Digital Competence Framework for Austria

DigComp 2.3 AT (2022)

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Vienna, November 2022

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Foreword

Since 2018, the fit4internet Association has been working on the standardisation, evaluation, qualification, and certification of digital competences based on the European Reference Framework for Digital Competences (DigComp EU). Over this period, experts from different professional backgrounds have worked together to consider the different perspectives, experiences, and needs concerning digital transformation as well as the empowerment people require to achieve it. At the Austrian level, a special "community of practice" was established to deal with the implementation of DigComp and its various dimensions, and find practical solutions for the labour market, the economy, and society.

As a member of the Digital Skills and Job Coalition (DSJC) and the Community of Practice (CoP) belonging to the European Commission's Joint Research Center (JRC), fit4internet is involved in the development of DigComp at a European level and can contribute developments from Austria accordingly. In 2021, together with colleagues from the European Commission, fit4internet organised a two-day community-led event on "The future of digital competences - digital skills certification and DigComp implementation in Austria" as part of the Austrian Digital Skills and Job Coalition. The requirements for the further development and implementation of the Digital Competences Framework were also discussed at this event.

As a result of these discussions and recommendations for action, fit4internet launched an extensive, multi-stage research and consultation process with practitioners from different professional backgrounds, which incorporated the experience gained from implementing the DigComp between 2019 and 2022 and thus led to the further development of DigComp AT into the DigComp 2.3 AT version.

The highly dynamic, rapid, and innovative development processes are based on unique collaboration across disciplinary boundaries. We would like to extend our thanks to all those involved and interested in the development and implementation of DigComp in Austria over the past few years.

Ulrike Domany-Funtan, MBA
Secretary General fit4internet – Raising Digital Competences in Austria (association)

Introduction

Digitalisation and digital transformation have fundamentally changed our world, our views thereof, and the way we live our lives therein. The "culture of life" or "living world" that has gradually emerged as a result is referred to as *digitality*. To be able to lead a self-determined life, made judgements, and make informed, well-founded, and well-considered decisions, digital competences and digital general knowledge are indispensable.

The ongoing digital transformation means that we must continuously observe these changes and constantly update our ideas surrounding them. A few decades ago, computers still only concerned a few experts, and all media were analogue. Now, digitality concerns *everyone* without exception due to its universal, life-cultural character. This is why *everyone* needs an idea of digitality that is as accessible as possible, as well as the necessary competences to be able to deal safely and critically with digital technologies and media. Digital competence encompasses the essential aspects of media competence and IT competence, but it covers more and goes beyond their scope.

There are several digital, IT, and media competence models with different logics, scopes, and histories. One such model is the *Digital Competence Framework for Austria (DigComp 2.3 AT, 2022 version),* which is presented below. It supplements the European DigComp 2.2 Framework (2022) with essential aspects of digital understanding as well as media literacy and the so-called competences for the 21st century.

The Digital Competence Framework for Austria was developed in 2018 and published at the beginning of 2019. It was created by translating the European (English-language) DigComp 2.1 Model into German for the first time. It was also adapted based on the results of a research project and expanded to include competence area *0. Foundations and access*—an essential addition to the European DigComp Model that has also been repeatedly called for by other bodies.

As part of a multi-step curation and research process, version 2.2 AT, which was developed in 2018, was expanded in 2022 to include three perspectives (marked in *red* in the text) based upon current developments. The first two are essential to the foundations of our liberal democracy, while the third perspective addresses the contribution of IT to the climate crisis and climate protection:

- As citizens, our ability to judge is in greater demand than ever: both in everyday life and particularly in any processes concerning democratic co-determination. *Engaging with the digital world*—alone and with others—is indispensable for *developing* the necessary understanding and *adequate judgement*. In competence area *0. Foundations, access and digital understanding,* the title and competences have been expanded accordingly.
- Over the past few centuries, printing has turned us all into readers. Within a very short time, digitalisation has empowered us not only to create (multimedia) content, but also to publish it worldwide using social media, blogs, or our own websites, bypassing editorial systems such as newspapers, radio, publishing houses, etc. The now well-known problem of fake news, to name just one of the many consequences of this development, makes it clear that authorship also needs to be learned and mastered. Competence area 3. *Digital content creation, production, and publication,* now explicitly addresses this and has been expanded to include the competence of *publishing content and objects digitally in different public spheres in a legally compliant way.*
- Information technology systems are now some of the most relevant and in some cases blatantly climate-damaging consumers of electricity and resources, as well as major emitters of $C0_2$. To raise awareness of this, the competence area *4. Safety* was expanded to include the aspect of *sustainable use of resources in the acquisition and operation of IT.*

After an introductory overview of the Digital Competence Framework for Austria as well as its dimensions and levels, the following text provides an overview of the European and Austrian context in which the model

was created and should be understood: also in conscious connection with or in distinction to some "neighbouring" competence models.

Subsequently, the development process, the entire model, and its dimensions are explained in detail. In contrast to the European model, the competence levels in DigComp 2.3 AT are described in a way which enables them be assigned to the levels of the National Qualifications Framework NQF (Appendix 1, currently only available in German) for the first time. Additionally—also in contrast to the European model—the Austrian model uses observable, transversal everyday scenarios of a simple (e.g., *you buy a new smartphone, put it into operation, and use it)* or more complex nature (e.g., y*ou solve professional or business issues and challenges, taking the options provided by digitalisation into account in consideration of the associated opportunities and risks)*, which generally touch on all areas of digital competence (Appendix 2, currently only available in German). At the "interfaces" of the scenarios with the competence areas, levels, and competences, fit4internet has developed self-assessment (CHECKs) and knowledge-based questions (QUIZzes) and has made them available free of charge to all interested parties for their guidance.

Many thanks to all those who contributed to this development and publication within the framework of the consultation process, scientific project, and many talks and discussions!

Thomas Nárosy BEd MBA MAS
Educational and scientific management of the DigComp development process in Austria

The Digital Competence Framework for Austria - DigComp 2.3 AT at a glance

The DigComp 2.3 AT competence model is a further development of the European and Austrian DigComp 2.2 reference framework and outlines the field of citizens' digital competences in the most general, complete, and comprehensive way possible. The European reference framework is written in English; initially, the Austrian model was created by translating the European model into German and was updated and expanded in relevant places in a second step. In 2018, the DigComp 2.2 AT version was commissioned by the then Federal Ministry for Digital and Economic Affairs (BMDW); in 2022, a practice-oriented further development and update, the DigComp 2.3 AT version, was commissioned by the fit4internet Association on the basis of over 3 years of practical and field work.

Dimension of competence areas and competences

DigComp 2.3 AT divides the field of digital competences into six competence areas (0.-5.) which are described in more detail in a total of twenty-seven (0.1.-5.4.) individual competences. To maintain coherence with the European model's numbering system, the competence area "foundations, access, and digital understanding", which precedes the Austrian model, was given the number 0. The main developments from DigComp 2.2 AT to the current version DigComp 2.3 AT are shown in red below. All adaptations can be found in detail below in the chapter DIGCOMP 2.3 AT IN DETAIL - THE AUSTRIAN VERSION OF THE EUROPEAN REFERENCE FRAMEWORK FOR DIGITAL COMPETENCES.

0. Foundations, access, and digital understanding

0.1. Understanding the concepts of digitalisation
0.2. Using digital devices and technologies
0.3. Knowing, using, and providing inclusive forms of access to digital content
0.4. Engaging with the digital world and developing the ability to make judgements

1. Information and data literacy

1.1. Browsing, searching, and filtering data, information, and digital content
1.2. Critically evaluating and interpreting data, information, and digital content
1.3. Managing data, information, and digital content

2. Communication, interaction and collaboration

2.1. Interacting through digital technologies
2.2. Using digital technologies to share data and information and to collaborate
2.3. Using digital technologies for social participation
2.4. Carrying out purchases and sales
2.5. Using appropriate forms of expression
2.6. Understanding and managing digital identity

3. Digital content creation, production, and publication

3.1. Developing digital content and objects
3.2. Integrating and re-elaborating digital content and objects
3.3. Respecting copyright and licences
3.4. Programming and automating processes
3.5. Publishing content and objects digitally in different public spheres in a legally compliant way

4. Safety and sustainable use of resources

4.1. Protecting devices
4.2. Protecting personal or confidential data and privacy
4.3. Protecting health and wellbeing
4.4. Protecting oneself and others from fraud and consumer rights abuse
4.5. Protecting the environment and sustainably operating IT

5. Problem solving, innovation and continuous learning

5.1 Solving technical problems
5.2 Identifying needs and technological responses
5.3 Creatively and innovatively using digital technologies
5.4 Identifying and closing digital competence gaps

Dimension of competence levels

DigComp 2.3 AT describes the development and expression of these competences using a total of eight levels. As a result of this level structure, the DigComp reference framework correlates with the European Qualifications Framework (EQF), which also has eight levels, and the referenced national qualifications frameworks: in Austria, the eight-level NQF. Regarding the formal education system in Austria, level 1 of the Austrian NQF could be compared in a very simplified way, for example, with learning outcomes at primary school level, and level 8 with a university professorship or highly qualified research and innovation activity. However, the Federal Act on the National Qualifications Framework (NQF Act)[1] has created a model that addresses and regulates informal, non-formal, and formal learning in an interlinked way for the first time. In the NQF, the degree of autonomy (levels 1-4) or the competence to manage work and learning contexts and their complexity and degree of contingency is decisive (levels 5-8).

FOUNDATION	**Level 1 Elementary FOUNDATION** under direct instruction
	Level 2 Solid FOUNDATION under guidance with some degree of independence
INTERMEDIATE	**Level 3 Solid INTERMEDIATE** with responsibility for the completion of work or learning tasks
	Level 4 Upper INTERMEDIATE taking action within the action parameters of work or learning contexts
ADVANCED	**Level 5 Comprehensively ADVANCED** leading and supervising in work or learning contexts
	Level 6 In-depth ADVANCED leading complex technical or professional activities incl. decision-making responsibility
HIGHLY SPECIALISED	**Level 7 Strategically HIGHLY SPECIALISED** leading and designing complex, unpredictable work or learning contexts
	Level 8 Innovatively HIGHLY SPECIALISED technical authority, scientific and professional integrity, and sustained commitment

[1] https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20009496

To better understand the competence frameworks's character

Reference frameworks are models that represent reality. As digital technologies, their areas of application, and their social contexts continue to develop dynamically, such models must be plausible and connectable in the present, and open to development in the future.

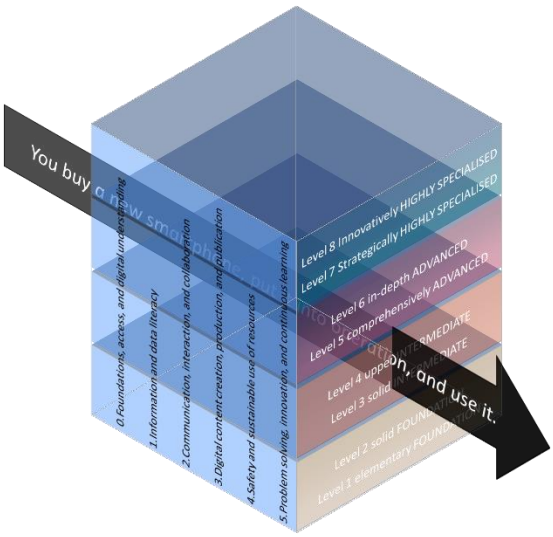

FIGURE 1 DIGITAL COMPETENCE FRAMEWORK FOR AUSTRIA - DIGCOMP 2.3 AT

The field of digital competences described in the DigComp reference framework can be imagined systematically as a three-dimensional object (Figure 1). However, in the face of digitalisation, the competences of humankind cannot be packed "neatly" into a cube "in reality". In another model, the field of digital competences is more like a tree (Figure 2), which is somewhat straightforward and compact in the trunk (levels 1 to 4), but branches off in all directions, quickly growing upwards and outwards and thus "into the blue" from level 5 onwards.

