



Competencies Related to the Web and Digital Accessibility

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Abstract: *An important aspect of information technology (and digital information/content) should be and is its inclusiveness and openness to people with disabilities (PwD) as well as to all other people with special needs. Web and digital accessibility are the basics of digital inclusion, needed to assure equality in the digital world. Each profession should implement, support and promote accessibility in domains that it is responsible for. Accessibility is an important priority today for all. In this paper, the competencies related to the web and digital accessibility are analyzed and discussed. The goal of the study presented is to investigate, using in-depth content analysis, how accessibility is defined and described in information technology standards, recommendations, models and frameworks of (digital) competencies.*

1. INTRODUCTION

In the UN Convention on the Rights of Persons with Disabilities ([United Nations, 2006, p. 9](#)), Article 9 – Accessibility, emphasizes the need for taking appropriate measures to ensure that persons with disabilities access, among others, information and communications, including belonging technologies and systems.

In the digital world, equal rights and opportunities are unthinkable without web and digital accessibility implemented.

Web accessibility is fostered by Web Content Accessibility Guidelines (WCAG), in the form of the international standard ISO/IEC 40500:2012 Information Technology - W3C Web Content Accessibility Guidelines (WCAG) 2.0 ([International Organization for Standardization, 2012](#)). Following the WCAG we can make content accessible to people with disabilities, as well as to those whose abilities decrease due to aging, as well as those who have a temporary disability or some other difficulty (slower Internet connection, for example).

Web accessibility as well as the accessibility of the content (PDF and some other documents/formats) is the focus of Directive (EU) 2016/2102 of the European Parliament and of the Council of 26 October 2016 on the accessibility of the websites and mobile applications of public sector bodies ([European Parliament, 2016](#)).

Web and digital accessibility are defined and fostered by many international standards, directives, legal documents and recommendations and guidelines such as:

- EN 301 549 - Accessibility requirements for ICT products and services) ([ETSI, 2021](#)) as well as other related standards, guidelines and legislation (such as ([European Parliament, 2016](#)))
- ISO/IEC 29138-1:2018, Information technology, User interface accessibility, Part 1: User accessibility needs ([International Organization for Standardization, 2018](#))

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- ISO/IEC TR 29138-2:2009, Information technology, Accessibility considerations for people with disabilities, Part 2: Standards inventory ([International Organization for Standardization, 2009](#))

It is professional (of all professions) and also a moral duty to assure and foster accessibility and to do that we all have to be equipped with the corresponding competencies. This is the reason to explore if the competencies related to digital accessibility are referenced and how in the digital competence frameworks of both ICT professionals and all other citizens.

2. METHODS

The main method used to explore it is analysis of the content of the selected documents relevant to the area of web and digital competencies of

- ICT professions - web and digital competencies as “professional” competencies and
- other professions, wider audience, citizens – “general” web and digital competencies.

Only two main, relevant documents recognized and used across Europe to define digital skills in general per each group of intended users were selected to be analyzed.

For ICT professions they are:

- the European e-Competence Framework (e-CF) - European Standard EN 16234-1:2019 ([CEN, 2019](#)), defining 40 competencies of the ICT professionals in five (ICT business) areas, and
- the Skills Framework for the Information Age (SFIA) ([SFIA Foundation, 2021](#)), describing the skills required by professionals responsible for “designing, developing, managing and protecting both the data and the technology that power the digital world”.

For other professions selected documents relevant to the web and digital accessibility are:

- the DigComp 2.2: The Digital Competence Framework for Citizens ([Vuorikari et al., 2022](#)), is intended for all citizens, no matter the profession, in the context of employment, education and training, and lifelong learning, it provides a common understanding of what digital competence is, serves as a basis for framing digital skills policy as well as it enables evaluating own digital competence,
- the European Framework for the Digital Competence of Educators: DigCompEdu ([Re-decker, 2017](#)), 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” (p. 9), it promotes the digital competence and boost innovation in education.

Content of those documents was analyzed to check whether or not and how web and/or digital accessibility, as a term, have been directly addressed in the definition of competencies or their description or elements.

3. RESULTS

In the following tables (Tables 1, 2, 3 and 4) show in which parts of the frameworks (documents) and how digital accessibility has been directly referenced in the text.

In the **European e-Competence Framework (e-CF)**, shortly e-CF Framework, accessibility is one (T1) of the seven transversal aspects being relevant to all competencies defined by the standard. The transversal aspects could be incorporated by using the phrase, ‘Being aware of and if applicable, behaving proactively in’ (CEN, 2019, p. 15).

