formal education system is far from providing them with relevant involvement in terms of their marginalisation (why). Exploring informal digital approaches with young adults as a starting point to bridging the formal and informal learning experiences (how) may be an effective strategy to promote digital competencies associated with information, communication and digital creativity (what).

1.4 Digital competencies for employability

The economy digitisation is contributing to the polarization of the labour market: on one hand, it has led to an increased demand for high-skilled individuals, able to use the new technologies to carry out their professional tasks; on the other hand, it has led to a decreased demand for low-skilled workers. Again, the automation based on smart technologies replacing humans has resulted in some cases of jobs losses, while at the same time the process of digitisation is favouring the emergence of new jobs requiring cognitive and interactive abilities that are complementary to computer-based work. Moreover, digitisation is also leading to the transformation of existing jobs, reshaping the job tasks and, consequentially, the skills that are necessary to perform certain jobs.

Recent figures on digital skills and the labour market indicate the increasing mismatch between the digital skills needed on the side of job demand and the digital skills currently available on the supply side. Furthermore, Eurostat data shows how rapidly the job tasks of the employed internet users are changing, due to the evolution of the various software used in the workplace. The workers very often had to learn how to use new equipment for their job and part of them admitted to needing further training.

1.5 Mapping of the digital skills required for the integration of the technology into the classes for adult education

Multilingual classification of European Skills, Competences, Qualifications and Occupations (ESCO) and DIGCOMP

ESCO is the multilingual classification of European Skills, Competences, Qualifications and Occupations. ESCO is coordinated by DG Employment, Social Affairs and Inclusion, and supported by the European Centre for the Development of Vocational Training (Cedefop) and is an important part of the Europe 2020 strategy. The ESCO classification identifies and categorises skills, competences, qualifications and occupations relevant for the EU labour market and education and training. It systematically shows the relationships between the different concepts.

An example of gap analysis to compare existing frameworks is the ESCO[9] list of transversal ICT skills. DIGCOMP framework was used as one of the reference tools for gauging the competence areas and needed skills. DIGCOMP has itself taken advantage of this collaboration by adding some new concepts into its updated framework. The table below shows the five areas finally included in the list and the corresponding areas.

DIGCOMP	ESCO Transversal ICT skills
Information and data literacy	Digital data-processing
Communication and collaboration	Digital communication
Digital content creation	Content-creation with ICT software
Safety	ICT Safety
Problem-solving	Problem-solving with ICT tools and hardware

Table 2 The mapping of the DIGCOMP and ESCO competence areas

European e-Competence Framework (e-CF) and DIGCOMP

The e-Competence Framework (e-CF) is a common European framework for ICT Professionals in all sectors. To better understand the synergies between these two frameworks e-CF was also mapped with DIGCOMP. In this case, the main difference between the instruments is that one is for a general audience, i.e. DIGCOMP for citizens, whereas the e-CF framework is for professionals working in the ICT sector.

[9] https://ec.europa.eu/esco/

The advantage of mapping the two is to show the continuity of certain skills when passing from competencies expected of citizens to those expected of ICT professionals. The next table presents the entire list of cross-references.

DigComp competence	*Nature of cross-reference*	e-CF competence
3.4 Programming	*could correspond with*	A.6 Application Design (EQF levels 3-6); B.1 Application Development (EQF levels 3- 8); B.6 Systems Engineering (EQF levels 6-7)
1.3 Storing and retrieving information	*higher levels could correspond with*	D.10 Information and Knowledge Management (EQF levels 6-8)
4.1 Protecting devices	*higher levels could correspond with*	D.1 Information Security Strategy Management (EQF levels 7-8); E.8 Information Security Management (EQF levels 5-7)
4.4 Protecting the environment	*higher levels could correspond with*	A.8 Sustainable Development (EQF levels 6-7)
5.1 Solving technical problems	*higher levels could correspond with*	C.4 Problem Management (EQF levels 4-7)
5.3 Innovating and creatively using technology	*higher levels could correspond with*	A.9 Innovating (EQF levels 7-8)
5.2 Identifying needs and technological responses	*higher levels could partially correspond with*	A.4 Product/Service Planning (EQF levels 4-7)
5.4 Identifying digital competence gaps	*higher levels could partially correspond with*	D.3 Education and Training Provision (EQF levels 4-6); D.9 Personnel Development (EQF levels 4-7)
2.6 Managing Digital Identity	*higher levels could partially correspond with*	E.3 Risk Management (EQF levels 4-7)
3.3 Copyright and Licences	*higher levels could partially correspond with*	D.8 Contract Management EQF levels 4-7) Note: many others also mention IPR as a knowledge example

Table 3 Cross-reference between DIGCOMP and e-CF

DIGCOMP and UNESCO's Media and Information Literacy (MIL) framework

DIGCOMP was mapped to UNESCO's work on Media and Information Literacy[10], which brings together the fields of Information and Media literacy as "a combined set of competencies necessary for life and work today". JRC incorporated this perspective with the DIGCOMP 2.0 update, which encompasses the main components of Information Literacy and parts of Media Literacy as shown in the next table.

DIGCOMP Competences	Global Media and Information Literacy Assessment Framework "MIL Subject Matters"
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	1.1. Definition and articulation of a need for information 1.2 Search and location of information and media content 1.3 Access to information, media content and media and information providers 1.4 Retrieval and holding/storage of information and media content 2.2 Assessment of information and media content, and media and information providers 2.3 Evaluation of information and media content, and media and information providers 2.4 Organisation of information and media content
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	3.2 Communication of information, media content and knowledge ethically and effectively in an ethical and effective manner 3.3 Participating in societal-public activities as an active citizen 3.4 Monitoring influence of information, media content, knowledge production and use, as well as of media and information providers
Digital content creation 3.1 Developing digital content 3.2 Integrating and re-elaborating digital content 3.3 Copyright and licences 3.4 Programming	3.1 Creation of knowledge and creative expression 3.2 Communication of information, media content and knowledge ethically and effectively in an ethical and effective manner
Safety 4.1 Protecting devices 4.2 Protecting personal data and privacy	

[10] UNESO, Media and Information Literacy: http://www.unesco.org/new/en/communication-and-information/media-development/media-literacy/mil-as-composite-concept/

4.3 Protecting health and well-being 4.4 Protecting the environment	
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	

Table 4 Cross-reference between DIGCOMP and UNESCO's Media and Information Literacy

ECDL/ICDL Framework and DIGCOMP mapping

ICDL[11] is an international organisation that benefits from the unique support of experts from national computer societies and education and training partners, local and regional authorities, national governments, international development organisations, as well as public and private sector employers in all sectors worldwide to develop vendor-independent digital competence standards in the workforce, education, and society. The Foundation provides certification in more than 100 countries, enable individuals and organisations to assess, build and certify their competence in the use of computers and digital tools to the globally-recognised European Computer Driving Licence (ECDL) standard, known as ICDL outside Europe. The ECDL Foundation has been an active stakeholder in the development of the DIGCOMP framework from its initial stages, sharing its expertise in defining, structuring, and assessing digital skills. The DIGCOMP framework is a general, high-level description of the set of competencies relevant for users of digital technology. ECDL offers specific solutions in this area. ECDL has carried out an exercise of mapping the ICDL programme to DIGCOMP, which has been identified as an implementation example by the Joint Research Centre (JRC). ECDL modules were mapped both to DIGCOMP 1.0 and 2.0. JRC has reviewed these mappings and identified them as implementation examples of using the framework. ECDL certificates can be used as proof of acquired competence for various purposes, for example in the Europass CV (similarly to languages certificates that prove language levels indicated in the language grid). The mapping schema is presented in the next Figure.

[11] https://icdleurope.org/policy-and-publications/icdl-and-digcomp/

DigComp Area	DigComp Competences	ECDL Modules
Information and Data Literacy	Browsing, searching and filtering data, information and digital content Evaluating data, information and digital content Managing data, information and digital content	Computer Essentials Information Literacy
Communication and Collaboration	Interacting through digital technologies Sharing through digital technologies Engaging in citizenship through digital technologies Collaborating through digital technologies Netiquette Managing digital identity	Online Essentials Online Collaboration ICT in Education
Digital Content Creation	Developing digital content Integrating and re-elaborating digital content Copyright and licences Programming	Word Processing Spreadsheets Presentation Using Databases Advanced Word Processing Advanced Spreadsheets Web Editing Image Editing Project Planning 2D CAD Advanced Database Advanced Presentation
Safety	Protecting devices Protecting personal data and privacy Protecting health and well-being Protecting the environment	IT Security
Problem Solving	Solving technical problems Identifying needs and technological responses Creatively using digital technologies Identifying digital competence gaps	Computing ICT Troubleshooting* * Coming in 2017

Note: *Some modules may support more than one competence area - for example, Computing relates to Programming in Digital Content Creation, as well as Problem Solving; Computer Essentials and Online Essentials both include issues relating to Safety.*

Figure 4 ECDL and DIGICOMP competences mapping model[12]

[12] Source: https://icdleurope.org/policy-and-publications/icdl-and-digcomp/

1.6 Digital Competence Framework for Educators

The teaching professions face rapidly changing demands, which require a new, broader and more sophisticated set of competences than before. The ubiquity of digital devices and applications, in particular, requires educators to develop their digital competence.