Yet another representation (Figure 3) puts the competence levels into a 360-degree analogy. 180 degrees indicate independent as well as comprehensively advanced (leadership) competences in professional and everyday life. Competence levels 6 to 8 (360 degrees) close the circle. On the one hand, this indicates that the demand level of competence levels 6 to (especially) 8 is clearly above that of competence levels 1 to 5. On the other hand, the innovations of competence level 8 have an ongoing effect on the entire population's professional and everyday life: what is the knowledge and ability of a few researchers at time t1 is part of everyday culture at a later time t2.

FIGURE 2 DIGITAL COMPETENCES IN FORM OF A TREE

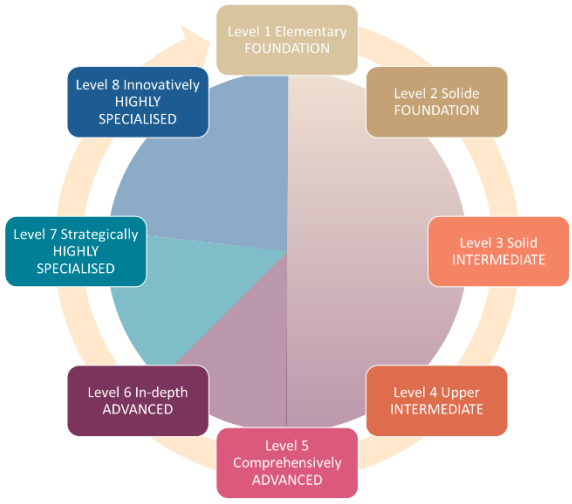

FIGURE 3 DIGCOMP 2.3 AT AS 360-DEGREE ANALOGY

Reference frameworks are therefore helpful and necessary for gaining understanding, orientation, imagination, conceptuality, discourse, and connectivity, as well as an overview.

- They serve as a "lens" for viewing the construct of digital competences. Ongoing discussions and updates help to prevent this "visual tool" from becoming "blind" or having "rose-tinted glasses".

- Reference frameworks aid the assessment and description of personal competences and reveal strengths and areas that can be focussed upon.
- They are the basis for the development of competence checks, quizzes, and exams, as well as associated learning opportunities, syllabi, and curricula.
- As such, they can also provide structure for educational programmes and thus make them easier to find.

However, competence models can only describe reality in a limited and relative way. Due to the aforementioned dynamics of developments in digitalisation, the Austrian Digital Competence Framework - DigComp 2.3 AT (just like the European Reference Framework for Digital Competences - DigComp 2.2) is a snapshot that will be further adapted at the appropriate time.

Key competence 4. digital competence (quoted from the COUNCIL RECOMMENDATION of 22 May 2018 on key competences for lifelong learning[2])

"Digital competence involves the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), intellectual property related questions, problem solving and critical thinking.

Essential knowledge, skills and attitudes related to this competence

- *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. 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.*
- *Engagement with digital technologies and content requires a reflective and critical, yet curious, openminded and forward-looking attitude to their evolution. It also requires an ethical, safe and responsible approach to the use of these tools."*

[2] https://eur-lex.europa.eu/legal-content/DE/TXT/HTML/?uri=CELEX:32018H0604(01)&from=EN (accessed 8.10.2022)
https://op.europa.eu/en/publication-detail/-/publication/297a33c8-a1f3-11e9-9d01-01aa75ed71a1/language-en

Digital competence models - overview and context

Over the past two decades, there has been a significant increase in awareness for the need for lifelong, or continuous learning. The general lengthening of educational pathways as well as the likelihood that people will not be able to pursue the profession they learnt when they were younger until they retire are only two of the many phenomena which reflect this dynamic. Over the past four years, since work was carried out on DigComp 2.2 AT (summer and autumn 2018), this aspect has received another dramatic boost. Labour shortages mean that companies must increasingly be prepared to invest in the development of their future staff and cannot simply expect to find individuals who are 'fit for service' in the labour market. Continuous learning is therefore a key skill for individuals as well as organisations, and it links the digital competence model for Austria with other 21st century competence models.

This overview aims not only to deepen the understanding of the "phenomenon of digital competences", but also to provide an impression of the ongoing contextual change. This is because, as mentioned previously, each competence model reflects the issues and comprehension of the time in which it was created, its contexts, and its boundaries, and will continue to evolve. For example, in recent years, there has been a strong increase in our understanding of the universal relevance of sustainability and climate protection, which is also reflected in certain formulations and priorities.

EU key competences

Despite increasing awareness of the climate, energy, and distribution crises[3], digitalisation is still one of the key drivers of development today and will continue to be for the foreseeable future. The EU, for example, already took this into account on 18 December 2006 by including digital competence in its Recommendation of the European Parliament and of the Council 2006/962/EC[4] on key competences for lifelong learning. In this recommendation, eight key competences which are important for every individual in a knowledge-based society were defined for the first time.

Since then, the competence requirements have evolved. Therefore, in 2016 and 2017, the European Commission carried out a consultation process, part of which was public. As a result, Recommendation 2018/C 189/01 on key competences for lifelong learning[5] was published on 22 May 2018. This supplements, updates, and replaces the document from 2006.

The following table compares the two versions of the key competence model. Although there are many similarities, the additions, shifts, extensions, and different priorities in the context of digitalisation are noteworthy, as is the fact that a distinction is made between IT competence (explicitly shown in point 3 in the 2018 German version) and digital competence (point 4).

EU key competences (2006)	**EU key competences (2018)**
1. Native language competence	1. Literacy
2. Foreign language competence	2. Foreign language competence
3. Mathematical and basic scientific-technical competence	3. Mathematical competence and competence in science, informatics and technology

[3] An up-to-date overview and corresponding recommendations for action are provided in the new report to the Club of Rome, published in September 2022, 50 years after "The Limits to Growth": https://www.earth4all.life/ (accessed 8.10.2022).
[4] https://eur-lex.europa.eu/legal-content/DE/TXT/HTML/?uri=CELEX:32006H0962&from=DE (accessed: 8.10.2022)
[5] https://eur-lex.europa.eu/legal-content/DE/TXT/HTML/?uri=CELEX:32018H0604(01)&from=EN (accessed:11.1.2019)

4. Computer literacy	4. Digital competence
5. Learning competence	5. Personal, social and learning competence
6. Social competence and civic competence	6. Civic competence
7. Personal initiative and entrepreneurial competence	7. Entrepreneurial competence
8. Cultural awareness and expression	8. Cultural awareness and expression

The revised catalogue of competences is complemented by further recommendations for implementation made by the European Commission, which can be summarised in the following points:

1. Right to high-quality and inclusive lifelong education for all;
2. Promoting the development of key competences, first and foremost the basic competences of reading, writing, arithmetic, and basic digital competences;
3. Promoting acquisition through interdisciplinary and multifaceted cooperation between all actors and institutions, and through the development of appropriate tools and support;
4. Consideration of the seventeen United Nations Sustainable Development Goals[6];
5. Reporting, documentation, and networking regarding experiences, tools, and progress.

The EU DigComp Framework - from version 1.0 to version 2.2

The European Commission's Joint Research Centre (JRC) launched its research programmes "on Learning and Skills for the Digital Era"[7] in 2005, and there have been more than 20 major studies and more than 100 different publications to date. Under the auspices of several Directorates General, several interrelated frameworks of reference (Figure 4) have been established and further developed in the domains of citizens, educators, organisations, and society.[8]

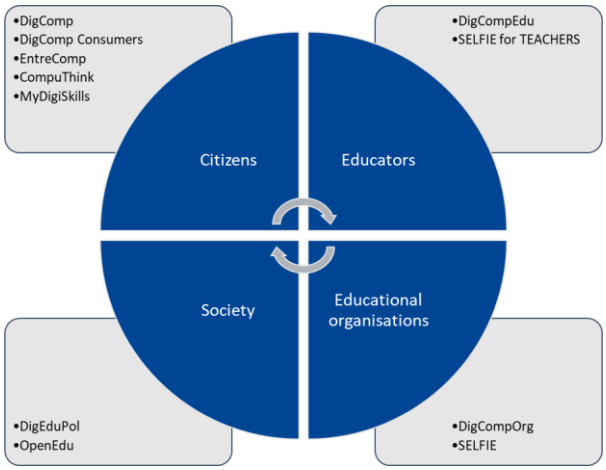

FIGURE 4 SELECTED FRAMEWORKS AND SELF-ASSESSMENT TOOLS OF THE JRC

Version 1.0 of the DigComp reference framework was published in 2013. It was followed by version 2.0 in 2016, and version 2.1 in 2017, upon which the 2018 Austrian DigComp 2.2 AT model is based. The 2.1 European version was followed by the 2.2 European version in 2022, which remained unchanged with

[6] https://www.bundeskanzleramt.gv.at/nachhaltige-entwicklung-agenda-2030 (accessed: 8.10.2022)

[7] https://joint-research-centre.ec.europa.eu/scientific-activities-z/learning-and-skills-digital-era_en - more detailed information on the terms in the following footnote can be found here. (accessed: 29.10.2022)

[8] DigComp: Digital skills for citizens | DigCompConsumers: Digital skills for consumers | EntreComp: Framework for entrepreneurship skills | CompuThink: Computer Thinking | MyDigiSkills: Self-assessment tool for citizens | DigCompEdu: Digital skills for educators | SELFIE for TEACHERS: Self-assessment tool for teachers | DigCompOrg: Framework for digitally competent educational organisations | SELFIE: Self-assessment tool for educational organisations | DigiEduPol: Key principles for the design of digital education policies | OpenEdu: A support framework for institutions of higher education

regard to the competence areas and competences but was supplemented by a wealth of current practical examples with regard to knowledge, skills, and attitudes.

In terms of content, the basic structure chosen—as was the case with the eight EU key competences—has proven itself. The changes between 2013 and 2017 reflect certain developments, such as the increased perception of "digitalisation" as an overall term for the development or awareness of "data" and "privacy". At the European level, the framework remained unchanged in 2022; what has changed and expanded is the interpretative content, the metaphors, and figures as well as the resources in the document, the reading of which (Vuorikari, R., Kluzer, S. and Punie, Y., 2022) is strongly recommended.[9]

DigComp 1.0 (2013)	DigComp 2.1 (2017) = DigComp 2.2 (2022)
1. information 1.1 Browsing, searching and filtering information 1.2 Evaluating Information 1.3 Storing and retrieving information	**1. information and data literacy** 1.1 Browsing, searching and filtering data, information and digital content 1.2 Evaluating data, information and digital content 1.3 Managing data, information and digital content
2. communication 2.1 Interacting through technologies 2.2 Sharing information and content 2.3 Engaging in online citizenship 2.4 Collaborating through digital channels 2.5 Netiquette 2.6 Managing digital identity	**2 Communication and collaboration** 2.1 Interacting through digital technologies 2.2 Sharing through digital technologies 2.3 Engaging in citizenship through digital technologies 2.4 Collaborating through digital technologies 2.5 Netiquette 2.6 Managing digital identity
3. content creation 3.1 Developing content 3.2 Integrating and re-elaborating 3.3 Copyright and licences 3.4 Programming	**3. Digital content creation** 3.1 Developing digital content 3.2 Integrating and re-elaborating digital content 3.3 Copyright and licences 3.4 Programming
4. safety 4.1 Protecting devices 4.2 Protecting personal data	**4. Safety** 4.1 Protecting devices 4.2 Protecting personal data and privacy

[9] This text repeatedly refers to Vuorikari, R., Kluzer, S. and Punie, Y., (2022) in terms of content, but refrains from adopting or translating it in full, as the Digital Competence Framework for Austria takes a slightly different path in some of its dimensions, as explained below. Furthermore, this text goes into detail about Austrian developments which, by their very nature, cannot play a role in the European competence model.