Accessibility, as stated in (CEN, 2019, p. 15):

- “is applicable to the design of products, devices, services or environments to ensure that they are usable by all, irrespective of their personal capacities”
- “is relevant to the extent to which products, systems, services, environments and facilities can be used by people from a population with the widest range of characteristics and capabilities to achieve a specified goal
- “is also relevant, for example, when working in adverse conditions (such as noisy or badly illuminated environments) or stressful situations”.

Accessibility is also connected to usability as it is one of its characteristics (CEN, 2019, p. 16). The e-CF Framework outlines the minimum requirements of ICT professional competence (with the typical knowledge and skills to support orientation and understanding), clearly defining which elements are mandatory (shall) and which are merely examples (should/may/can...).

In the e-CF Framework (CEN, 2019), competencies are organized and described through the four dimensions as follows:

- Dimension 1: Five e-Competence areas “expressing the abilities of planning (conceiving, designing, deciding, etc.), building (developing and implementing), running (delivering, supporting, maintaining, etc.), enabling (creating the proper conditions), and managing (conducting, ensuring, etc)” (CEN, 2019, p. 10),
- Dimension 2: e-Competences (a title and a generic description of the competence) for each e-Competence area (41 in total),
- Dimension 3: Five work proficiency levels (e-1 to e-5) for each competence which defines proficiency criteria and describe the degree of mastery required by an ICT professional to meet different levels of performance in each competence” and are characterized by a combination of levels of influence within a community, context complexity, autonomy, and typical behaviour expressed by examples of action verbs” (CEN, 2019, p. 11),
- Dimension 4: Knowledge and skills examples “provided to add value to the competence descriptor and are not intended to be exhaustive” offering “inspiration and orientation for the identification of further context-specific knowledge and skills assignment” (CEN, 2019, p. 11), and
- Transversal Aspects that apply across the entire framework, recognizing “the relevance of many crosscutting aspects that are important in the ICT workplace”, complementing competence descriptions and providing “additional descriptors that vary in their relevance to each competence ranging from the need for awareness to proactive engagement” (CEN, 2019, p. 11).

Table 1 shows the dimensions of the e-CF framework in which, in their text, digital accessibility is directly referenced. From Table 1, the dimensions of the framework Dimension 3 (e-Competence proficiency levels e-1 to e-5, related to EQF levels 3 to 8; SHALL APPLY) and the part of Skills examples (Is able to MAY APPLY) in Dimension 4 are omitted, because in their text digital accessibility is not mentioned.

Table 1. Digital accessibility competencies addressed in European e-Competence Framework (e-CF)

Dimension 1 e-Comp. area	Dimension 2 e-competence: Title + generic description SHALL APPLY	Dimension 4 Knowledge examples Knows/ aware of/ familiar with MAY APPLY
A. PLAN	A.5. Architecture Design Takes into account interoperability, reversibility, scalability, usability, accessibility and security, including the need to account for the development and management of vulnerability within existing and emerging technologies.	K2 systems architecture requirements: performance, maintainability, extendibility, scalability, availability, security and accessibility
A. PLAN	A.6. Application Design Ensures that all aspects take into account interoperability, usability, accessibility and security.	K10 accessibility-related requirements, standards and frameworks
A. PLAN	A.10. User Experience	K5 principles, standards, methods and frameworks related to ergonomics and accessibility
B. BUILD	B.1. Application Development	K8 usability and accessibility requirements
B. BUILD	B.3. Testing	K3 the different sorts of tests (functional, integration, performance, usability, accessibility, security, stress, etc.)

Source: Own processing based on [CEN, 2019](#)

In Annex B (informative) Positioning this standard to other structures and frameworks, there are related ISO (and IEEE) standards and standardization initiatives emphasized. Regarding accessibility, ISO/IEC DIS 29138-1: Information technology - User interface accessibility (ISO/IEC 29138-1:2018 Information technology - User interface accessibility - Part 1: User accessibility needs) has been mentioned as an example, as well as ISO/IEC TR 29138-2:2009 Information technology - Accessibility considerations for people with disabilities - Part 2: Standards inventory, and EN 301 549 Accessibility requirements suitable for public procurement of ICT products and services in Europe.

Skills Framework for the Information Age (SFIA) “has become the global common reference for skills and competency for the digital world” ([SFIA Foundation, 2021, p.3](#)). Documents that complement the SFIA framework, which can be downloaded from the website <https://sfia-online.org/>, enable skills and competence development in the ICT area.