Education institutions are currently facing the challenge of seeking to innovate ways of conducting their education work, especially in light of the recent technological, economic and social changes that are currently taking place, with the aim of training and educating new generations for an uncertain and disconcerting future (OpenMind BBVA, 2017).

Within the professional competences of the teacher, different authors allude to those skills or abilities related to the use of technological tools for conducting their professional activity in the classroom, which is different in many aspects to the use that could be given to them in the household environment (Blau et.al. 2017). Modern education requires the addition of technologies, which at the moment are digital. This demands that the teachers possess a significant Teachers Digital Competence (TDC) for the mastery of the ICT and their integration into the teaching and learning processes (Hatlevik et.al., 2018). This competence is understood as a set of capacities, abilities, knowledge or skills that teachers possess to solve educational problems by integrating ICT. At the same time, the mastery of the TDC empowers the teacher for the use of the ICT not only as support for their existing practices but also to transform them (Uerz et.al., 2018).

Some factors considered to be mobilizing variables of the TDC are described below:

1. Training of the teacher: the teacher's work experience, initial training and the degree of knowledge of the ICT tools are fundamental factor for the development of TDC (Garzon Atracho et.al, 2019).
2. Resources: quality of the infrastructure and availability of the digital devices and technologies necessary (Gil-Florez et.al., 2017). Some teachers assert their pre-disposition for integrating ICT resources into teaching-learning practices if they had the necessary means.
3. Usage time: dedication to ICT usage in and out of the classroom as an element that favours the teacher's digital competence. Insufficient time available to prepare the Technology-enhanced learning (TEL) sessions through the is an opposing element (Asian et.al., 2016).
4. Attitude towards technology: the attitudes and beliefs the teacher has concerning the TEL opportunities are critical variables that will determine the addition of the ICT to the teaching practice of the teacher, and not only their addiction but also how they are introduced and the functions assigned to them (Ghomi&Redecker, 2019). This attitude is perceived in the teacher's use of certain technologies such as social networks (Scherer, 2019).

For the acquisition of the teacher's digital competence, a series of competence frameworks have been suggested. All of these seek to discover in which manner the technology should be integrated and used in teaching, to identify the training needs and to propose to personalize training itineraries.

Furthermore, in agreement with comments by different authors, the following can be considered the most consolidated: (Please see the next table.)

Model Framework	Institution	Reference	Areas or dimensions of TDC
ICT standards for FID	Ministry of Education, Chile	Enlaces (2008)	Pedagogical, technical, school management, social, ethical and legal aspects of development.
NETS-T	ISTE	ISTE (2008)	Learning and creativity of the students, learning and evaluation experiences, work, citizenship and professional growth.
Teachers ICT competence standards	UNESCO	Unesco (2008)	Policy and vision, curriculum and evaluation, pedagogy, ICT, organization and administration, professional teacher training.
Teachers ICT competencies	Ministry of Education, Chile	Enlaces (2011)	Pedagogical, technical, management, social, ethical and legal, and professional development.
DigiLit Leicester	Leicester City Council	Fraser, Atkins & Richard (2013)	Search, evaluation and organization, create and share, evaluation and feedback, communication, collaboration, and participation, security, identity, development.
ICT competences for professional teacher development	Ministry of National Education, Colombia	Ministerio Educación Nacional (2013)	Technological, communicative, pedagogical, management and research.
Common Framework for TDC	Ministry of Education, Government of Spain	INTEF (2014 y 2017)	Information, communication, content creation, security, problem-solving
TDC Rubric	ARGET, Universitat Rovira i Virgili	Lázaro & Gisbert (2015)	Didactic, curricular and methodological; planning, organization and management of digital technology resources and spaces; relational, ethical and security; personal and professional
TDC definition	Generalitat de Catalunya	Departament d'Ensenyament (2016)	Design, planning and didactic implementation; management of digital technology resources and spaces; communication and collaboration; ethics and digital citizenship; professional development
DIGCOMP-EDU	European	Redecker & Punie	Social and professional commitment; digital

	Commission	(2017)	resources; digital pedagogy; evaluation and feedback; empowerment of students; facilitate students' digital competence

Table 5 Teachers Digital Competence frameworks and models. Updated by Esteve (2015) and Lazaro (2015)

Altogether, an evaluation study through the use of expert competence highlighted the DigCompEdu model as the most adequate for evaluating the Teachers Digital Competence.

The European Framework for the Digital Competence of Educators (DigCompEdu) is a scientifically sound framework describing what it means for educators to be digitally competent. It provides a general reference frame to support the development of educator-specific digital competences in Europe. DigCompEdu is directed towards educators at all levels of education, from early childhood to higher and adult education, including general and vocational education and training, special needs education, and non-formal learning contexts. It aims to provide a general reference frame for developers of Digital Competence models, i.e. the Member States, regional governments, relevant national and regional agencies, educational organisations themselves, and public or private professional training providers.

DigCompEdu considers six different competences areas with a total of 22 competences.

- Area 1 focuses on the professional environment;
- Area 2 on sourcing, creating and sharing digital resources;
- Area 3 on managing and orchestrating the use of digital tools in teaching and learning;
- Area 4 on digital tools and strategies to enhance assessment;
- Area 5 on the use of digital tools to empower learners;
- Area 6 on facilitating learners' digital competence.

Areas 2 to 5 form the pedagogic core of the framework. They detail the competencies educators need to possess to foster effective, inclusive and innovative learning strategies, using digital tools. Please see the next Figure.

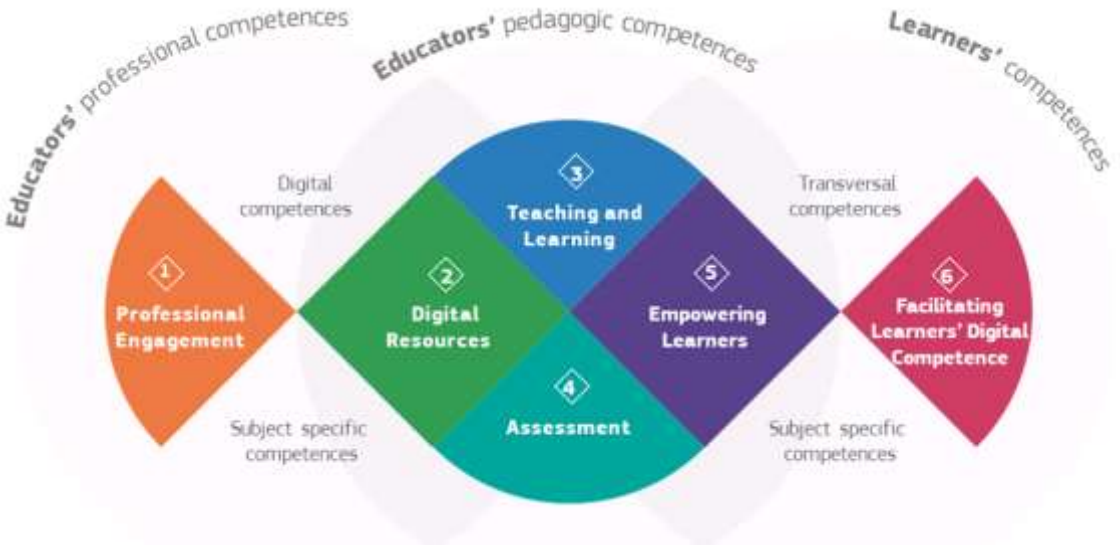

Figure 5 DigCompEdu[13] - competences areas

To encourage take-up, it is proposed to refer to proficiency levels using motivating role descriptors. These can, however, be mapped onto the proficiency levels used by the Common European Framework of Reference for Languages (CEFR), ranging from A1 (Newcomer) to C2 (Pioneer). In general, the following characterisations apply:

- Newcomers (A1) little experience and contact with education technology. Need continuous guidance to improve his or her digital competence level.
- Explorers (A2) little contact with education technology. Have not developed specific strategies for including ICT in the classroom. Need external guidance to improve their digital competence level for teachers.
- Integrators (B1) experiment with education technology and reflects on its adequacy for different educational contexts.
- Experts (B2) utilize a wide range of educational technologies critically and with confidence and creativity. Seek the continued improvement of teaching practices.
- Leaders (C1) rely on a broad repertoire of flexible, comprehensive and effective digital strategies. They can adapt their needs to different resources, strategies and knowledge within their reach. A source of inspiration for others.
- Pioneers (C2) question the adequacy of contemporary digital and pedagogical practices, of which they are experts. They lead the innovation of ICT and are a role model to follow for other educators.