4.3 Protecting health 4.4 Protecting the environment	4.3 Protecting health and well-being 4.4 Protecting the environment
5. problem solving 5.1 Solving technical problems 5.2 Identifying needs and technological responses 5.3 Innovating and creatively using technology 5.4 Identifying digital competence gaps	**5. Problem solving** 5.1 Solving technical problems 5.2 Identifying needs and technological responses 5.3 ~~Innovating and~~ Creatively using digital technologies 5.4 Identifying digital competence gaps

The main difference between versions 1.0 and 2.1. or 2.2 does not concern the competence catalogue, but undoubtedly lies in the development from a *three-level model* in version 1.0 ...

- DigComp 1.0: A - Foundation | B - Intermediate | C - Advanced

... to an *eight-level development scale* in versions 2.1/2.2 ...

- DigComp 2.1/2.2: Foundation Levels 1&2 | Intermediate Levels 3&4 | Advanced Levels 5&6 | Highly specialised Levels 7&8

As a result of these eight levels, the DigComp framework is now strongly based on the European Qualifications Framework EQF, which also has eight levels. These eight levels will be dealt with in more detail in the description of the DigComp 2.3 AT reference framework that follows later.

The main difference between the 2.1 and 2.2 European versions, in turn, lies in the collaborative mode of creation or revision: the DigComp Community of Practice[10] (CoP) initiated by the JRC for this purpose had 575 members from 57 countries at the beginning of 2022 and is open to all interested parties. Austria, represented by the fit4internet Association and the Federal Ministry for Digital and Economic Affairs, stepped into the Community of Practice with the development of version 2.2 AT in 2018 and actively participated in the development of the 2.2 European version. This deliberative, co-creative, co-constructive, and collaborative work is an essential prerequisite now and in the future for keeping the DigComp model relevant, recognised, meaningful, and sustainable in Europe as well as for shaping this model further.

The DigComp framework as part of larger "ecosystems"

A closer look shows that there are broad areas of overlap between the individual competence models and that the models are not clearly defined.

- For example, competence 3.4 of the DigComp model, *Programming and automating processes*, is assigned to EU key competence 4 *Digital competence on the* one hand, and at the same time it is deepened in EU key competence 3 *Mathematical competence and competence in science, informatics and technology* on the other.
- *Informatic thinking is* undoubtedly related to digitalisation, but it is only one part of digital competence. Digitally competent action also requires *media competence* (after all, most of today's

[10] https://ec.europa.eu/jrc/communities/en/community/digcompedu-community/news/digcomp-community-practice-digcomp-cop (accessed 29.10.2022)

media are digital). However, to equate media competence and digital competence would be a mistake and misses the point of both competence models, which overlap but also have their own descriptive logics and fields of action.

- *Protecting the environment and sustainably operating IT* is competence 4.5 of the DigComp framework; at the same time, on behalf of the European Commission, the JRC has developed a framework of sustainable competences known as *GreenComp*[11] that goes beyond sustainable IT operations.
- The *LifeComp Framework*[12] further differentiates between EU Key Competence *5 Personal, social and learning* competences in the context of lifelong learning, but also touches on essential digital competences related to critical thinking, communication, collaboration, problem solving, and further education.
- Furthermore, similarities with models of the so-called *21st Century Skills* (Figure 5) are unmistakable, but they are also reflected, and points of contact can be traced in other competence models.

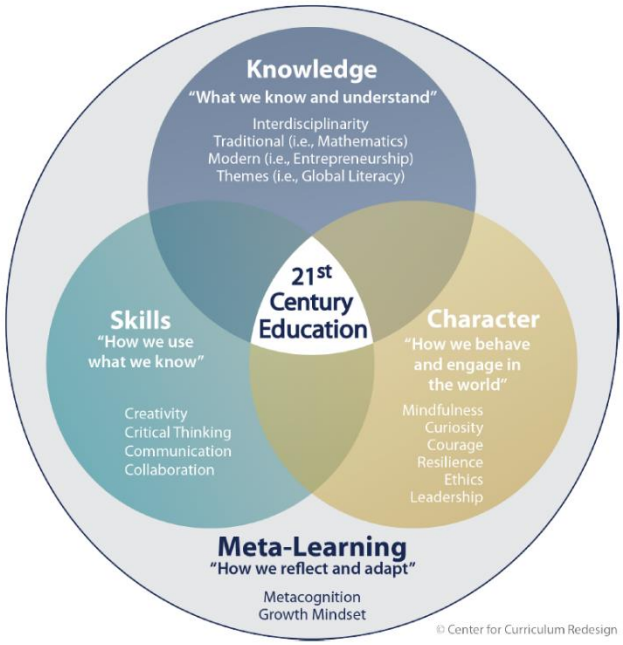

FIGURE 5 21ST CENTURY SKILLS MODELS (FADEL ET AL, 2015)

This diversity invites us to produce a coherent, overall image of the complexities and interconnections. Martínez et al. (2021) proposed a *meta-framework of digital literacy* with six dimensions, seven transversal and three direct competences, and 53 skills (Figure 6). Van Laar et al. (2017) explored the relationship between digital skills and 21st century skills. Ultimately, each model leads to a certain gain in knowledge from certain perspectives, but the more

[11] https://publications.jrc.ec.europa.eu/repository/handle/JRC128040 (accessed: 29.10.2022)

[12] https://joint-research-centre.ec.europa.eu/lifecomp_en (accessed: 29.10.2022)

"complete" a model intends to be, the more effort is required to understand and disseminate the respective view.

This, in turn, means that the more "complete" a model is, the more difficult it is to disseminate—it is not quick and easy enough to grasp and memorise. To achieve this, it should not contain more than seven plus/minus two "chunks" of information. [13]

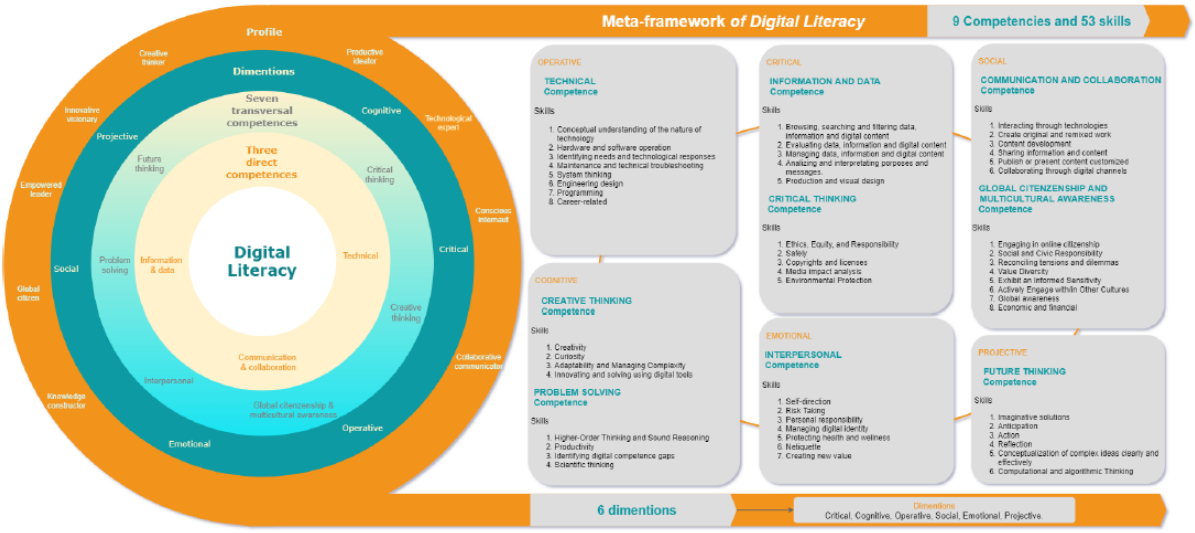

FIGURE 6 META-FRAMEWORK OF DIGITAL LITERACY (MARTINEZ ET AL., 2021)

For the scope, "correctness", and "completeness" of the DigComp model, which has now been translated into 13 European languages[14] , this means three things:

- ☑ A broadly effective model is not too extensive and five to nine points or sub-points suffice for it to be comprehensible for its purposes: the DigComp model has five or, in the Austrian version, six competence areas, each of which is subdivided into no more than six competences.
- ☑ A broadly effective model discloses its perspective, as is done, for example, for the DigComp model in the following definition: ***"Digital competence involves the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society.*** *It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital [sic!] well-being and competences related to cybersecurity), intellectual property related questions, problem solving and critical thinking."*[15]
- ☑ A broadly effective model is thus also aware of its "relativity"—in the sense of its "relation" to other models and thus in the sense of the area it covers, its overlaps with other models "left and right, above and below" and its limits.

There are several plausible and thus "correct" ways to gather the different and more or less interrelated models into a larger orientation framework and context. Some of these ways of thinking shall conclude this train of thought.

[13] https://en.wikipedia.org/wiki/The_Magical_Number_Seven,_Plus_or_Minus_Two (accessed: 29.10.2022)

[14] Vuokari et al. (2022), p. 55

[15] https://eur-lex.europa.eu/legal-content/DE/TXT/HTML/?uri=CELEX:32018H0604(01)&from=EN (accessed 8.10.2022)
https://op.europa.eu/en/publication-detail/-/publication/297a33c8-a1f3-11e9-9d01-01aa75ed71a1/language-en

A systematic approach based on the individual

The EU key competences model is suitable for gaining an overview based on individuals' competences. In the following illustration (Figure 7), the European Commission's *LifeComp*[16] , *EntreComp*[17] *, GreenComp*[18]*,* and *DigComp* models are assigned (more or less exactly) to this model in an inner circle. The European Council's *Common European Framework of Reference for Languages CEFR-GERS*[19] and the *Reference Framework of Competences for a Democratic Culture RFCDC*[20] as well as the Center for Curriculum Redesign's 21st Century Education model *Four-Dimensional Education: The Competencies Learners Need to Succeed*[21] are arranged outside the circle. This presentation makes no claim to completeness but aims to exemplify how competence frameworks of different provenance can be related, interact with each other, and at the same time pursue their respective focuses independently. For the revision and further development of competence models, it is particularly crucial to know the context in order to be able to consciously receive suggestions, make expansions, recognise gaps, strengthen commonalities, or maintain boundaries.

[16] https://joint-research-centre.ec.europa.eu/lifecomp_en (accessed 29.10.2022)

[17] https://ec.europa.eu/social/main.jsp?catId=1317&langId=en (accessed 29.10.2022)

[18] https://joint-research-centre.ec.europa.eu/greencomp-european-sustainability-competence-framework_en (accessed 29.10.2022)

[19] https://www.coe.int/en/web/common-european-framework-reference-languages (accessed 29.10.2022)

[20] https://www.coe.int/en/web/reference-framework-of-competences-for-democratic-culture/home (accessed 29.10.2022)

[21] https://curriculumredesign.org/our-work/four-dimensional-21st-century-education-learning-competencies-future-2030/ (accessed 29.10.2022)

FIGURE 7: SEVERAL COMPETENCE MODELS OF DIFFERENT PROVENANCE, WHICH CAN BE ASSIGNED (MORE OR LESS EXACTLY) TO INDIVIDUAL EU KEY COMPETENCE DOMAINS.