Within the SFIA Framework document ([SFIA Foundation, 2021](#)) one hundred and two skills are arranged into six categories and nineteen subcategories in total. Each skill has a unique name and unique code for simple reference as well as an associated range of levels of responsibility (and accountability). There are seven levels of responsibility (1 – Follow, 2 – Assist, 3 – Apply, 4 – Enable, 5 - Ensure, advise, 6 - Initiate, influence and 7 - Set strategy, inspire, mobilize) defined in SFIA but there is not such a skill having all seven levels used. Each level of responsibility is defined through the elements of Autonomy, Influence, Complexity, Business skills and Knowledge.

In the SFIA Framework, skills are constructed with the elements of Skill name, Skill code, Skill description, Guidance notes (a broader description and examples), and Level description (definitions of the skill for each of the levels at which it is practiced) ([SFIA Foundation, 2021, p. 23](#)).

Table 2 shows the SFIA Framework skills elements in which digital accessibility is directly referenced.

Table 2. Digital accessibility competencies addressed in the Skills Framework for the Information Age (SFIA)

Category/ Subcategory	Skill name Skill code Skill description	Guidance note (Activities):	Level (The skill range of levels) Level description
Development and implementation/ User experience	User Experience Analysis UNAN Understanding the context of use for systems, products and services and specifying user experience requirements and design goals.	<ul style="list-style-type: none"> • understanding and specifying user experience and user accessibility requirements for all potential users. 	Level 4 (3-5) Specifies measurable criteria for the required usability and accessibility of systems, products, services and devices. Level 5 (3-5) Plans and manages user experience and accessibility analysis activities.
	User experience design HCEV Producing design concepts and prototypes for user interactions with and experiences of a product, system or service.	<ul style="list-style-type: none"> • understanding and addressing design goals, usability and accessibility requirements • using an iterative design process to enhance user satisfaction by improving usability and accessibility 	Level 3 (3-6) Review design goals and agreed security, usability and accessibility requirements. Level 4 (3-6) Evaluate alternative design options and recommend designs taking into account performance, security, usability and accessibility requirements. Level 6 (3-6) Obtains organizational commitment to strategies to deliver required user experience, usability, accessibility and security.
	User experience evaluation USEV Validating systems, products or services against user experience goals, metrics and targets.		Level 4 (2-6) Validates that security, usability and accessibility requirements have been met. Checks operational systems, products, services, or devices for changes in usability and accessibility needs. Level 5 (2-6) Assures that the security, usability and accessibility requirements have been met and that required practices have been followed. Advises on the achievement of required usability and accessibility levels of specific designs or prototypes. Prioritises input for future user research. Level 6 (2-6) Specifies standards and methods for security, usability and accessibility and ensure that this is addressed in future designs.
Development and implementation/ Content management	Content authoring INCA Planning, designing and creating textual information, supported where necessary by graphical content.		Level 4 (1-6) Controls, monitors, and evaluates content to ensure quality, consistency and accessibility of messages and optimal use of chosen media.
	Content publishing ICPM Managing and continually improving the processes that collect, assemble and publish content.		Level 2 (1-6) Applies principles of usability and accessibility to published information.

Source: Own processing based on [SFIA Foundation, 2021](#)

The DigComp 2.2: The Digital Competence Framework for Citizens ([Vuorikari et al., 2022](#)) contains five dimensions of Competence area, (Dimension 1), Competence (Dimension 2), Proficiencies level (Dimension 3), Examples of knowledge, skills and attitudes (Dimension 4), and Use cases (Dimension 5) with Employment and Learning scenarios. In five Competence

areas (Information and data literacy, Communication and collaboration, Digital content creation, Safety, and Problem-solving) there are 21 competencies in total defined and described.

The biggest changes in version 2.2 compared to previous versions of DigComp from the aspect of accessibility are the emphasis on the importance of accessibility, the introduction of digital accessibility (highlighted with (DA)) in the examples of knowledge, skills and attitudes (Dimension 4), as well as Annex 4, which presents a version of the framework accessible for a screen reader.

In the Glossary of the DigComp 2.2 Framework (Vuorikari et al., 2022) the definition of Digital accessibility (DA) is also given as “extent to which people from a population with the widest range of characteristics and capabilities can use digital products, systems, services, environments and facilities to achieve a specified goal in a specified context of use (direct use or use supported by assistive technologies). (Modified from EN 301547).” (p. 63).

Table 3 presents Dimensions 1, 2, and 4 of the DigComp 2.2 in which, digital accessibility is directly referenced. From Table 3, the dimensions Dimension 3 and 5 are omitted, because in them accessibility is not mentioned/referenced.