13 https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/european-framework-digital-competence-educators-digcompedu

The synthesis of the DigCompEdu Framework is presented in the next table:

Competence Areas	Competencies' Description
1. Professional engagement	1.1 Organisational communication *To use digital technologies to enhance organisational communication with learners, parents and third parties. To contribute to collaboratively developing and improving organisational communication strategies.*
	1.2 Professional collaboration *To use digital technologies to engage in collaboration with other educators, sharing and exchanging knowledge and experiences and collaboratively innovating pedagogic practices.*
	1.3 Reflective practice *To individually reflect on, critically assess and actively develop one's own digital pedagogical practice and that of one's educational community.*
	1.4 Digital Continuous Professional Development (CPD) *To use digital sources and resources for continuous professional development.*
2. Digital Resources	2.1 Selecting digital resources *To identify, assess and select digital resources for teaching and learning. To consider the specific learning objective, context, pedagogical approach, and learner group, when selecting digital resources and planning their use.*
	2.2 Creating and modifying digital resources *To modify and build on existing openly-licensed resources and other resources where this is permitted. To create or cocreate new digital educational resources. To consider the specific learning objective, context, pedagogical approach, and learner group, when designing digital resources and planning their use.*
	2.3 Managing, protecting and sharing digital resources *To organise digital content and make it available to learners, parents and other educators. To effectively protect sensitive digital content. To respect privacy and copyright rules. To understand the use and creation of open licenses and open educational resources, including their proper attribution.*
3. Teaching and Learning	3.1 Teaching *To plan for and implement digital devices and resources into the teaching process, to enhance the effectiveness of teaching interventions. To appropriately manage and orchestrate digital teaching interventions. To experiment with and develop new formats and pedagogical methods for instruction.*
	3.2 Guidance *To use digital technologies and services to enhance the interaction with learners, individually and collectively, within and outside the learning session. To use digital technologies to offer timely and targeted guidance and assistance. To experiment with and develop new forms and formats for offering guidance and support.*
	3.3 Collaborative learning *To use digital technologies to foster and enhance learner collaboration. To enable learners to use digital technologies as part of collaborative assignments, as a means for enhancing communication and collaboration and for collaborative knowledge creation.*

	3.4 Self-regulated learning *To use digital technologies to support self-regulated learning processes, i.e. to enable learners to plan, monitor and reflect on their own learning, provide evidence of progress, share insights and come up with creative solutions.*
4. Assessment	4.1 Assessment strategies *To use digital technologies for formative and summative assessment. To enhance the diversity and suitability of assessment formats and approaches.*
	4.2 Analysing evidence *To generate, select, critically analyse and interpret digital evidence on learner activity, performance and progress, to inform teaching and learning.*
	4.3 Feedback and Planning *To use digital technologies to provide targeted and timely feedback to learners. To adapt teaching strategies accordingly and to provide targeted support, based on the evidence generated by the digital technologies used. To enable learners and parents to understand the evidence provided by digital technologies and use it for decision-making.*
5. Empowering Learners	5.1 Accessibility and inclusion *To ensure accessibility to learning resources and activities, for all learners, including those with special needs. To consider and respond to learners' (digital) expectations, abilities, uses and misconceptions, as well as contextual, physical or cognitive constraints to their use of digital technologies.*
	5.2 Differentiation and personalisation *To use digital technologies to address learners' diverse learning needs, by allowing learners to advance at different levels and speeds, follow individual learning pathways and goals.*
	5.3 Actively engaging learners *To use digital technologies to foster learners' active and creative engagement with a subject matter. To use digital technologies within pedagogic strategies that foster learners' transversal skills, open learning to new, real-world contexts, involve learners themselves in hands-on activities, scientific investigation and complex problem solving, or in other ways that increase learners' active engagement and creative expression.*
6. Facilitating Learners' Digital Competence	6.1 Information and media literacy *To incorporate learning activities, assignments and assessments which require learners to articulate information needs; to find information and resources in digital environments; to organise, process, analyse and interpret information; and to compare and critically evaluate the credibility and reliability of information and its sources*
	6.2 Digital communication & collaboration *To incorporate learning activities, assignments and assessments which require learners to effectively and responsibly use digital technologies for communication, collaboration and civic participation.*
	6.3 Digital content creation *To incorporate assignments and learning activities that require learners to express themselves through digital means, and to modify and create digital content in different formats. To teach learners how copyright and licenses apply to digital content, how to reference sources and attribute licenses.*

	6.4. Responsible use *To take measures to ensure learners' physical, psychological and social wellbeing while using digital technologies. To empower learners to manage risks and use digital technologies safely and responsibly.*
	6.5 Digital problem solving *To incorporate learning and assessment activities that require learners to identify and solve technical problems or to transfer technological knowledge creatively to new situations.*

Table 6 DigCompEdu competence descriptors

The fact that DIGCOMP framework is being constantly updated shows the dynamic nature of this competence: since ICTs are continuously changing, what must be learned about the digital landscape is constantly transforming. Therefore, being a digitally competent individual is a moving target for citizens requiring cognitive flexibility and openness towards change. A key message from this for adults' trainers in the field is that, rather than focussing on merely technical knowledge or specific IT tools, which risk becoming rapidly obsolete, trainers should encourage learners to approach "the machine" by trial and error stimulating exploratory attitudes, abductive abilities and problem-solving skills.

As for the exploratory attitudes, the trainers should encourage the trainees to approach the new software and/or digital interfaces with curiosity, looking around the screen, trying and testing, formulating hypotheses on the functions associated with the icons. Therefore, rather than stressing the need for memorising technical procedures – which is also challenging especially for older people, trainers should encourage trial-and-error learning processes, where making mistakes is not a shame but a productive way to reflect on the causes of the error, while being successful may generate new good practices.

Trainers should also promote abductive processes of making inferences related to the elaboration of information found on the web: while browsing the web is not a linear process, serendipity is the main feature of the way how we access online resources. This involves a positive attitude towards the unknown or also a pleasure for random discoveries. But to make sense of random discoveries the ability to carry on abductive inferences becomes crucial. Thinking of the web, the navigation experience from one Internet source to another requires users to develop the ability to generate new meanings in the wide landscape of the digital networked complexity.

Finally, in the face of the several challenges of the digital world, trainers should support the development of problem-solving skills associated with the use of technologies. Problem-solving skills could be considered from the following two important aspects: on one side, they are meant as the capacity of solving technological issues, on the other side, they refer to the ability to propose technological solutions for the problems of everyday life. Both aspects are clearly identified in the DIGCOMP framework where the

problem-solving skills associated with digital technologies include abilities such as solving technical problems from trouble-shooting to solving more complex problems; identifying needs and technological responses through the critical evaluation of possible solutions; creatively using technology for multimedia production and expression of oneself. Learning by doing approaches are recommended to promote this type of skill and digital media offers several opportunities to engage adult learners in the creative process of multimedia production. Making an artefact such as the multimedia resume, which was the aim of the previously mentioned Links-up workshop, allows trainees to get involved in learning by doing activities requiring learners to confront technical challenges as well as being creative and expressing themselves.

In conclusion, digital competence has to do not only with technologies but also – and mostly – with skills that are crucial for lifelong learning processes. Through the promotion of trial-and-error learning processes, serendipity and abductive reasoning as well as learning by doing, trainers may encourage adult learners to improve their digital competences both for active citizenship and as a means for continuous professional development and learning.

2. ASSESSMENT AND EVALUATION SYSTEMS IN DISTANCE LEARNING

Measuring learning is a necessary part of every teacher's work. Teachers need to check for student understanding, and students and leaders need to know how students are doing overall to help them successfully prepare for further education or work. In addition to supporting learning across content areas, technology-enabled assessments can help reduce the time, resources, and disruption to learning required for the administration of paper assessments. Assessments delivered using technology also can provide a more complete and nuanced picture of student needs, interests, and abilities than can traditional assessments, allowing educators to personalize learning.

Technology-enabled tools also can support teacher evaluation and coaching. These tools capture video and other evidence of qualities of teaching such as teamwork and collaboration. They provide new avenues for self-reflection, peer reflection and feedback, and supervisor evaluation[14].

The assessment allows both instructor and student to monitor progress towards achieving learning objectives and can be approached in a variety of ways.

2.1. Types of assessment

There are two main types of assessment: summative assessment and formative assessment. These are sometimes referred to as assessment of learning and assessment for learning, respectively. The key to good assessment practice is to understand what each type contributes and to build mechanisms and solutions to maximise the effectiveness of each.

The purpose of formative assessments is to monitor student learning and provide ongoing feedback to staff and students. It is an assessment of learning. If designed appropriately, it helps students identify their strengths and weaknesses, can enable students to improve their self-regulatory skills so that they manage their education less haphazardly than is commonly found. It also provides information to the teaching staff about the areas students are struggling with so that sufficient support can be put in place.

Formative assessment can be tutor-led, peer or self-assessment. Formative assessments have low stakes and usually carry no grade, which in some instances may discourage the students from doing the task or fully engaging with it.