A systematic approach based on organisations and collectives

Thinking about competences in a general and "generic" way, starting with individuals, is undoubtedly important, but must be balanced and kept in relation by considering other perspectives. Requirements profiles for jobs, for example, or somewhat more general occupational profiles constitute such a complementary approach.

Both perspectives—individual and organisational—pursue their purposes and more or less overlap in individuals. In this process, the job or occupational profile will be much more detailed and in-depth in some areas than the DigComp model is able or wants to be: for example, with regard to certain programming skills or the knowledge about and mastery of certain ERP software. Other competences, for example that of using digital technologies for social participation (competence 2.3), may not play a role in a job, but are indispensable for the privately politically active individual. Both perspectives are therefore relevant, indispensable, and yet not congruent. This example also shows the difference between education for

professional requirements and *education* as a general human requirement: education is *more than* and different to training.

FIGURE 8 THE EUROPEAN DIGCOMP 2.2 MODEL AS A PENTAGON

A final thought on the weighting of the competence areas and competences: a list like the one in the DigComp model tends to lead to us attributing importance to the competences in numerical order (1 to 5 or 0 to 5). Those areas at the beginning receive more attention than those at the end; however, all competence areas seem to be roughly equally relevant. The representation of the European DigComp 2.2 model as a pentagon (Figure 8) instead of a list relativises this view somewhat: here, there is no beginning and no end. Perhaps the small "DigComp pentagon" in the centre forms the basis for the future integration of Austrian competence area *0. Foundations, access and digital understanding* into the European model? However, the areas remain of equal size, which "suggests" equal relevance. Some will attribute a certain significance to the arrangement of competence areas 1 and 5 at the tip of the pentagon. These areas could also be given different emphases by changing the layout and thus changing their relationship, or by changing their proportions.

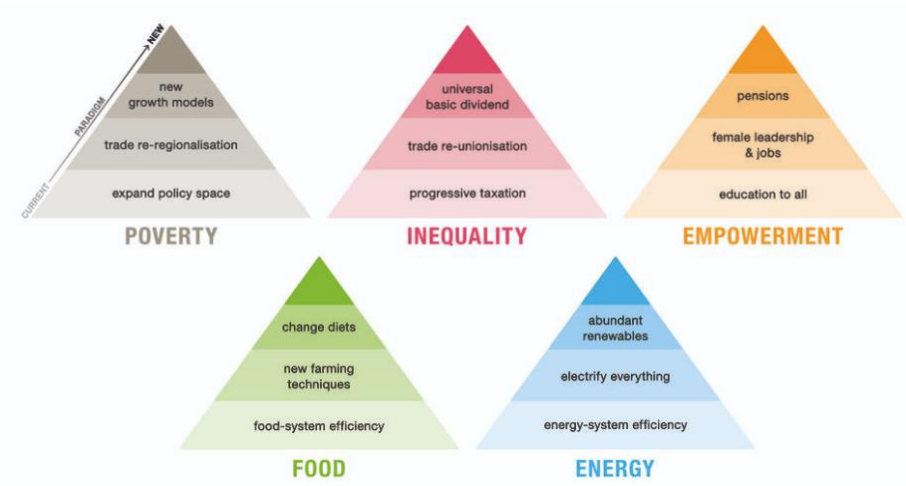

FIGURE 9 THE FIVE TURNING POINTS IN EARTH4ALL, AS NEW REPORT TO THE CLUB OF ROME

These weighting considerations gain even greater importance if the framework of reference they are related to is broadened, which "relativises" digital competence in yet another way.

Digital skills are undoubtedly highly important in the face of a digitally transforming world and a life culture of digitality. However, this could also lead to them obscuring the view of things which might be of even greater significance. If we take a look at the United Nations' seventeen Sustainable Development Goals[22] or an even closer look at the five turning points in *Earth4All*[23] (Figure 9), the new report to the Club of Rome (50 years after *The Limits to Growth*), they show that digital literacy is embedded in a larger societal and political whole that demands and challenges individual/self-judgement, personal and ethically based decisions, as well as political regulations in the form of collectively binding solutions: cybercriminal or security expert? The undermining of acceptable working conditions by an exploitative platform economy or the guarantee of legal protection by regulations such as the General Data Protection Regulation? Insane power consumption resulting from cryptocurrencies or "smart" control of networked, sustainable energy resources?...

[22] https://www.bundeskanzleramt.gv.at/nachhaltige-entwicklung-agenda-2030 (accessed: 8.10.2022)

[23] https://www.earth4all.life/ (accessed 8.10.2022)

It should now be clear that digital competence is not an "objective and neutral" concept that is "dutifully" learnt by heart and "diligently" implemented and fulfilled. *Dealing with digitality and developing judgement* means dealing with different interests, perspectives, and possibilities: (by no means contradictory) concepts such as the European Commission's *2030 Digital Compass: Your Digital Decade*[24], UNESCO's Media and Information Literacy Framework (MIL - cf. UNESCO 2013), the *Vienna Manifesto for Digital Humanism*[25], ethicist Julian Nida-Rümelin's (currently Director of the Bavarian Research Institute for Digital Transformation) call for his own European digitalisation model (Nida-Rümelin 2022), or *Freiheit digital*[26], a memorandum of the Protestant Church in Germany, to name a few, can support this debate and sharpen judgement.

The DigComp implementation experience

The European Commission's publications *DigComp into Action. Get Inspired Make It Happen. A user guide to the European Digital Competence Framework* (2018), *DigComp at Work* (2020) and *DigComp at Work. Implementation Guide* (2020) constitute detailed and differentiated reports on experiences with the implementation of the DigComp Reference Framework. To summarise:

- What digitalisation is, can, and will trigger is unresolved. Digitalisation is "work in progress" and "history in progress".
- In particular, the issue of social cohesion (keyword: inclusion) is viewed with great concern by many; but there are also loud cries for appropriate education, relevant research and development, institution building, as well as courageously embracing the associated opportunities.
- The DigComp Framework is one of many measures used to capture digitalisation and the demands and opportunities it provides for citizens. This framework is also a work in progress, but it has provided institutions and companies with relevant input for developing and using (digital) instruments for measuring and developing competences.
- The effectiveness of these tools and certificates strongly depends on the target group and the context in which they are used.
- The openness and dynamics of development suggest a network association of initiatives, companies, and institutions that are involved or responsible and active in matters of digitalisation. However, a central support institution that actively promotes communication and cohesion is absolutely necessary.
- Being open-minded about one's own mistakes and those made by others (understood as learning opportunities) and discussing them is essential.

In particular, the experience of Denmark and Estonia, both of which are known to be "digital champions", points strongly to the need for an adapted, flexible "translation" of any framework into the respective context and for special consideration of the institutions, communities, and people with whom joint action is taken.

[24] https://futurium.ec.europa.eu/en/digital-compass (accessed 31.10.2022)

[25] https://dighum.ec.tuwien.ac.at/wp-content/uploads/2019/07/Vienna_Manifesto_on_Digital_Humanism_DE.pdf (accessed 31.10.2022)

[26] https://www.ekd.de/freiheit-digital-63984.htm (accessed 31.10.2022)

The past four years of development in Austria have demonstrated an impressive path, made possible by interdisciplinary and institutional cooperation. In the meantime, Austria has taken on a pioneering role in Europe concerning the practice-oriented implementation of DigComp!

Milestones on the Austrian path

It would go beyond the scope of this publication to provide a complete outline of the development and understanding of digital competences in Austria in recent decades. Moreover, this path has not only been shaped by institutional or governmental input, but has been greatly sought, paved, and followed by a wealth of economic, academic, technical, and private initiatives. All the levels of this "history in progress" would first have to be researched, written and, above all, continuously updated. At this point, therefore, only selected key milestones of "institutional Austria" should provide current orientation and an overview.

Since 2006: digi.komp – digital competences. Informatics education.

For almost 20 years, the so-called "digi.komp initiative" has been promoted in the Austrian school sector. While implementation at schools and universities was initially voluntary, the concern for digital literacy is now being integrated step by step into curricula and binding requirements—most recently into the curriculum for basic digital education, which will be introduced as a compulsory subject in 2022.

- *digi.komp4* - a digital competence model and implementation examples for primary schools (4 refers to the highest, i.e., year 4 of primary school)
- *digi.komp8* - digital competences and implementation examples for secondary level 1, which ends in year 8 of school (implemented by means of the new subject *Compulsory Exercise in Basic Digital Education* introduced in 2018/19, which was replaced by the compulsory subject Basic Digital Education in 2022).
- *digi.komp12* - digital competences and implementation examples for upper secondary schools up to year 12 (some vocational schools have had explicit and detailed subject curricula in the field of computer science for decades).
- *digi.kompP* - digital competences for educators. This model is currently being made compulsory in initial and in-service teacher training.

Over the years, this initiative has been supported and further developed by various projects and networks (*eLC, eLSA, eLSA advanced, KidZ, NMS eLearning*), which were combined in 2016 in the Ministry of Education's *eEducation initiative*[27].

2016: Digital Roadmap Austria[28]

It is not only the opportunities and potential of digitalisation but also the challenges and dangers that affect society and the economy as a whole. Therefore, answers and development approaches regarding the technological change, which is driven by digitalisation, must be sought across the board.

In 2016, the Austrian Federal Government developed the Digital Roadmap as a guide to the digital future in a very broad, partly also public, consultation process and published it at the end of the same year. The Digital Roadmap comprises twelve fields of action and measures: (*1) Education (2) Infrastructure (3) Research and Innovation (4) Economy (5) Work and Jobs (6) Health, Care, and Social Affairs (7) Environment, Energy, Agriculture, and Climate Protection (8) Mobility and Transport (9) Media, Civil Courage, and Culture (10) Integration and Inclusion (11) Safety, Security, and Trust (12) Politics and Administration*.

[27] https://eeducation.at/ueber-eeducation (accessed 31.10.2022)

[28] https://www.digitalroadmap.gv.at/fileadmin/downloads/digital_road_map_broschuere.pdf (accessed: 31.10.2022)

The Digital Roadmap Austria considered the effects of digitalisation on society as a whole and the consequences to be drawn from them for the first time.

2015-2018: the Federal Council's Green Papers

In 2015, the Federal Council began to discuss the topics of digitalisation at a broad, including parliamentary, level. Since then, the following Green Papers have been published—always combined with expert opinions, public participation processes, and parliamentary enquiries:

- *Green Paper on Digital Change and Policy*[29] (2015)
- *Green Paper on Digital Courage*[30] (2016)
- *Green Paper on Digitalisation and Democracy*[31] (2017)
- *Green Paper on Shaping a Socially Just Digital Future*[32] (2018)

2018/19: Compulsory exercise in basic digital education

Following the ordinance introducing the Compulsory Exercise in Basic Digital Education[33] (which also continues the digi.komp8 concept mentioned above), 14-year-old Austrians, i.e., all new secondary and grammar school leavers, were expected to be thoroughly digitally literate for the first time. This development also had an impact on the question regarding the extent and way in which digital literacy is "normal" and "taken for granted" among adults of any age.

The curriculum for basic digital education has achieved the feat of bringing the *digital and informatics competences as* well as *media competences* and *socio-political competences* affected or addressed by digitalisation, as well as the communities behind them and their expertise in particular, together under a common roof.