Table 3. Digital accessibility competencies addressed in the DigComp 2.2: The Digital Competence Framework for Citizens

Competence area (Dimension 1)	Competence (Dimension 2)	Examples of knowledge (K), skills (S) and attitudes (A) (Dimension 4)	
1. Information and data literacy	1.1 Browsing, searching and filtering data, information and digital content	15. Concerned with inaccessibility of information for all users	A
2. Communication and collaboration	2.1 Interacting through digital technologies	45. Aware of which communication tools and services are appropriate - inclusive and accessible for all users	K
	2.4 Collaborating through digital technologies	91. Inclined to use digital tools for fostering collaboration ensuring digital accessibility	A
	2.5 Netiquette	96. Aware of accessibility requirements when communicating	K
3. Digital content creation	3.1 Developing digital content	120. Aware of what “digital accessibility” means and how important is for all users	K
		122. Can use tools and techniques to create accessible digital content following relevant standards and guidelines	S
		129. Inclined to follow relevant standards and guidelines to test the accessibility of web/digital content	A
	3.2 Integrating and re-elaborating digital content	132. Knows how to use tools and to enhance digital accessibility of digital content	S
5. Problem-solving dimension	5.2 Identifying needs and technological responses	230. Knows technical approaches for improvement of inclusiveness and accessibility of digital content and services	K
		231. Aware that AI-driven speech-based technology can enhance the accessibility of digital tools and devices	K
		234. Knows how to choose assistive tools to foster accessibility	S

Source: Own processing based on Vuorikari et al., 2022

The European Framework for the Digital Competence of Educators: DigCompEdu (Redecker, 2017), defines digital competence (competencies) concerning educator’s professional competencies, educator’s pedagogical competencies, and learner’s competencies.

Table 4. Digital accessibility competencies addressed in the European Framework for the Digital Competence of Educators: DigCompEdu

Competence Area	05 Empowering Learners
Competence	<p>Accessibility and inclusion</p> <ul style="list-style-type: none"> 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.
Activities	<ul style="list-style-type: none"> To provide equitable access to appropriate digital technologies and resources, e.g. ensuring that all students have access to the digital technologies used. To select and employ digital pedagogical strategies which respond to learners' digital context, e.g. contextual constraints to their technology use (e.g. availability), competences, expectations, attitudes, misconceptions and misuses. To employ digital technologies and strategies, e.g. assistive technologies, designed for learners in need of special support (e.g. learners with physical or mental constraints; learners with learning disorders). To consider and respond to potential accessibility issues when selecting, modifying or creating digital resources and to provide alternative or compensatory tools or approaches for learners with special needs. To employ design principles for increasing accessibility of the resources and digital environments used in teaching. To continuously monitor and reflect on the suitability of the measures implemented to improve accessibility and adapt strategies accordingly.
Progression & Statements	<ul style="list-style-type: none"> Newcomer (A1) Being concerned about accessibility and inclusion. I am afraid that the use of digital technologies in teaching will make it even more difficult for already disadvantaged students to participate and keep up with the others. Explorer (A2) Being aware of accessibility and inclusion issues. I understand the importance of ensuring equal access to the digital technologies used for all students. I am aware that digital technologies can hinder or improve accessibility. Integrator (B1) Addressing accessibility and inclusion. I understand how access to digital technology creates divides and how students' social and economic conditions have an impact on the way technology is used. I ensure that all students have access to the digital technologies I use. I am aware that compensatory digital technologies can be used for learners' in need of special support (e.g. learners with physical or mental constraints; and learners with learning disorders). Expert (B2) Enabling accessibility and inclusion. I select digital pedagogical strategies that adapt to learners' digital contexts, e.g. limited usage time, and type of device available. I consider and respond to potential accessibility issues when selecting, modifying or creating digital resources and provide alternative or compensatory tools or approaches for learners with special needs. I employ digital technologies and strategies, e.g. assistive technologies, to remediate individual learners' accessibility problems, e.g. visual or hearing impairments. Leader (C1) Enhancing accessibility and inclusion. I select and employ digital pedagogical strategies fitted to learners' digital technology uses, competences, expectations, attitudes, misconceptions and misuses. I employ design principles for increasing accessibility for the resources and digital environments used in teaching, e.g. as concerns font, size, colours, language, layout, structure. I continuously monitor and reflect on the suitability of the measures implemented to improve accessibility and adapt my strategies accordingly. Pioneer (C2) Innovating strategies for accessibility and inclusion. I reflect on, discuss, re-design and innovate strategies for equal access to and inclusion in digital education.