In contrast, summative assessments evaluate student learning, knowledge, proficiency, or success after an instructional period, as a unit, course, or program by comparison against some standards or benchmarks. Summative assessments are almost always formally graded and often heavily weighted. However, feedback

[14] https://tech.ed.gov/netp/assessment/

from summative assessments can be used formatively by both students and faculty to guide their efforts and activities in subsequent courses. Summative assessment can be used to great effect in conjunction and alignment with formative assessment, and instructors can consider a variety of ways to combine these approaches.

Both forms of assessment can vary across several dimensions (Trumbull and Lash, 2013):

- Informal / formal
- Immediate / delayed feedback
- Embedded in lesson plan / stand-alone
- Spontaneous / planned
- Individual/group
- Verbal/nonverbal
- Oral/written
- Graded / ungraded
- Open-ended response / closed/constrained response
- Teacher initiated/controlled / student initiated/controlled
- Teacher and student(s) / peers
- Process-oriented / product-oriented
- Brief / extended
- Scaffolded (teacher supported) / independently performed

An over-reliance on summative assessment after an element of study gives students a grade but provides very little feedback that will help them develop and improve before they reach the end of the module/programme. Formative assessments, provide a highly effective and risk-free environment in which students can learn and experiment. They also provide a useful lead-in to summative assessments, so long as the feedback is provided. Therefore achieving a balance between formative and summative assessments is important.

The table below are provided with some examples of formative and summative assessments.

Formative assessments	Summative assessments
In-class discussions	Instructor-created exams
Clicker questions	Standardized tests
Low-stakes group work	Final projects
Weekly quizzes	Final essays
1-minute reflection writing assignments	Final presentations
Homework assignments	Final reports
Surveys	Final Grades

Table 7 Examples of Formative and Summative Assessments

2.2. Summative assessment

Summative assessments are used to evaluate student learning, skill acquisition, and academic achievement after a defined instructional period. Generally speaking, summative assessments are defined by three major criteria[15]:

- The tests, assignments, or projects are used to determine whether students have learned what they were expected to learn. In other words, what makes an assessment "summative" is not the design of the test, assignment, or self-evaluation, per se, but the way it is used—i.e., to determine whether and to what degree students have learned the material they have been taught.
- Summative assessments are given after a specific instructional period, and therefore they are generally evaluative, rather than diagnostic—i.e., they are more appropriately used to determine learning progress and achievement, evaluate the effectiveness of educational programs, measure progress toward improvement goals, or make course-placement decisions, among other possible applications.
- Summative-assessment results are often recorded as scores or grades that are then factored into a student's permanent academic record, whether they end up as letter grades on a report card or test scores used in the college admissions process. While summative assessments are typically a major component of the grading process in most districts, schools, and courses, not all assessments considered to be summative are graded.

[15] https://www.edglossary.org/summative-assessment/

Summative assessments are commonly contrasted with formative assessments, which collect detailed information that educators can use to improve instruction and student learning while it's happening. In other words, formative assessments are often said to be for learning, while summative assessments are for learning. Common summative assessments include:

- Tests
- Final exams
- Reports
- Papers
- End-of-class projects

Some of the most well-known and widely discussed examples of summative assessments are the standardized tests administered by states and testing organizations, usually in math, reading, writing, and science. Other examples of summative assessments include:

- End-of-unit / chapter tests.
- End-of-term / semester tests.
- Standardized tests that are used for school accountability, college admissions (e.g., the SAT or ACT), or end-of-course evaluation (e.g., Advanced Placement or International Baccalaureate exams).
- Culminating demonstrations of learning or other forms of "performance assessment," such as portfolios of student work that are collected over time and evaluated by teachers or capstone projects that students work on over extended periods and that they present and defend after a school year or their high school education.

Summative assessments almost always take place at the end of a course unless a teacher decides to break a course into more manageable chunks. They're often cumulative, and they're used to evaluate a student's long-term information retention.

While most summative assessments are given after an instructional period, some summative assessments can still be used diagnostically. For example, the growing availability of student data, made possible by online grading systems and databases, can give teachers access to assessment results from previous years or other courses. By reviewing this data, teachers may be able to identify students more likely to struggle academically in certain subject areas or with certain concepts. Besides, students may be allowed to take some summative tests multiple times, and teachers might use the results to help prepare students for future administrations of the test.

It should also be noted that districts and schools may use "interim" or "benchmark" tests to monitor the academic progress of students and determine whether they are on track to mastering the material that will

be evaluated on end-of-course tests or standardized tests. Some educators consider interim tests to be formative since they are often used diagnostically to inform instructional modifications, but others may consider them to be summative. There is an ongoing debate in the education community about this distinction, and interim assessments may be defined differently from place to place.

2.3. Digital formative assessment

Digital technologies used in education include student e-portfolios, social media, digital textbooks, mobile learning, classroom polling, digital games and integrating formative and summative assessment. According to research focused on a review of the literature and publications on digital formative assessment, resulting from international research and policy studies (Looney, 2019), digital learning and assessment have the potential to support more powerful student learning. Approaches to formative assessment reflect education cultures and thus vary across countries and research traditions. While digital formative assessment may have a significant impact on student motivation and learning, its effectiveness also depends on how it is used, and how it is integrated with teaching and learning aims. Formative assessment is not one specific practice, but rather an approach to teaching and learning. It may be best seen as a dynamic process, as teaching and learning are adapted according to conditions and needs identified in the assessment process (Clark, 2010).

The OECD (2005) synthesised different approaches to formative assessment based on international research and observations of classroom practices across several OECD countries, and suggested a general framework encompassing:

- Establishment of learning goals and tracking of individual student progress toward those goals.
- Use of varied approaches to assessing student understanding.
- Feedback on student performance and adaptation of instruction to meet identified needs.
- Active involvement of students in the learning process.
- Use of varied instruction methods to meet diverse student needs.
- Establishment of a classroom culture that encourages interaction and the use of assessment tools.

More recently Black and Wiliam (2018) have highlighted that any “theory of formative assessment” needs to “…be embedded within a wider theoretical field, specifically, within a theory of pedagogy”. The authors propose a model for the design of educational activities influenced by theories of pedagogy, instruction and learning and by subject disciplines. Please see the next Figure.

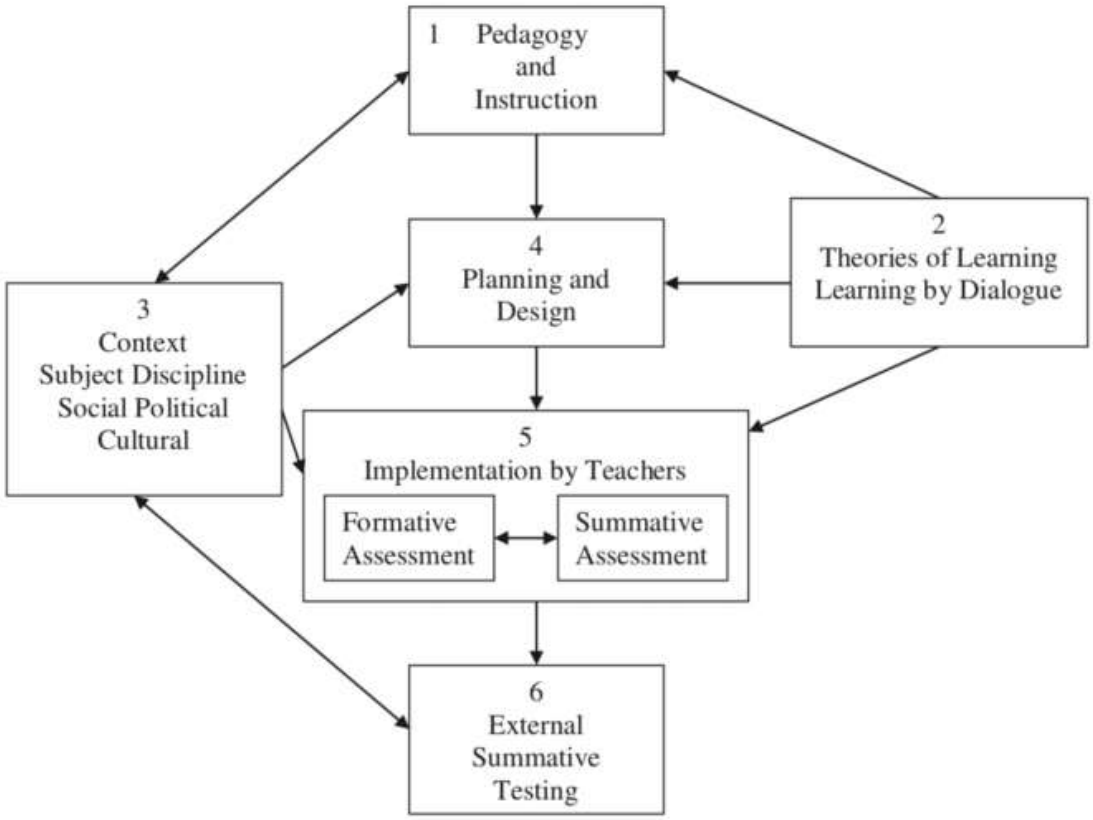

Figure 6. Model for an assessment concerning pedagogy (Black and Wiliam, 2018, p. 551)

The advantages of different digital learning environments could be summarized as follows:

- rapid (real-time) feedback and staging of next steps for learning at an appropriate level of difficulty;
- support for learners' choices (to personalise learning and support intrinsic motivation);
- immersive learning environments to support situated learning;
- mobile tools to support the assessment of "anytime-anywhere" learning;
- set up of complex problems that challenge learners and support collective engagement in problem-solving in small groups or massively multiplayer online platforms;
- opportunities for self-and peer-assessment;
- access to resources and online exemplars;
- collection ("mining") of educational data to better understand learning processes and contexts, and in turn, use these data to generate learning analytics to predict student progress and adapt learning;
- potential for more seamless integration of formative and summative assessments;
- opportunities for learners to design their own learning goals and strategies.