2019: oesterreich.gv.at - Austria's digital office and digitalaustria.gv.at

For more than 20 years, "official Austria" has considered, among other things, the growing digital competences of citizens and the opportunities and demands of digitalisation through a wealth of services that are now taken for granted and are even indispensable. (NOTE: all the milestones in Austria's digital transformation listed below can still be accessed under the URLs mentioned; almost all of them now have a new, common portal thanks to the digital office).

- *help.gv.at* - has been a hub between public authorities and citizens since 1997, providing information on official administrative processes and, if available, the opportunities for completing them electronically, and has become the digital office's search and orientation tool.
- *ris.bka.gv.at* - the Republic of Austria's digital legal information system has been online since 1998; since 1 January 2014, the legally effective announcement of applicable laws has been carried out exclusively here.

[29] https://www.parlament.gv.at/ZUSD/PDF/Gruenbuch_Digitaler_Wandel_und_Politik_20151111.pdf (access: 11.1.2019)
[30] https://www.parlament.gv.at/ZUSD/PDF/Gruenbuch_Digitale_Courage_Republik_Oesterreich_Bundesrat.pdf (access: 11.1.2019)
[31] https://www.parlament.gv.at/ZUSD/PDF/Gruenbuch_Digitalisierung_und_Demokratie_ACC.pdf (access: 11.1.2019)
[32] http://www.businessart.at/images/doku/gruenbuch_digitalezukunft_20180628_web.pdf (access: 11.1.2019)
[33] https://bildung.bmbwf.gv.at/schulen/schule40/dgb/index.html (access: 11.1.2019)

- *finanzonline.bmf.gv.at* - the "digital tax office" has been open twenty-four hours a day, seven days a week since 2003 and enables, for example, the digital submission of tax returns and employee assessments.

- *usp.gv.at* - has been the Republic of Austria's central Internet portal for businesses since 2010 and provides, for example, access to eGovernment applications such as eFoundation or eInvoice.

- *handy-signatur.at* - since 2009, this has been a legally valid signature and digital ID card in one. Using the mobile phone signature, citizens can, for example, register for all the services listed here (they can also now use ID Austria on a trial basis—see below).

The federal government declared 2019 the "Year of Digitalisation". *österreich.gv.at, Austria's digital office,* has become the central, cross-authority online platform that citizens can use to carry out many official tasks, independent of time and place. Its abundance—and continuous expansion—is far beyond the scope of this publication; at the same time, the use of digital (eGovernment) services has become a matter of course, even indispensable, for broad sections of the population (not least triggered by the Covid-19 pandemic), which is best illustrated here using two current screenshots from the digital office.

First and foremost, there is the possibility of secure and unique identification of citizens. As a successor to the mobile phone signature, ID Austria is currently (2022) being tested (as part of the European eIDAS initiative and regulation[34]).

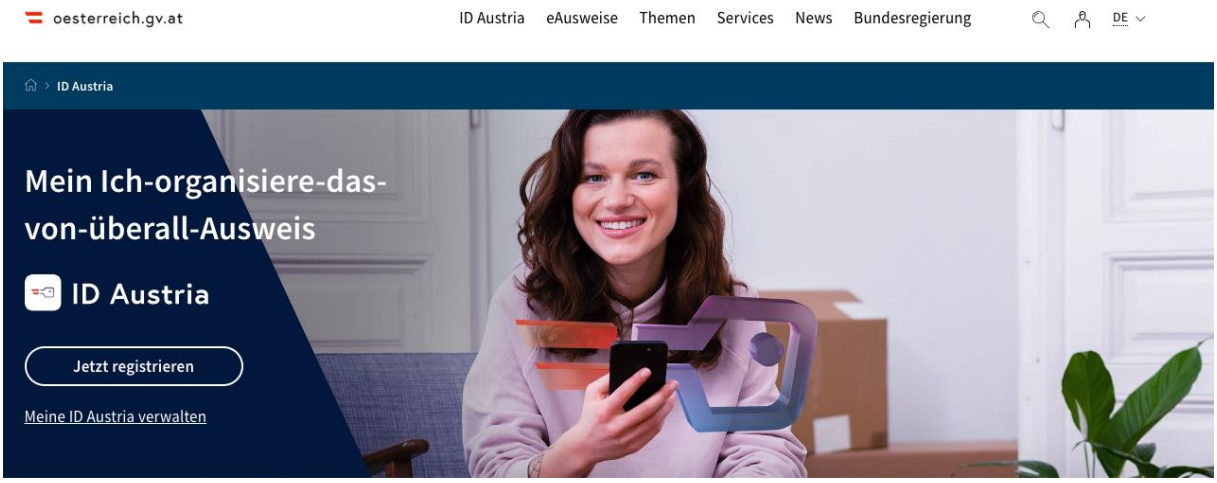

FIGURE 10: ID AUSTRIA WILL REPLACE THE MOBILE PHONE SIGNATURE AS A EUROPE-WIDE VALID DIGITAL SIGNATURE AFTER THE CURRENT TEST PHASE (2022) (WEBSITE CURRENTLY ONLY AVAILABLE IN GERMAN)

In the autumn of 2022, the digital driving licence became the first eID card. Moreover, obtaining criminal records, signing petitions for referendums, filing insurance documents, dealing with tax matters, and the like are now part of everyday life for many.

[34] https://www.eid.as/de/ (accessed: 31.10.2022)

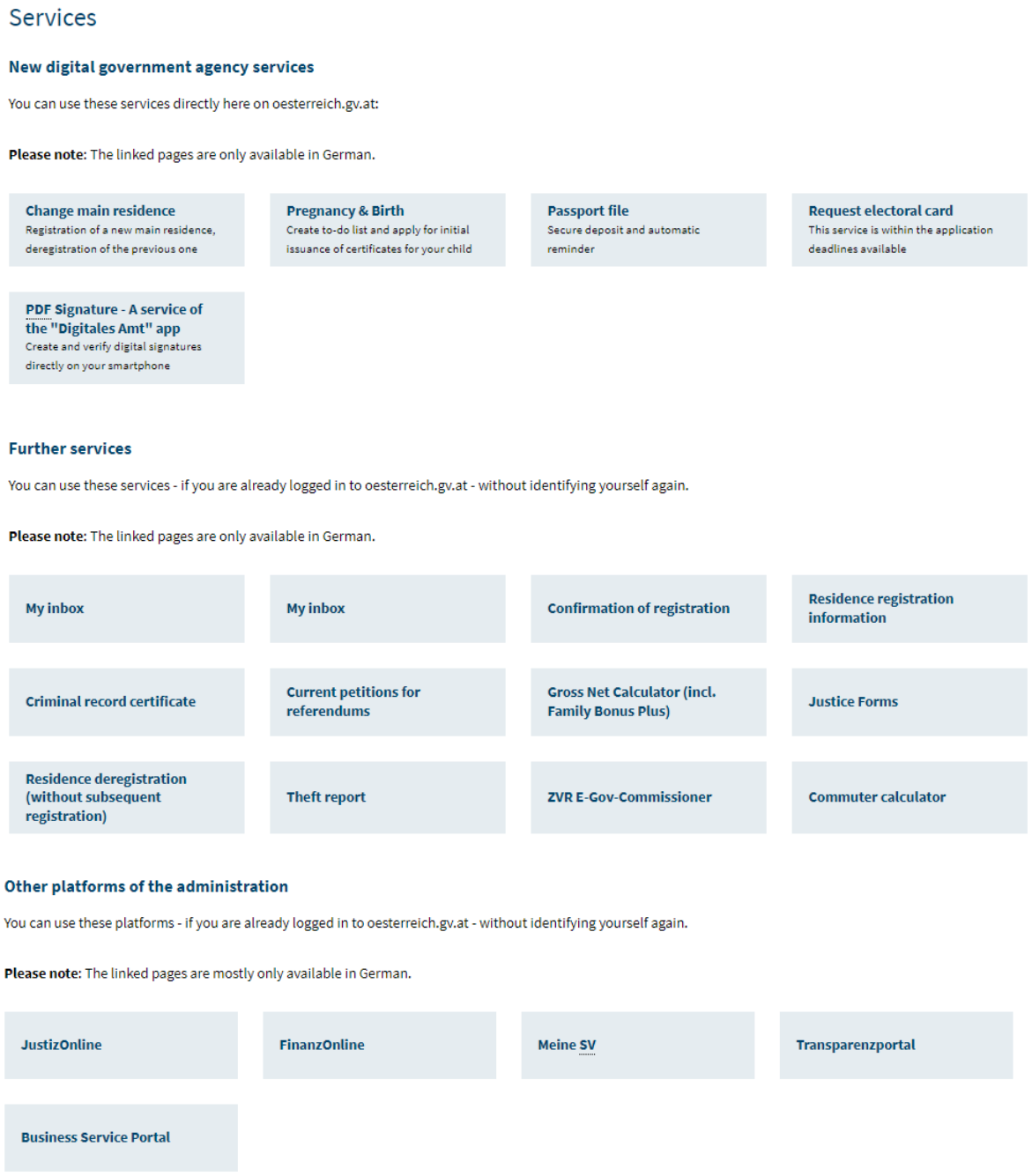

FIGURE 11: AN OVERVIEW OF NEW OR ALREADY EXISTING SERVICES OF THE DIGITAL OFFICE AND AN (INCOMPLETE) OVERVIEW OF THE REPUBLIC OF AUSTRIA'S OTHER E-GOVERNMENT PLATFORMS.

At this point, however, it must also be mentioned that the changeover to digital services is not only a *relief,* but also a burden for many—especially the older population. An inclusive, barrier-free state and community must also keep these aspects in mind and act accordingly.

The *Digital Austria* platform *digitalaustria.gv.at* complements the digital office by providing information on current initiatives, digital knowledge and studies, digitalisation reports, as well as an overview and insights into various fields of action of the digital transformation at the federal level. At this point, it is pertinent to mention the countless digital initiatives at the provincial and municipal level, which go far beyond the citations on this platform.