Source: Own processing based on [Redecker, 2017](#)

4. DISCUSSION AND FUTURE RESEARCH

In both IT and education professions related relevant documents there are references to the term and concept of digital accessibility.

In IT-selected relevant documents “digital accessibility” is either:

- defined as transversal skill, mentioned just in two e-competences - Dimension 2 (Title + generic descriptions) and in a few examples of Knowledge - Dimension 4 of the e-CF Framework (CEN, 2019), or
- mentioned in very few Guidance notes (Activities) and Level description elements of the Skills Framework for the Information Age (SFIA) (SFIA Foundation, 2021).

It is far away of to be expected to promote and foster digital accessibility.

In selected relevant documents for other professions “digital accessibility” is either:

- just lightly referenced and emphasized in a few (in 7) Competences – Dimension 2 and Examples of knowledge (K) (in 5 out of 259 K, S and A in total), skills (S) (in 3 out of 259 K, S and A in total) and attitudes (A) (in 3 out of 259 K, S and A in total) – Dimension 4 of the DigComp 2.2: The Digital Competence Framework for Citizens (Vuorikari et al., 2022), or
- strongly defined, referenced and emphasized in the European Framework for the Digital Competence of Educators: DigCompEdu (Redecker, 2017, p. 70) as a separate Competence “Accessibility and inclusion” with all Activities, Progression & Statements (of the level of competence) described.

No matter the missing strong references in all analyzed documents, especially those related to the IT profession, the documents are very valuable as a starting point for promoting and assuring digital accessibility.

In this sense, competencies needed to support web and digital accessibility for/expected from IT professionals should be (at least):

- awareness and compliance/application of guidelines from international (IT) standards (ISO/IEC 40500:2012 Information technology W3C Web Content Accessibility Guidelines (WCAG) 2.0 (International Organization for Standardization, 2012) and EN 301 549 - Accessibility requirements for ICT products and services) (ETSI, 2021) as well as other related standards, guidelines and legislative (such as (European Parliament, 2016)),
- awareness of expected (few) competencies related to accessibility defined in model(s) of IT profession: European e-Competence Framework (e-CF) (CEN, 2019) and Skills Framework for the Information Age (SFIA) (SFIA Foundation, 2021).

Competencies needed to support web and digital accessibility for/expected from all other professionals (citizens) should be (at least):

- awareness and ensuring digital accessibility in the sense of DigComp 2.2 - The Digital Competence Framework for Citizens,
- awareness and empowering others (learners) to promote, provide and benefit from accessible digital technologies/content in the sense of DigCompEdu - European Framework for the Digital Competence of Educators, as well as other standards, guidelines and legislation.

Further research is directed to the exploration of the current state and levels of competencies related to digital accessibility, IT and educational professionals, as well as citizens in general.

5. CONCLUSION

Digital technologies are powerful tools in each area and aspect of our lives. It could (and should be) be used to make us more empowered and successful in mastering all (life, private and business) challenges and tasks, but at the same time so that none of us is neglected and pushed into a (even more) worse position and deeper digital divide. Digital accessibility should be strongly recognized and emphasized in all aspects of digital technologies, in related knowledge, skills and attitudes as well as usage/practice. To assure it two professions play crucial role: IT and educational professions.

Both IT and educational professionals have tasks of being actively engaged in

- assuring (higher level of) digital accessibility of digital products and services (software, hardware, orgware,...) as well as (digital) content and environment, and in
- spreading awareness, knowledge and best practice examples of digital accessibility.

Digital accessibility naturally belongs to the IT profession, in general as well as to some specializations (Web Accessibility Specialist and/or Accessible Document Specialist for which the certification offers International Association of Accessibility Professionals (IAAP) ([Certification, n.d.](#)) for example).

Considering that digital technologies are represented in all aspects of human activity, digital accessibility also strongly belongs to educational professions, because all other future professionals (and citizens) who will use digital technologies as expected responsibly, taking into account and caring about accessibility, are formed through education.

Results of the analysis presented in this paper show that for both (IT and educational) professions digital accessibility has been referenced more or less (but still not enough) in relevant frameworks and models of digital competencies.

For both professions, there is a strong need for digital accessibility and related concepts and prerequisites to be embedded, defined and emphasized in respective profession/digital competency frameworks and models. Profession/digital competency frameworks and models are the broadest and most effective platforms to support digital accessibility and accessibility and inclusion in general.

It should and will turn today's modern, digital societies into inclusive ones.

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