According to Black and Wiliam (2010) digital formative assessment includes all features of the digital learning environment that support the assessment of student progress and which provide information to be used as feedback to modify the teaching and learning activities in which students are engaged. Assessment becomes 'formative' when evidence of learning is actually used by teachers and learners to adapt to the next steps in the learning process.

In her comprehensive study Loney (2018) propose a typology presented in the next table where a range of tools and platforms that support digital formative assessment are set out in the vertical axis of the typology, while different modes for formative assessment are set out in its horizontal axis. Please see the next table.

Typology	The digital learning environment	Student-centred learning and assessment	Student collaborative learning and assessment
Personalised learning platforms • **e-portfolios/digital diaries**	Students' learning environments, use of multi-modal materials/tools	Student-directed, reflection, selfassessment.	Peer assessment, collaborative projects, etc.
• **Digital storytelling**	Students' learning environments, use of multi-modal materials/tools	Student-directed, reflection, selfassessment	Peer assessment, collaborative storytelling, etc.
• **Social media (blogs, wikis)**	Students/teachers identify areas for online discussion. Integrated with other tools (e-textbooks, mobile learning, etc.)	Peer feedback	Discussion boards, Facebook, blogs and wikis, text messages and other social media to support peer collaboration and assessment
Online resources	Internet-based resources to support student research	Teacher scaffolding to develop student research skills.	Peer assessment, collaborative research project
E-textbooks	Multi-modal materials/tools to demonstrate and model content/interactivity	Student self-pacing; Automatically differentiated (adaptive) or differentiated by the teacher (nonadaptive)	Discussion boards, Facebook, blogs and wikis, text messages and other social media to support peer collaboration and assessment

Table 8. Typology of digital formative assessment tools, platforms and modes (Source: Looney, 2019)

A range of tools and platforms that support digital formative assessment are set out in the vertical axis of the typology, while different modes for formative assessment are set out in its horizontal axis. The categories for the horizontal axis, in particular, require further explanation:

- The digital learning environment – This column draws Black and Wiliam's (2018) proposed model for an assessment concerning pedagogy. The term 'learning environment' within the typology thus refers to the use of digital platforms and tools to structure learning and content aims, to guide and sequence activities, and to elicit evidence of understanding. It may involve a combination of technologies as well as face-to-face interactions. The specific approach will vary by subject area and learning aims but needs to be grounded in theories of learning and to support learning through interaction (whether with fellow learners, the teacher or with learning objects in the digital environment)
- Student-centred learning and assessment – This column emphasizes the importance of student agency, including student-centred learning and assessment to identify and adapt learning. For example, a variety of Web 2.0 tools may embed assessment (e.g. through quizzes embedded in e-textbooks) or students may use platforms to design their own multi-modal projects. Assessment may draw on non-digital tools such as rubrics that set out standards and criteria by which to measure the quality of their own work. E-coaches and other digital monitoring tools may help students to track their progress toward learning goals, provide automated feedback and/or scaffold activities for learning based on prior responses.
- Student collaborative learning and assessment - This column emphasizes the importance of student collaboration and collective engagement in learning and assessment. For example, students may benefit from online peer feedback (e.g. through online discussion platforms). Multiplayer online games designed for educational purposes provide opportunities for students to address complex, ill-defined problems. In these environments, assessment is grounded in the problem-solving activity itself. While games may scaffold levels of challenge, learners participating in the process may also play an active role in assessing the effectiveness of different problem-solving approaches and may contribute new ways to refine and improve them.

Put differently, the first column highlights teacher decisions on how to use different digital tools and platforms to support student learning, to track student progress and identify learning needs, to provide varied instruction methods, and to encourage student interaction and the use of assessment tools in digital environments.

The second column highlights the use of digital tools and platforms to support each student's active involvement in his/her learning, the scaffolding of learning to meet specific learning needs (with as little or as much feedback is appropriate), student choice and ability to focus on most motivating areas, and the use of assessment tools to track progress and adjust learning strategies.

The third column highlights the importance of classroom cultures that encourage interaction and the use of assessment tools. Students interact with each other, provide peer assessment and feedback, and interact with specific problems or learning challenges.

2.4. Recommendations and Considerations for Online Assessments

Recommendations for summative assessments

Because summative assessments are usually higher-stakes than formative assessments, it is especially important to ensure that the assessment aligns with the goals and expected outcomes of the instruction. In this regard the following main issues have to be considered:

- Using a Rubric or Table of Specifications to layout expected performance criteria for a range of grades. Rubrics will describe what an ideal assignment looks like, and "summarize" expected performance at the beginning of the term, providing students with a trajectory and sense of completion.
- Designing clear and effective questions that meet criteria while allowing students the freedom to express their knowledge creatively and in ways that honour how they digested, constructed, or mastered meaning.
- Assessing comprehensiveness - effective summative assessments provide an opportunity for students to consider the totality of a course's content, making broad connections, demonstrating synthesized skills, and exploring deeper concepts that drive or found a course's ideas and content.
- Making parameters clear - when approaching a final assessment, instructors can ensure that parameters are well defined (length of assessment, depth of response, time and date, grading standards); knowledge assessed relates clearly to content covered in course, and students with disabilities are provided required space and support.
- Considering blind grading - Instructors may wish to know whose work they grade, to provide feedback that speaks to a student's term-long trajectory. If instructors wish to provide truly unbiased summative assessment, they can also consider a variety of blind grading techniques.

Recommendations for formative assessments

Ideally, formative assessment strategies improve teaching and learning simultaneously. Instructors can help students grow as learners by actively encouraging them to self-assess their skills and knowledge retention, and by giving clear instructions and feedback. Seven principles (adapted from Nicol and Macfarlane-Dick, 2007 with additions) can guide instructor strategies:

- Clear criteria for what defines good performance should be specified: Instructors can explain criteria and encourage student discussion and reflection about these criteria.
- Students' self-reflection encouragement: The students could be asked students to utilize course criteria to evaluate their own (or a peer's) work and to share what kinds of feedback they find most valuable.
- Provision of detailed and actionable feedback to students: Instructors can consistently provide specific feedback tied to predefined criteria, with opportunities to revise or apply feedback before final submission. Feedback may be corrective and forward-looking, rather than just evaluative. Examples include comments on multiple paper drafts, criterion discussions during 1-on-1 conferences, and regular online quizzes.
- Teacher and peer dialogue around learning encouragement - Instructors can discuss with the students the formative learning process where students reflect on the course and instructors respond to student concerns. During the feedback sessions, the students can also identify examples of feedback comments they found useful and explain how they helped.
- Promoting positive motivational beliefs and self-esteem - Students will be more motivated and engaged when they are assured that instructors care for their development. Instructors can allow for rewrites/resubmissions to signal that an assignment is designed to promote the development of learning. These rewrites might utilize low-stakes assessments, or even automated online testing that is anonymous, and (if appropriate) allows for unlimited resubmissions.
- Provision of opportunities to close the gap between current and desired performance: Instructors can improve student motivation and engagement by making visible any opportunities to close gaps between current and desired performance such as opportunities for resubmission, specific points for task-based assignments, etc.
- Collect information that can be used to help shape the teaching - Instructors can feel free to collect useful information from students to provide targeted feedback and instruction. Students can identify where they are having difficulties, either on an assignment or test or in written submissions. This approach also promotes metacognition, as students are asked to think about their learning. Poorvu Center staff can also perform a classroom observation or conduct a small group feedback session that can provide instructors with potential student struggles.