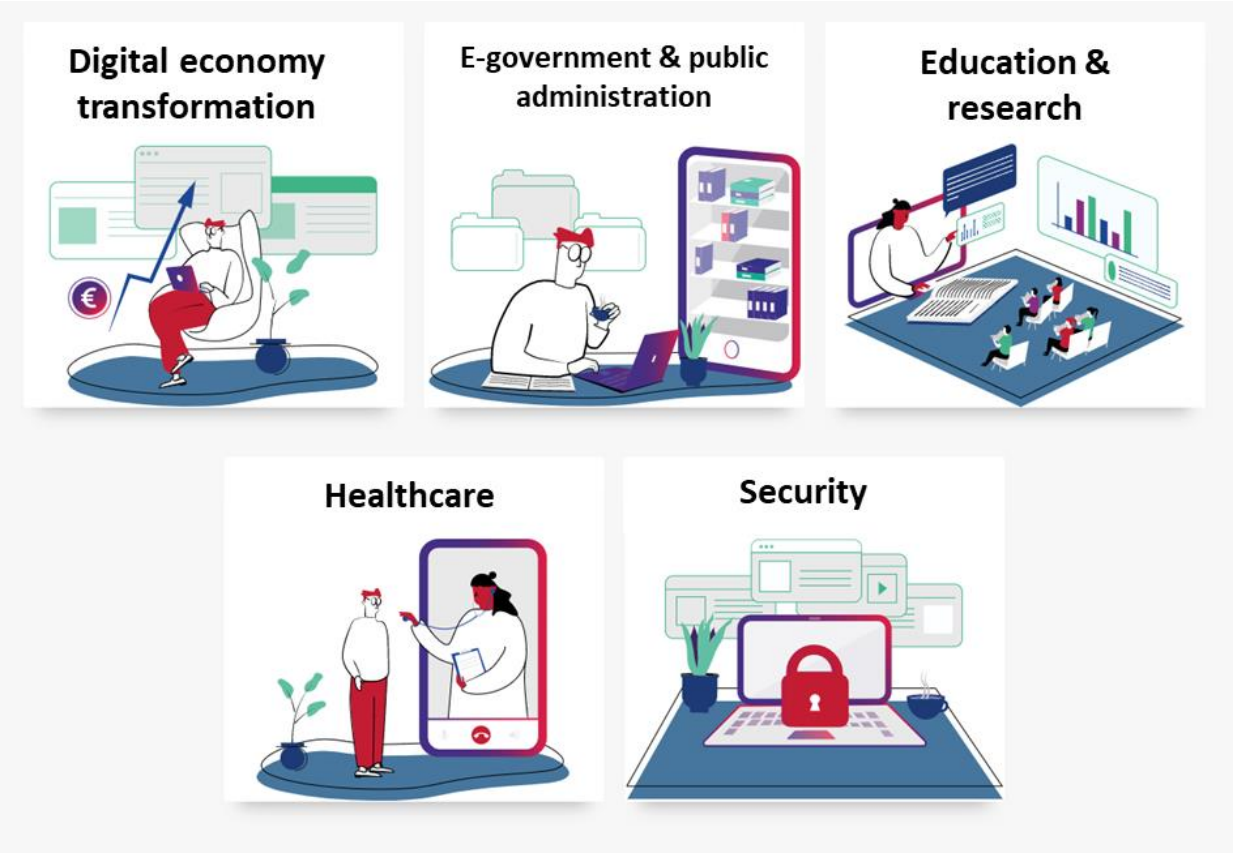

FIGURE 12: THE DIGITAL TRANSFORMATION'S FIELDS OF ACTION IN THE E-GOVERNMENT SECTOR

2019: fit4internet - Association for the enhancement of digital skills in Austria

The fit4internet Association, founded in 2018 and publicly active since 2019, is part of a non-partisan and independent initiative for the qualification and quantification of digital competences in the Austrian population. Supported by leading Austrian companies and regional/municipal stakeholders as members of the association, its primary goal is to enable the competent use of digital technologies and the broad participation of the entire society in digitalisation.

fit4internet is a non-profit association and works in close cooperation with companies, institutions, and organisations to promote digital literacy in Austria.

The platform www.fit4internet.at is operated jointly with the former Federal Ministry for Digital and Economic Affairs (BMDW) and, since mid-2022, with the Federal Ministry of Finance (BMF). On this platform, citizens have the opportunity to obtain comprehensive information on the standardisation, evaluation, and qualification of digital competences. Austrians are supported in keeping pace with the rapid digital transformation and in using their knowledge and know-how for

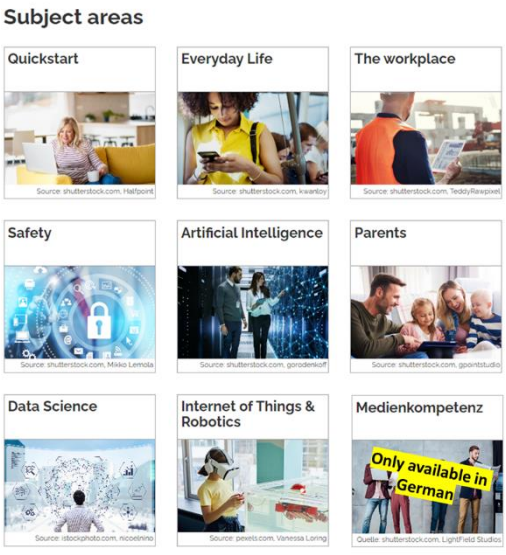

FIGURE 13: THE SUBJECT AREAS OF THE FIT4INTERNET EVALUATION TOOLS AS OF AUTUMN 2022

their personal and professional development through qualification opportunities.[35]

With this goal in mind, fit4internet has not only worked to curate and further develop the digital competence model for Austria but has also set about developing instruments for assessing digital competences in recent years. Since autumn 2022 (Figure 13), quality-assured, conclusive self-assessment (CHECKs) and knowledge-based questions (QUIZzes) have been available to all interested parties in nine subject areas[36]. These tools are also continuously expanded to include specific topics or based upon requirements in cooperation with domain experts.

Since the spring of 2022, it has been possible for those interested in Austria (and soon beyond) to obtain certificates to prove their digital competences in a certification system in accordance with the Digital Competence Framework for Austria. The basis for this is an examination on general digital knowledge in everyday life and work: the so-called *Dig-CERT* online knowledge test[37] is an instrument for recording digital competences that was developed on the basis of in-depth psychometric validity and reliability analyses (i.e., scientific item analyses). It is expected that from 2023 onwards, further learning outcome verifications and certificates can be combined to form a DigComp-compliant portfolio within the framework of the Digital Skills Profile (DSP).

In this area (curation of the DigComp framework and development of meaningful instruments for orientation and location determination for all interested parties as well as the various—ISO standard-compliant—ways to recognise, award, and certify digital competences), Austria is now a pioneer in Europe thanks to the work of fit4internet and its partners and thanks to the support and cooperation with the public sector required to achieve this. This know-how is currently being made available to the two German states of Bavaria and North Rhine-Westphalia in the scope of an EU project.[38]

fit4internet also conducted the first representative survey, the Digital Skills Barometer (DSB)[39] , to measure digital skills in Austria based on the DigComp 2.2 AT with self-assessment *and* knowledge-based questions. The survey was conducted in the months of April and May 2022 with a sample stratified by gender, age, and province among almost 4,000 people living in Austria. The results of the Digital Skills Barometer provide a detailed picture of the Austrian population's digital knowledge for the first time.

2020 to date: A "Corona Boost" and other current developments

Since 2020, Corona has changed the world dramatically and led to new insights that too little digitalisation can be as problematic as too much of it. Home schooling and working from home, e-commerce and AI-supported vaccine development, fake news, and ransomware have dramatically accelerated the digital transformation and simultaneously reminded us (sometimes painfully) of all the things that need to be considered and are at stake in the negotiation of life, social, and world relations in digitality. The concluding list, which is in alphabetical order, intends—without claiming to be exhaustive—to demonstrate the extent to which we have arrived in digitality on a national level alone.

- *Digital Innovation Hubs*:[40] funded by the FFG, Digital Innovation Hubs support Austrian SMEs with digitalisation using their expertise and infrastructure. They offer a wide range of services in the modules Information, Further Education, and Digital Innovation. The Federal Ministry of Labour

[35] https://www.fit4internet.at/view/verein (accessed 31.10.2022)

[36] https://www.fit4internet.at/page/assessment (accessed 31.10.2022)

[37] https://dig-cert.at/ (accessed 31.10.2022)

[38] https://www.aed.or.at/aed_projekte/digital-upskilling-strategies-for-bavaria-and-north-rhine-westphalia-2/ (accessed 31.10.2022)

[39] https://www.fit4internet.at/view/verstehen-zahlendatenfakten (accessed 31.10.2022); currently only available in German.

[40] https://www.ffg.at/dih (accessed 31.10.2022)

and Economic Affairs (BMAW) and the National Foundation for Research, Technology and Development support the establishment of digital innovation hubs in Austria. Currently (2022), there are six national digital hubs spread across Austria.

- *Digital school*[41] and the *compulsory subject of basic digital education*:[42] from the school year 2022/23 onwards, the new compulsory subject "Digital Literacy" will be introduced within the lower levels of secondary and grammar schools and at least one hour in the school timetable will be dedicated to this subject. The compulsory exercise will expire in the school year 2022/23 and will only be taught in year 8 in this school year. Even though the curriculum has some shortcomings compared to the expired compulsory exercise[43] and unfortunately the DigComp framework is not the basis of the curriculum competence areas (the competence area of *security is* completely missing from the five competence areas of the curriculum), it must be noted that digitalisation is finally receiving the necessary attention within school education. The portal *Digital School* describes the far-reaching initiatives of the Federal Ministry of Education, Science and Research in terms of digital transformation—not least the equipping of hundreds of thousands of pupils with digital end devices, which will hopefully be followed in the foreseeable future by the professionalisation and financing of IT support to an extent that companies and other public institutions have known for decades.
- *DIO Data Intelligence Offensive*:[44] the DIO Data Intelligence Offensive is the cooperation platform for the Big Data sector. This association for the promotion of the data economy and the optimisation of data technologies aims to advance and promote business models for the exchange and monetisation of data according to the strictest ethical and legal standards. One of its flagship projects is *Gaia-X.* Originating from a Franco-German flagship project, it aims to pave the way for a European digital ecosystem. Stakeholders in the data economy are working together on proposals, framework conditions, definitions, etc. to create a secure and networked data infrastructure. On the one hand, this should promote innovation and strengthen Europe in the international context, while meeting the highest standards of digital sovereignty on the other.
- *Digital Skills and Job Coalition DSJC*:[45] this platform was launched as one of the initiatives under the *Connecting Europe programme.* It will contribute to the *Digital Europe* programme, which aims to increase Europe's competitiveness in the global digital economy by building digital capacity and ensuring widespread use of digital technologies across the EU. Under the *digital skills* programme pillar, the platform strives to strengthen the digital skills of the European society and workforce. Almost all EU member states as well as many companies, institutions, and associations are members of the DSJC, including Austria and fit4internet.
- *Digital Humanism[46] and the VIENNA MANIFEST FOR DIGITAL HUMANISM:[47]* in May 2019, a number of renowned researchers from Europe and the USA, led by Hannes Werthner from the Vienna University of Technology, published the *Vienna Manifesto for Digital Humanism*. An analysis of developments and a call for reflection and action in the face of current and future technological developments are followed by core demands such as: digital technologies should be designed to promote democracy and inclusion. Or: scientific approaches across different disciplines are a prerequisite for mastering the challenges. The Wiener Zeitung, an Austrian newspaper, dedicates a continuously curated online dossier to Digital Humanism.[48]

[41] https://digitaleschule.gv.at/ (accessed 31.10.2022)

[42] https://www.bmbwf.gv.at/Themen/schule/zrp/dibi/dgb.html (accessed 31.10.2022)

[43] https://journals.univie.ac.at/index.php/mp/article/view/7496 (accessed 31.10.2022)

[44] https://www.dataintelligence.at/ (accessed 31.10.2022)

[45] https://digital-skills-jobs.europa.eu/en/about/national-coalitions/austria-national-coalition-allianz-fur-digitale-skills-und-berufe (accessed 31.10.2022)

[46] https://diezukunft.at/hat-der-digitale-humanismus-eine-zukunft-von-alexander-schmolz/ (accessed 31.10.2022)

[47] https://dighum.ec.tuwien.ac.at/wp-content/uploads/2019/07/Vienna_Manifesto_on_Digital_Humanism_DE.pdf (accessed 1.11.2022)

[48] https://www.wienerzeitung.at/dossiers/digitaler-humanismus/ (accessed 1.11.2022)

- *FFG funding programmes*:[49] the Austrian Research Promotion Agency (FFG) is both an innovation powerhouse and flagship. In the field of digitalisation and broadband, the FFG currently offers 15 funding programmes that can be submitted at any time in the national scope alone.
- *KMU.DIGITAL*:[50] this initiative promotes individual consulting for Austrian small and medium-sized enterprises (SMEs) by certified experts on the topics of business models and processes (incl. resource optimisation), e-commerce and online marketing, IT and cybersecurity, and digital administration. Subsequently, the implementation of their digitalisation projects is also supported with the help of new investments. The digitalisation campaign KMU.DIGITAL is an initiative of the Federal Ministry of Labour and Economic Affairs (BMAW) in cooperation with the Austrian Economic Chamber (WKO) and is refinanced by the European Union.
- wîse up:[51] wîse up is the largest digital education platform in Austria and bundles more than 15,000 online courses across all sectors in the form of interactive learning content such as videos, texts, webinars, and quiz formats. It is operated by the WKO across all federal provinces.

[49] https://www.ffg.at/ffg-wegweiser (accessed 31.10.2022)

[50] https://www.kmudigital.at/ (accessed 31.10.2022)

[51] https://wise-up.at/ (accessed 31.10.2022)

DigComp 2.3 AT in detail – the Austrian version of the European Reference Framework for Digital Competences

The Digital Competence Framework for Austria - DigComp 2.3 AT is the further development of the European and Austrian DigComp 2.2 reference framework and outlines the field of citizens' digital competences in the most general, complete, and comprehensive way possible. The European Reference Framework for Digital Competences is written in English; the Austrian model was created by translating the European model into German in a first step and was updated and expanded in relevant places in a second step. In 2018, the DigComp 2.2 AT version was commissioned by the then Federal Ministry for Digital and Economic Affairs (BMDW); in 2022, a practice-oriented further development and update in the form of the DigComp 2.3 AT version was commissioned by the fit4internet Association on the basis of over three years of practical and field work.

The development process

Reference frameworks are abstract frameworks of thought that attempt to model complex and possibly evolving realities. They are helpful and necessary for gaining understanding, orientation, imagination, conceptuality, discourse, connectivity, and an overview. They support the assessment and description of personal, sometimes also institutional, competences and reveal strengths and areas that can be focussed on. However, they are always the result of discourse, consultation, and negotiation processes and thus differ significantly from scientific-mathematical theories.

In line with the practice followed by the European Commission, which has already discursively developed the eight key competences for lifelong learning and its DigComp reference framework several times, the Austrian DigComp versions also began with an initial research and consultation process (2018), which led to DigComp version 2.2 AT. This was followed by a continuous curation and research process, another consultation process, and the present revision process (2022), at the end of which DigComp version 2.3 AT was made available. The following sections outline this process.

Initial context research and consultation process

The initial contextual research and consultation process took place in August, September, and October 2018 on behalf of the former Federal Ministry for Digital and Economic Affairs (BMDW). Based on preliminary discussions, structured interviews were conducted with experts across all domains of adult education. The evaluation was carried out as a qualitative content analysis and led to the following summarised results:

1. The European Reference Framework for Digital Skills - DigComp 2.1 is to be extended by a competence area that includes basic conceptual knowledge about digitalisation, IT, the Internet, etc., and includes the interaction and operation of digital devices.
2. Knowledge about legal regulations ("the Internet as a legal space") is to be integrated.
3. Critical thinking and the evaluation of information are essential aspects and should be made clear accordingly.
4. Independent learning as well as digital learning should be given an appropriate weighting, whereby informal learning is of particular importance.
5. The number and definition of the competence levels is criticised and should be reconsidered, although the applicability (cf. EQF/NQF) should be taken into account.

Language-sensitive translation into German and revision of content as well as additions: DigComp 2.2 AT (2018)

In September and October 2018, a language-sensitive translation of the complete, English-language DigComp 2.1 framework and its supplementation was carried out into German based on the insights gained in the consultation process.

The translation into German was based on the exact wording of the English text to the greatest extent possible. However, in areas where the exact translation would have distorted the meaning in German, better equivalents were sought. For example:

- Competence "*2.3 Engaging in citizenship through digital technologies"* was translated as *"2.3 Using digital technologies for social participation".* This also reflects the relevance of social participation in Austrian political discourse, as is made clear in the Green Papers of the Federal Council, for example.
- The "nerd term*" "2.5 Netiquette"* was dropped; the competence now reads *"2.5. Using appropriate forms of expression."*

In accordance with the results of the consultation process, amendments, streamlining, and extensions were carried out. For example:

- The aspect of initial access to the field of digital competences and the prerequisites required for this, which is completely missing in the European model, was prefixed to the DigComp 2.2 AT model with the ordinal number 0. The reason for choosing ordinal number 0 was so as to continue to conform to the European model in terms of numbering.
  In the opinion of the development team and supported by international literature, this is an *essential* improvement of the Austrian model compared to the European specification. It provides a basis for all fundamental aspects of social participation in the field of digital competences. In the meantime, it has become apparent that the importance of competence *"0.1 Understanding the concepts of digitalisation"* is particularly essential; after all, living in a digitalised world means being able to recognise, understand, assess and, if necessary, avoid its (problematic) effects and connections to a greater and greater extent.
- The aspect of business transactions (purchasing, exchanging, auctions, app stores, etc.) as well as the aspects of fraud prevention and consumer protection were completely missing and were supplemented by the competences *"2.4 Carrying out purchases and sales"* and *"4.4 Protecting oneself and others from fraud and consumer rights abuse".*
- Therefore, due to the progress of technology and concrete practice, it seemed reasonable to the development team to combine the competences *"2.2 Sharing through digital technologies"* and "2.*4 Collaborating through digital technologies"* mentioned separately in DigComp 2.1 into the competence *"2.2 Using digital technologies to share data and information and to collaborate".*
- In the Austrian version, competence 3.4 is *"Programming and automating processes"*, which corresponds better to the everyday reality of the general population.
- Last but not least, competence area 5. *"Problem solving" is* now substantially supplemented as *"Problem solving, innovation, and continuous learning".*

The translation or reformulation of detailed competence characteristics at the individual competence levels was dispensed with altogether. In the opinion of the development team, the informative value of the English DigComp 2.1 text is not substantial here.

After completion of the translation and supplementary work, the development team felt that it made sense to reflect the changes, which were more far-reaching overall, with a new DigComp version number 2.2 AT,

which was published in German[52] and English[53] by the Federal Ministry for Digital and Economic Affairs (BMDW) at the beginning of 2019.

Continuous curation and research by the task force

In order to keep the digital competence framework relevant and up to date for Austria, continuous, institutionalised curation work is needed. For this purpose, the Austrian interdisciplinary Task Force for Digital Competences[54] was created at the beginning of 2019 by the former Federal Ministry for Digital and Economic Affairs (BMDW) as an advisory body for digital competences. It is co-chaired by the fit4internet Association and the "Digitalisation of Society" department of the Federal Ministry of Finance (BMF). The recommendations of the task force are publicly available to all stakeholders in politics, business, and science. The members of the task force come from the fields of adult education, science, and research as well as business, and work free of charge. The guiding criteria for the composition of the task force are professional expertise, interdisciplinarity, independence, and non-partisanship. In addition to networking and exchange, the goals of the task force are:

- *Acceptance:* the Digital Competence Framework for Austria – DigComp AT should become and remain a widely accepted and coherently understood working basis in Austria for the development and improvement of digital competences of all citizens.
- *Updating*: the Digital Competence Framework for Austria and the application scenarios derived from it should be continuously updated and, if necessary, expanded through the work of the task force, and thus be able to keep pace with the dynamics of digitalisation and its opportunities and challenges.

The work of the task force is accompanied by a researcher in residence[55] at the fit4internet Association, who rotates every two years, and by DiSS - the Digital Study Snapshot[56] , a project of the former Federal Ministry for Digital and Economic Affairs (BMDW). The "snapshots" of current studies on digital competences in society, the economy, and the labour market produced within the framework of this project continuously provided the task force with relevant information for its task.

At the end of 2020, the JRC initiated a collaborative process to further develop the European DigComp framework (Figure 14), which resulted in the publication of the European DigComp 2.2 in 2022. Austrian stakeholders, such as the fit4internet Association and the Federal Ministry for Digital and Economic Affairs, as well as numerous representatives of the Digital Competences Task Force,

FIGURE 14 COLLABORATIVE PROCESS TO FURTHER DEVELOP THE EUROPEAN DIGCOMP FRAMEWORK

[52] https://www.bmf.gv.at/dam/jcr:54bbe103-7164-494e-bb30-cd152d9e9b33/DigComp2.2_V33-barrierefrei.pdf (accessed: 1.11.2022)

[53] https://www.bmf.gv.at/dam/jcr:d0376afe-8fa8-4dfd-86d6-1f86fe367b1b/2021-07_DigComp_2.2_Digitales%20Kompetenzmodell_EN_barrierefrei.pdf (accessed: 1.11.2022)

[54] https://www.bmf.gv.at/themen/digitalisierung/Gremien-und-Organisationen/Taskforce-Digitale-Kompetenzen.html (accessed: 1.11.2022)

[55] https://www.fit4internet.at/view/researcher-in-residence (accessed 1.11.2022)

[56] https://www.conedu.com/portfolio-item/projekt-diss/ (accessed 1.11.2022)

were actively involved in the work of the DigComp Community of Practice[57] (CoP), which was established by the JRC for this purpose. At the beginning of 2022, it already had 575 members from 57 countries in Europe and beyond and is open to all interested parties. It was clear that the outcome of the developments at the European level had to be awaited before revising the Austrian model. Parallel to the European process, the taskforce produced a white paper (Nárosy et al. 2022) on the third anniversary (January 2022) of the publication of DigComp 2.2 AT, which presented previous work results and perspectives for a next version of the digital competence model for Austria.

The results of the European process DigComp 2.2 had been available since spring 2022 (unfortunately without the extension of the competence areas to include aspect *0. Foundations, access and digital understanding,* which was urgently recommended by Austria), thus paving the way for the practical further development of the next version of the digital competence model for Austria, which is now available here, on behalf of the fit4internet Association.

... and the consultation and revision process: DigComp 2.3 AT (2022)

An informal, low-intensity curation, observation, and opinion-forming process lasting approximately three years was followed by an intense, formal consultation and revision phase concerning the digital competence model for Austria. This took place from June to November 2022, and the planning work took place beforehand in April and May 2022 (Figure 15). The first step was a workshop with experts at the beginning of June 2022, which involved the collection of corresponding observations and phenomena that reflect this newness in line with the question: "What is new regarding general digital awareness since 2018?" Furthermore, the set of transversal scenarios defined in 2019-2022 of a simple (e.g., *you buy a new smartphone, put it into operation, and use it)* or more complex nature (y*ou solve professional or business issues and challenges, taking the options provided by digitalisation into account in consideration of the associated opportunities and risks)*, which form the basis of the fit4internet instruments for competence assessment, were reviewed and weighted according to relevance for different population groups. Both the question "What is new regarding general digital awareness since 2018?" and the interim results were subsequently submitted to the task force for consultation, discussed, and revised in June 2022.

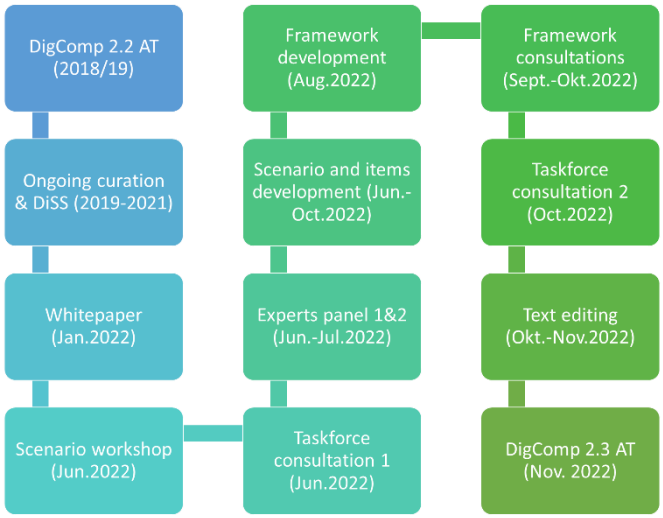

FIGURE 11 REVISION SCHEDULE

In June and July 2022, a panel of experts reviewed existing and new Dig-CERT knowledge questions (i.e., digital common knowledge questions), which led to further input regarding the practical framework development (competences and competence areas). In parallel, several teams of domain experts from the fields of AI, IoT, Data Science, Robotics, and Industry 4.0 worked on current transversal scenarios as well as self-assessment and knowledge questions.