Assessment solutions based on DIGCOMP

As in other implementation steps, using the DIGCOMP framework firstly involves the selection of the relevant competencies to be assessed, based on the target users and goals of the initiative. Assessment

solutions can also be based on adapted DIGCOMP frameworks. Then, DIGCOMP components (competence descriptors, learning outcomes at different proficiency levels, examples of skills, knowledge and attitudes) can be used:

- To prepare self-assessment questions directly or with some variations;
- As a reference to prepare more detailed and contextualised questions (referring to specific tools, application domains etc.), both in self-assessment or knowledge-based perspectives (most experiences);
- To inspire the preparation/description of authentic tasks and challenges for evaluation, both in knowledge-based and performance-based perspectives.

Concerning assessment methodology, different approaches with different pros and cons can be adopted, depending on one's goals and target users (e.g. population at large, specific worker categories etc.), circumstances and resources:

- Self-assessment questions, where individuals are asked to evaluate how well they perform ICT related tasks and what they know about related issues or to agree/disagree through a declarative questionnaire with statements about one's behaviour in different digital situations. This approach is useful to raise awareness about digital competence and make users reflect on their perceived strengths and weaknesses;
- Knowledge-based tests, where individuals are presented with real problems in a variety of real-life situations and they have to indicate what they would do in a given situation, what would happen in reality etc. This approach measures factual knowledge (knowing that…) and procedural knowledge (knowing how to perform digital tasks) or both. It can thus produce a more accurate picture of a user's digital competence;
- Performance-based evaluation, where users are requested to solve digital challenges, reflecting real situations that they may face and entailing the use of tools such as browsers, word processors, spreadsheets etc. This approach generates the most accurate picture of one's competence seen as 'knowledge in action. But it can be very demanding (also in terms of technical complexity and costs) for test providers and challenging for users. So it is usually adopted given issuing a certification;
- A mix of the above methods. To offer a more complete assessment and resulting profile, a test can integrate other elements, beyond competences.

Considerations for Online Assessments

In light of the online learning context and to best support academic integrity is of great importance to consider the format of the assessments (e.g., multiple-choice, short answer, project-based), the level of thinking the assessments require as well as the established grading structure of the instructional flow. Specifically, the following considerations should be discussed:

- Selection of assessment formats that ask students to explain their thinking: Academic integrity can be increased by asking students to explain their approach, logic, or thinking. This can involve short-answer items, written work, annotated portfolios or recorded/annotated presentations. Multiple-choice exams can also be adapted to ask students to explain how they came to an answer. These explanations are harder to replicate than selecting the correct answer. This approach has the added benefit of improving students' reflection on course content, which supports deeper learning.
- Selection of assessments that require deeper levels of processing: Deepening the level of engagement required to correctly answer items can reduce the likelihood of an answer is easily found online or in textbooks. For example, multiple-choice items that ask students to compare among options or to apply a specific concept, as opposed to asking for definitions, reduces opportunities for cheating. These higher-level items require a working knowledge of a concept, demonstrating a desired level of competence.
- Usage of a grading structure that supports the building of knowledge over time: Altering the grading system to provide credit for students' learning as they go through the course (i.e., formative assessment) as opposed to high stakes assessments at the middle and end of courses (i.e., summative assessment) can be especially beneficial. Smaller assignments or quizzes allow students to study less material more deeply, provides feedback on their learning with enough time for them to adjust their studying, and can reduce student anxiety compared to having a low number of high stakes exams.
- Increase academic integrity in multiple-choice and short-answer exams: Utilizing the options of the quiz development apps for randomization of quiz questions' order as well as the order of the responses within questions. Considering small edits to a question that change the correct answer between students while testing the same concepts. In this approach, the basic concepts are retained across questions but with subtle factors that change the outcome.
- Considering options and implications for when to take the test available to students and how long to give students to complete it, particularly if students vary across time zones. For example, some instructors prefer to leave the exam open for 12-48 hours to allow for time zone and technical challenges. Another option - to "chunk" exams into smaller sections spread out over time, allowing

students to focus on particular content while decreasing the stress on any single section of the exam.

- Practising the process: Giving students a chance to try out the selected assessment approach using a low-stakes exam or assignment can help instructors and students work out any technical challenges (e.g., uploading files, accessing links) that may arise during a higher-stakes exam. This will also allow students to experience what an online examination may be like, which can help alleviate student anxiety.
- Provision os possibility students to be able to upload their individual work. Creating questions that ask students to demonstrate their knowledge through models or figures can help students practice applying their learning. This approach also allows for the consideration of partial credit options.

These approaches, particularly when combined, essentially give each student a distinct test form. This can decrease the likelihood of dishonesty by increasing the effort associated with sharing or searching for answers. By taking these measures, students and instructors can focus on the course content rather than spending energy concerning academic integrity. Moreover, the selected assessment approaches have to ensure equity and fairness in grading and the full transparency of the process.

3. THE USE OF THE PROJECT-BASED LEARNING

Usually, the acronym PBL refers to Problem Based Learning, a rather broad range of student-centred teaching strategies based on the solution of real problems. However, it can identify a more specific set of constructivist-inspired pedagogical practices that goes by the name of Project-Based Learning. It is important to underline how the two approaches are linked to each other and to better understand which teaching practices can be introduced in the school in a meaningful way and with a probability of success.

In the original definition of Barrows (1986 and 1992) the PBL was spoken of as a "total approach to education", highlighting in particular how in this perspective learning is "the result of the process that leads to the understanding and solution of a problem".

Schmidt (1993) added that the implementation of a didactic strategy oriented to Problem Solving should be based above all on the activation of the foreknowledge necessary for the initial analysis of the problem, on the search for new useful information starting from the activated foreknowledge, on the restructuring by each student of the knowledge shared with colleagues and on the elaboration of semantic networks of new meanings. Learning should also be strongly contextualized, and the learning process should be based on the social construction of knowledge on the one hand and curiosity, on the discovery and enunciation of new problems on the other. In a further synthesis by Savery and Duffy (1995) the foundations of PBL and the teaching practices to which it can give rise were substantially identified in other essential principles of learning design: learning objectives should be related to real or recognizable problems. as real; problems should generate other problems; problems should be presented before activating any foreknowledge; teachers should play the role of facilitators at the metacognitive level; cooperative learning should finally represent a "critical component" of the PBL approach.

In these elements some fundamental principles of the constructivist approach are recognizable (Merrill, 1994 and 2002). More generally, it can also be said that the growing attention on Problem-based Learning is linked, from the ’90s to the convergence of various orientations of the constructivist matrix towards pedagogical practices centred on the problematic vision of knowledge. Various comparative studies on the evolution of this approach (Thomas, 2000) highlight, for example, the link between the PBL approach and studies on "situated Cognition" (Collins and Brown, 1989). However, Jonassen’s fundamental contributions (1999; 2000) on learning design and problem solving also reinforce the focus on PBL, as well as, in some respects, models that support the essential importance of peer interactions in education, like those that refer to the studies on the self-efficacy of Bandura (1993). Overall, a certain variety of definitions and interpretations emerges (Vernon and Blake, 1993), so much so that Bereiter and Scardamalia (2000) propose to distinguish between "PBL" and "pbl", identifying with the initials written in lower case and with the generic reference to problem-based learning a range

wide and undefined educational approaches in which, beyond the centrality of the problem, the procedures of analysis, discussion, sharing and solution of the problem itself are defined and particularly taken care of.

It is part of this more structured approach that particular declination of learning strategies oriented to the solution of problems that goes under the name of Project-Based Learning, and which is now referred to more and more often (although not without a doubt...) when using the abbreviation PBL.

Compared to the approach experimented and described by Barrows, this set of practices is characterized by a greater focus on design, or research (usually collaborative...) effectively and operational solutions to the initial problem, aiming if possible to concrete applications or trying to build "products" that make sense of the analysis carried out, systematically using new technologies. Research in this specific area shows how this evolution of PBL takes into account those aspects of constructivist philosophy more attentive to learning through "doing", from Schank to Papert, to Resnick.

But they consider themselves an integral part of the background that has led to the current field definitions on Project Based Learning also theories on the active involvement and motivation of students (Kearsley and Shneidermann, 1999) and those more oriented to the enhancement of differences in learning styles and especially of the multiple "intelligence" (Gardner, 1999). Overall, it is a set of structured methodologies closer to the reality of the school, often more attracted by the "active" dimension of educational experiments.

Thus, while Problem Based Learning, in the broad sense, is spreading especially in the university and adult education (where there are some favourable conditions, in particular, greater autonomy and critical ability by students...), Project-Based Learning is gradually becoming the "form" through which the problem-based approach is spreading in schools at the international level: systematized thanks to the work of the BIE (Buck Institute for Education[16]), these didactic strategies have been disseminated through the activity of other research centres and wide-ranging projects, the most important of which has been supported and is still carried out by Microsoft[17].

3.1 What is Project-Based Learning?

Project-Based Learning, or PBL, is an instructional approach built upon learning activities and real tasks that have brought challenges for students to solve. These activities generally reflect the types of learning and

[16] The BIE has been active in this area since 1987 (http://www.bie.org.) The BIE also manages the most important online resource repository on Project Based Learning (http://www.pbl-online.org/. [Retrieved online 02/02/2021]

[17] Microsoft's project is aimed at schools around the world, through partnerships with local stakeholders and institutions. In Italy it was carried out in collaboration with Giunti Editore and started in 2006 (Did@tic project). The first phase is oriented to the training of high school teachers: the first online courses to start the PBL methodology were attended by 2500 teachers, which are being added another 1000-2000 through further dissemination actions curated by IRRE.

work people do in the everyday world outside the classroom. PBL is generally done by groups of students working together toward a common goal. PBL teaches students not just content, but also important skills in ways students have to be able to function as adults in our society. These skills include communication and presentation skills, organization and time management skills, research and inquiry skills, self-assessment and reflection skills, group participation and leadership skills, and critical thinking. Performance is assessed on an individual basis and takes into account the quality of the product produced, the depth of content understanding demonstrated, and the contributions made to the ongoing process of project realization. PBL allows students to reflect upon their own ideas and opinions, and make decisions that affect project outcomes and the learning process in general. The final product results in high-quality, authentic products and presentations.

PBL advantages:

- Puts students in a position to use the knowledge that they get.
- Effective in helping students understand, apply, and retain information.
- Can allow students to work with professional experts who enrich and support the teachers' knowledge and how it connects to the real world.
- can be more effective than traditional instruction, and increase academic achievement.
- benefits include building skills such as critical thinking, communication and collaboration.
- Students who work on projects show increased motivation and engagement in their studies.

The innovation of the project-based approach is based on its emphasis on cooperative learning. Additionally, students create tangible results to represent what they have learned. Students use technology and inquiry to respond to a complex issue, problem or challenge. PBL focuses on student-centred inquiry and group learning with the teacher acting as a facilitator, as opposed to the one in charge. Activities match as nearly as possible the real-world tasks of professionals in practice rather than classroom-based tasks. This encourages interdisciplinary perspectives and enables learners to play diverse roles and build expertise that is applicable beyond a single well-defined. Lastly, it allows a range and diversity of outcomes open to multiple solutions, rather than a single correct response obtained by the application of predefined rules and procedures.

Learning are effective in building deep content understanding. Research also shows that PBL raises academic achievement and encourages student motivation to learn, in particular:

- It is more effective than traditional instruction in increasing academic achievement on annual state-administered assessment tests.
- It is more resultant than traditional instruction for teaching mathematics, economics, science, social science, clinical medical skills, and for careers in the health occupations and teaching.

- It is more practical than traditional instruction for long-term retention, skill development and satisfaction of students and teachers.
- It is more serviceable than traditional instruction for preparing students to integrate and explain concepts.
- It is especially effective with lower-achieving students.
- It improves students' mastery of 21st-century skills, such as critical thinking, communication, collaboration, creativity and innovation.
- It provides a fruitful model for whole-school reform.

PBL can create a context for a powerful learning community for promoting achievement, self-mastery, and contribution to the community.

3.2 Project Based Learning features

The main features of the Project-based learning approach can be synthesized as follows:

- Organized around a problem or challenge without a predetermined solution.
- Creates a need to know essential content and skills.
- Students design the process of reaching a solution.
- Requires critical thinking, problem-solving, collaboration, and various forms of communication.
- Provides the opportunity for students to examine the task from different perspectives using a variety of resources, separate relevant from irrelevant information, and manage the information they gather.
- Students learn to work independently and take responsibility when they are asked to make choices.
- Students regularly reflect on what they're doing.
- A final product (not necessarily material) is produced and is evaluated for quality.
- The classroom has an atmosphere that tolerates error and change.
- The teacher takes on the role of a facilitator rather than a leader since the project-based learning approach creates a "constructivist" learning environment in which students construct their own knowledge.

The approach changes the roles of student and teacher and increases participation. Today, with the universe of experts and information available through the Internet, students can access new and relevant information not yet discovered by their teacher.

Internet-using educators are discovering a new model of learning that we call "Side-by-side learning." It is becoming a more and more common experience to find students assuming both informal and formal roles as teachers of their peers and younger students.

Teachers who involve their students in project-based learning activities also find their role changing.

Rather than being simple dispensers of knowledge, they discover their primary tasks are to guide and coach and mentor their students. They teach their students how to question, and how to develop hypotheses and strategies for locating information. They become co-learners as their students take on a variety of learning projects which could be unfamiliar territory. In the end, most teachers who experience this

find it a rewarding experience.

When students can share their projects and activities with the "community" through their Web page presentations, or tangible results, they are not the only ones to benefit from the interaction with a larger audience. Teachers also make new peer connections and find support and encouragement from a wide variety of their colleagues and content experts.

Besides, with the growth of the Internet, more and more of "the community" can be found online, therefore allowing closer relationships between people inside schools and outside in the "real world". Parents, business leaders, scientists, and many other members of the community can play more effective and innovative roles as motivators, role models, sources of information, critics, evaluators, guides, and mentors.

The Internet also creates a new model of school-community involvement. As students move from simply consuming, to producing and publishing new and original information and knowledge, members of the community seek out and appreciate the information presented on their Web site.

3.3 Project-Based Learning in the online modality

In the face of the several challenges of the digital world, trainers should support the development of problem-solving skills associated with the use of technologies. Problem-solving skills could be considered from the following two important aspects: on one side, they are meant as the capacity of solving technological issues, on the other side, they refer to the ability to propose technological solutions for the problems of everyday life. Both aspects are identified in the DIGCOMP framework where the problem-solving skills associated with digital technologies include abilities such as solving technical problems from trouble-shooting to solving more complex problems; identifying needs and technological responses through the critical evaluation of possible solutions; creatively using technology for multimedia production and expression of oneself.

The PBL approach includes improved learning strategies and thinking skills development.

Learning to learn: Effective online projects encourage students to work on a problem in-depth, rather than covering many topics briefly.

Students also engage in learning what is needed to solve a problem or complete a project, rather than when the teacher decides on a predetermined curriculum. Both of these strategies are cited in educational reform literature as being important tools to improve learning.

Learning by doing approaches are recommended to promote this type of skill and digital media offers several opportunities to engage adult learners in the creative process of multimedia production. Making an artefact such as the multimedia resume, which was the aim of the previously mentioned Links-up workshop, allows trainees to get involved in learning by doing activities requiring learners to confront technical challenges as well as being creative and expressing themselves.

Lifelong Learning: Web projects build learning experiences connected to the kind of learning one does throughout life, rather than only on "school" subjects. By using the real tools for intellectual work that are used in the workplace, rather than oversimplified textbook techniques, students become familiar with the kinds of knowledge that exist. Finding information and people on the Internet gives students the knowledge of how to go about acquiring the knowledge they may need.

Through the promotion of trial-and-error learning processes, serendipity and abductive reasoning as well as learning by doing, trainers may encourage adult learners to improve their digital competences both for active citizenship and as a means for continuous professional development and learning.

Active learning: people learn best by "doing." In a well-designed Web project, students work in a hands-on mode with the physical world. They gather information and data, explore, create, experiment, physically manipulate things, and organize information. They have access to people and information from the real world, and they develop a closer relationship to the real-world context of problems and projects. The connections to real people, events, and problems in the world bring relevance and connection that is immediate and involves their interest, their intellect, and their participation.

Cooperative learning encourages active engagement by the students in learning, and it also builds critical skills needed in today's workplace. Online projects increase the audience and opportunity for cooperative learning by involving and communicating with a wide selection of people around the world. Students work directly with people from other places and cultures and collaborate not only with peers but with mentors and experts in a large number of fields.

Successful project-based learning (PBL) seeks to develop learning models blending classroom teaching, technology use, and problem-solving through projects and real-world challenges.

In this context, PBL develops 21st-century skills such as collaboration, communication, and critical thinking and digital skills as well. The use of technology enhances PBL, and PBL enhances comfort with technology in three ways:

Using realia to make the lesson real

"Realia" is a fancy word for when we use real-life stuff for teaching aids for example the dissection in a biology class or tasting foods mentioned in a short story. All of them are realia.

Realia aims to connect what students are learning in the class to actual life outside.

With PBL, it's very helpful for students to see realia before they begin working on their projects. Educators/teachers should do everything they can to help students forget that they're working on an assignment and engage them in creating something real.

For example: by allowing students to use Chromebooks or tablets or some sort of internet-connected device, you can open up an entire world of realia for your students. If your project is for students to design a zoo, give them time to go online so they can research real floor plans for real zoos.

This helps students to understand the real-life implications of their project, and it also develops digital literacy as students search online for the results they want.

Creating opportunities for communication and collaboration

The internet has already changed the way we communicate with each other for work, and it's bound to continue changing it in the future. Already, there's a movement called "digital nomads" of people who live anywhere they want because they work entirely online. In the future, we might all be digital nomads.

PBL lessons are the perfect place to increase your students' digital literacy by practising online communication skills. Students should brainstorm and communicate in person so they can learn how to communicate positively as a team both in-person and online modality.

For example: consider setting up an online channel for your students to collaborate over a project as homework. Applications like Trello or Asana are real workflow apps that businesses use to manage projects, and they happen to be perfect for project-based lessons as well. Groups within LMS can also be powerful tools for communication and collaboration, allowing members to work together to create shared resources and post updates (with videos, links, and polls).

Using these kinds of apps help students to not only work more efficiently, but also get experience using professional management tools. Of course, it will be important for the educator to monitor communication over these channels, just like it's important for an educator to monitor small groups when working in class.

Showcasing what's been learned

One of the most important parts of any PBL lesson comes at the end when students put their project on display. Showcasing their work instils students with a sense of pride, and it encourages other students.

Additionally, it can add a sense of ownership to a project when you tell students that they will display their creation once it's complete.

Example: display student projects around the school or to a public outside. The best way is to share projects online. This is an element of PBL that directly correlates to students' future careers. Out in the workforce, it's not only important for people to create great projects but also to prove the work they've accomplished. By proving the work they've done, students are not only taking pride in their work beyond treating it as an assignment, but they're also showing an authentic understanding of the material.

3.3.1 Some examples combining PBL with technology

Learning Management System

A Learning Management System (LMS) makes it easier for teachers to communicate course content with students effectively. Using a Learning Management System, teachers can edit course content as the learning project evolves, therefore allowing for flexible pedagogy. Learning Management Systems are also able to collect learner data across different activities. Learner data handling protocols such as SCORM and Tin Can API ensure that all learning activities that students undertake outside the classroom can be recorded into a Learning Record Store (LRS). Learning outside the classroom can therefore be logged into the Learning Management System through the use of Tin Can API.

Flipped Classroom

In the flipped classroom method, basic instructions are given to students before class through videos. By using videos for instruction before class, the classroom discussion would be better focused on problem-solving and critical thinking, encouraging an attitude of sustained inquiry.

Video Quiz

In-video quizzes can be integrated into online videos immediately after a course topic is discussed. Problem-solving immediately after concept introduction would lead to better knowledge retention, helping learners master the core content. Quizzes increase the learner’s time on the task and encourage more time for practice. Better knowledge retention means that classroom discussions will be much more productive.

Whiteboard Animation Videos

Whiteboard Animation videos are a great tool to explain complex concepts to students. The verbal cues in the video help guide the learner through the concept, while the visual part enables them to create a map of the new knowledge. Tools that can be used for whiteboard animation include VideoScribe and Adobe After Effects.

Web Quest

This is not what is often confused with generic network research on a given topic, but to connote an in-depth search of online resources concerning the solution of a real problem, initially posed by the teacher, designing a solution in the form of a critical presentation of the results obtained by searching, comparing and selecting resources and information.

4. INTRODUCING THE TECHNOLOGY INTO THE CLASSES FOR ADULT EDUCATION - CURRENT EUROPEAN EXPERIENCES

The fact that DIGCOMP framework is being constantly updated, as was presented in the first section, shows the dynamic nature of this competence: since ITCs are continuously changing, what must be learned about the digital landscape is constantly transforming. Therefore, being a digitally competent individual is a moving target for citizens requiring cognitive flexibility and openness towards change. A key message from this for adults' trainers in the field is that, rather than focussing on merely technical knowledge or specific IT tools, which risk becoming rapidly obsolete, trainers should encourage learners to approach "the machine" by trial and error stimulating exploratory attitudes, abductive abilities and problem-solving skills.

As for the exploratory attitudes, the trainers should encourage the trainees to approach the new software and/or digital interfaces with curiosity, looking around the screen, trying and testing, formulating hypotheses on the functions associated with the icons. Therefore, rather than stressing the need for memorising technical procedures – which is also challenging especially for older people, trainers should encourage trial-and-error learning processes, where making mistakes is not a shame but a productive way to reflect on the causes of the error, while being successful may generate new good practices.

Trainers should also promote abductive processes of making inferences related to the elaboration of information found on the web: while browsing the web is not a linear process, serendipity is the main feature of the way how we access online resources. This involves a positive attitude towards the unknown or also a pleasure for random discoveries. But to make sense of random discoveries the ability to carry on abductive inferences becomes crucial. Thinking of the web, the navigation experience from one Internet source to another requires users to develop the ability to generate new meanings in the wide landscape of the digital networked complexity.

In the following paragraphs, some European experiences will be described.

4.1 IDEAL - Integrating Digital Education in Adult Literacy

IDEAL (https://www.erasmusideal.com/) was an Erasmus+ project - Cooperation for innovation and the exchange of good practices - Strategic Partnerships for adult education co-funded by European Commission and coordinated by Luksia, Municipal Education and Training Consortium in Western Uusimaa. The aim was to provide guidance and training for adult educators across Europe on how to use ICT tools and digital methods to better deliver basic skills education. This was done through an integrative approach in collecting, sharing and disseminating innovative and inclusive teaching and learning practices using ICT tools

and digital methods. The project included the following main activities: developing guidance and training for adult educators and share the existing pedagogical know-how of partner organizations; organisation of two 5-day learning workshops in Finland and Italy.

The outputs developed included an Online Toolkit with Context and Need analysis, Good Practice Guidelines and Video Tutorials for teachers, trainers and other practitioners on integrating digital education in adult basic skill teaching.

In particular, the first guideline referred to the use of "gaming' to playing electronic games via consoles, computers or mobile phones and of social tools to enable people to meet, connect or collaborate through computer-mediated communication and to form online communities.

The second one was related to the accessible virtual learning environment (VLE) by organising and adapting the VLE so that all students can cope better with the lessons, learning content, materials and assignments by using the principles of UDL (Universal Design for Learning) for designing and organising an accessible VLE.

Finally, the third regarded the interactive whiteboard (IWB), aboard the size of a traditional whiteboard that connects to a computer; a projector projects the computer's desktop onto the board's surface; users control the computer from the board using a pen, finger, stylus, or another device.

4.2 See, Tell and Listen: Improving Refugees' Digital Literacy through Photovoice and Storytelling

See, Tell and Listen project (https://www.seetell-listen.com/) was co-founded by European Commission in the framework of Erasmus+ - Cooperation for innovation and the exchange of good practices - Strategic Partnerships for adult education and coordinated by Onselho Portugues para os refugiados CPR. The aim was to enhance the capabilities of refugees in the field of digital literacy and storytelling technique to give voice to people who have experienced a severe loss of control in their lives through the acquisition and/or the use of new tools and abilities.

The project was structured towards social inclusion along two axes:

1. Acquisition of tools and skills which are key to self-sufficiency in the current knowledge economy, particularly digital literacy, and the ability to create and shape narratives on forced displacement, which are key to enable refugees' sense of mastery over their life courses;

2. Development of innovative practice in education, specifically adult education, in an increasingly digital economy and information-centred society. Experience shows that traditional learning and teaching are not always adequate to the needs of refugees, particularly upon arrival. Innovation is thus the first-order need when training curricula are designed.

4.3 Flip the Classroom!

"Flip The Classroom!" project (https://flippedclass.weebly.com/) was co-founded by European Commission in the framework of Erasmus+ Cooperation for innovation and the exchange of good practices - Strategic Partnerships for adult education and coordinated by Midstod Simenntunar a Sudurnesjum (Iceland). It aimed to introduce adult's literacy teachers with innovative methods of learning immigrants foreign languages. It concentrates mainly on the concept of the Flipped Classroom to replicate into their classes. The teachers involved participated in lectures, practical exercises, activities based on role-plays. During the project, discussions took place to compare participants views, knowledge and experiences associated with teaching adults.

In detail, the project intended to provide adult literacy teachers with the knowledge on how to enrich the process of teaching adults foreign languages with special attention will be given to the technique known as „Flipped Classroom".

4.4 AHEAD - Web-based PBL training to improve headmasters skills and promote an 'innovative school'

The AHEAD was a Comenius project aiming to provide headmasters with the need skills (leadership and management) to cope with the management of the European project and to build a team in charge of the EU projects. The AHEAD didactic model combines a web-based PBL (Problem-Based-Learning) approach with a peer training method to promote the ongoing updating of headmasters' practical skills.

The main project results and products are the following:

- AHEAD DIDACTIC MODEL for the improvement of headmasters' practical skills to build a team within the school able to carry out innovative/research activities;
- E-LEARNING PLATFORM AND PBL REPOSITORY as web learning/collaborative setting for headmasters. It includes an e-learning platform and a PBL repository (a sort of "virtual training library") that will host the headmasters' cases/scenarios based on their real experiences;
- SELF-LEARNING TOOLKIT to promote the regular updating of headmasters skills and to exploit the AHEAD didactic model among EU schools thanks to a peer-training approach. in detail, it includes a set of tools and guidelines for headmasters to develop case/scenarios according to the AHEAD didactic model, during and after the project end, as well as to allow the exchange of good practices among EU schools and to promote the ongoing updating of their skills.

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