In August, an internal fit4internet team of experts used all the information and data to develop a revised and expanded version of both the transversal scenarios (Appendix 2, currently only available in German)

[57] https://ec.europa.eu/jrc/communities/en/community/digcompedu-community/news/digcomp-community-practice-digcomp-cop (accessed 29.10.2022)

and the competences and competence areas, i.e., the DigComp 2.3 AT competence model. The competence model was again discussed in several feedback sessions, reviewed by the task force in a final consultation session at the beginning of October, and adopted by general consensus. This was followed by the writing and editing of this text, which was finalised in November 2022.

As already mentioned in the introduction, this multi-stage consultation and revision process led to three main changes or extensions (marked in red in the text) of the Digital Competence Framework for Austria:

Examination of digitality and development of the corresponding ability to make judgements

As citizens, our ability to judge is in greater demand than ever: both in everyday life and especially in all processes concerning democratic co-determination. The digital transformation[58] is currently challenging us all to question our fundamental *"figures of the world and self-relationship"* (Koller 2012, p. 15). Again and again, it is about concrete decisions, about discussing and setting values, about shaping, inventing, and coping with adapting to the new—an educational process in the narrower and broader sense that always ties in with fundamental questions of humanity. Thus, the *"question of the Conditio Humana in the age of digitalisation"* (Schmoelz 2020, p. 211ff) becomes fundamental and aims to *"strengthen and not weaken the responsibility and authorship of people in the digital transformation, to use digital tools for support and not as a threat to human creativity and performance, and thus to counter both the mechanisation of people and the humanisation of machines. This new humanism could provide guidance on the European path"* (Nida-Rümelin 2021).

For these reasons and considerations, competence area 0. has been extended and is now: *0. Foundations, access and digital understanding*. In order to emphasise the necessity of the continuous process of engagement, which is more than the formation of individual understanding, a decision was made to consciously complement competence *0.1. Understanding the concepts of digitalisation with* a new competence *0.4 Engaging with the digital world and developing the ability to make judgements.*

The concept of digital literacy and the culmination of the digital transformation are both in a dynamic relationship: the Internet, which is both machine and medium. Digital literacy must reflect issues of current and future employment, collaboration, and competitiveness as well as participation as a citizen, as emphasised within the EU (Key Competences for Lifelong Learning[59]) and by the OECD (21st Century Skills[60]). At the same time, it is about our individual and personal freedoms and human rights, as well as sustainability and altruism, as displayed in UNESCO's Media and Information Literacy Framework (MIL - cf. UNESCO 2013). The Digital Competence Model for Austria—DigComp AT—has to deal with these demands and simultaneously face the question upon every further development as to whether and to what extent these demands are or can be met.

Publishing and production skills as key competences in digitality

In this sense, the reflections led to the observation and statement that competence area *3. digital content creation* falls short. Within a very short time, digitalisation has empowered us not only to create (multimedia) content, but also to publish it worldwide using social media, blogs, or our own websites, bypassing editorial systems such as newspapers, radio, publishing houses, etc. In this respect, *"the new media are not 'media' in the established sense. They radically alter the previously predominant pattern of communication in the public sphere by empowering all potential users in principle to become independent and equally entitled authors."* (Habermas 2022, pp. 36-37) The now well-known problem of fake news, to

[58] The digital transformation is one of many, but not the only "driver" or "megatrend" of change on a global scale. Climate crisis, population, migration, and refugee movements as well as fundamental emancipation, democratisation, economic, and educational gains (and losses) and questions of justice and distribution must always be considered here.

[59] https://eur-lex.europa.eu/legal-content/DE/TXT/PDF/?uri=CELEX:32018H0604(01)&from=EN (accessed: 4.11.2021)

[60] e.g., https://www.oecd.org/site/educeri21st/40756908.pdf (accessed: 4.11.2021)

name just one of the many consequential phenomena of this development, makes it clear: *" The author role also has to be learned; and as long as this has not been realised in the political exchange in social media, the quality of uninhibited discourse shielded from dissonant opinions and criticism will continue to suffer."* (Habermas 2022, p. 39)

The work of the domain experts in AI, IoT, DataScience, Robotics, and Industry 4.0 also made it clear that it is more than just media (texts, videos, etc.) that is now produced in a digital manner. CNC machines, 3D printers, robots—there is something fundamentally new here in the digital creation process that should be expressed by adding *objects* to the *content.* Competence area 3. now explicitly addresses these developments and is therefore: *3. Digital content creation, production, and publication.* It is also extended to include the competence *3.5 Publishing content and objects digitally in different public spheres in a legally compliant way.*

Sustainable use of resources - sustainable IT operations

Information technology systems are now some of the most relevant and in some cases blatantly climate-damaging consumers of electricity and resources, as well as major emitters of $C0_2$. The growing awareness of the planetary relevance of sustainability led to the consideration of making this aspect clear even at the highest level of the competence model: the competency areas. In order to raise awareness of this, the competence area is now *4. Safety and sustainable use of resources*.

In using IT itself, there are two aspects relating to citizens in terms of sustainability: on the one hand, the operation of (mostly) privately purchased devices such as smartphones and tablets, but also increasingly digitalised household devices: from refrigerators to cars; on the other hand, the use IT in the professional sphere (which we are partly responsible for), as well as the use of IT as a consumer, for example cloud, streaming, or e-government solutions. It is evident that the areas indicated here overlap. In any case, we each bear responsibility for our decisions and must therefore also consider the sustainable operation of IT, regardless of whether it is purchased by us or as a customer. Competence 4.5 (Protecting the environment) is therefore more precise: *Protecting the environment and sustainably operating IT*.

Further changes and adjustments

In addition to these three main additions, DigComp 2.3 AT also contains some linguistic and semantic improvements and additions to the content:

- Competency 0.2 is now *Using digital devices and technologies.* This takes into account the fact that functionalities are becoming more and more virtualised and thus less and less dependent on specific devices.
- Before using inclusive forms of access to digital content, one needs to *know* them; therefore, in competence 0.3. the verb *know has* been added and it now reads: *Knowing, using, and providing inclusive forms of access to digital content.*
- Competence area 2. has been expanded to *Communication, interaction and collaboration*. This considers the phenomenon that the term "communication" is now too "narrow" for the entire, digitally enabled spectrum of possibilities (up to and including human-machine interaction).
- Digital identities are becoming increasingly relevant and complex. Their design requires a comprehensive understanding of the possibilities and dangers. Competence 2.6 is therefore now: *Understanding and managing digital identity.*
- Two semantic changes were made in competence area 3: instead of developing *digital content*, competences 3.1 and 3.2 now refer to *content and objects* that are developed, integrated, or newly created in a digital *mode,* i.e., *digitally.* This also specifies that it is possible to *manifest* digitally *developed* content and objects in many cases—e.g., simply by printing them out. The content is then basically "doubled", i.e., it is not only digitally but (also) physically present and can be further processed in both an analogue and digital manner. In our opinion, this gives a more exact expression to the overlapping, comparability, and jumble of digital and analogue realities.

- Competence 3.3 lacked the usual verb—it now reads: *Respecting copyright and licences.*
- Competence 4.2 has been extended to include the aspect of protecting *confidential* data (i.e., including data that is not necessarily private and personal): a skill that is expected of every person working from home, for example, in relation to company data.
- Competence area 5 has been enriched to include the aspect of *innovation*—a term that was interestingly included in European DigComp version 1.0 (2013) and was deleted in version 2.1 (2017). Even if very few are actively involved in innovation themselves (or innovation achievements are attributed to competence level 8 in all competence levels of the DigComp model): in our opinion, it is also about awareness for the creative as well as innovative use of digital technologies. Competence area 5. is therefore: *Problem solving, innovation, and continuous learning*. Competence 5.3. has also been extended and reads as follows: *Creatively and innovatively using digital technologies.*
- Competence 5.4 has been extended to include the verb "close" and reads: *Identifying and closing digital competence gaps.*

Understanding DigComp - Dimensions and contents of the competence model

The Digital Competence Framework for Austria - DigComp 2.3 AT is multidimensional. [61]

1. Firstly, it divides the field of digital competences into six competence areas 0. to 5. (Dimension 1) ...

2. ... and describes them in more detail in a total of twenty-seven individual competences (dimension 2) 0.1. to 5.4.

3. Secondly, the model describes the development and expression of these competences in a total of eight levels (dimension 3).[62]

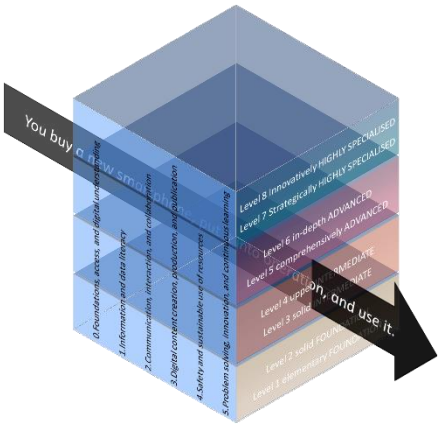

FIGURE 16 „PERMEATE“ THE DIGITAL COMPETENCE FRAMEWORK. KNOWLEDGE AND SELF-ASSESSMENT ITEMS ARE CREATED AT THE “INTERSECTION” AS DIMENSION 5.

4. In contrast to the European model, the Austrian model uses transversal scenarios of a simple (e.g., *you buy a new smartphone, put it into operation, and use it*) or more complex nature (e.g., y*ou solve professional or business issues and challenges, taking the options provided by digitalisation into account in consideration of the associated opportunities and risks*) that can be concretely observed in everyday life as the 4th dimension and generally touch on all areas of digital competence. All of the transversal scenarios that have been developed are documented in Annex 2 (currently only available in German).

5. At the "interfaces" of the scenarios with the competence areas, levels, and competences, fit4internet has developed self-assessment (CHECKs) and knowledge-based questions (QUIZzes)

[61] The publication on the Digital Competence Framework for Austria - DigComp 2.2 (Vuokari et al. 2022) speaks of a total of five dimensions, always connected with the German terminology chosen in this publication: (1) Competence area (2) Competence (3) Proficiency level (4) Examples of knowledge, skills, and attitudes (5) Use cases. As described above, the digital competence model for Austria follows a different approach for dimensions 4 and 5.

[62] Strictly speaking, the competence model also extends into another dimension: namely, that of difficulty, complexity, the scope of skills, and knowledge at certain competence levels. However, both the European model and its Austrian version completely refrain from making skills and knowledge at the different competence levels qualitatively assessable, for example, by means of further indicators; in other words, the model does not make any statements about whether a person has mastered competence "2.1 interacting through digital technologies" at level 3 "very well", "satisfactorily", or "sufficiently". It is sufficient for the basic understanding and applicability of the competence model to be aware of this dimension.

that take on the role of the 5th dimension. These self-assessment and knowledge-based questions are freely accessible by visiting fit4internet online.[63]

It is always necessary to remain aware that in the face of digitalisation, the competences of humanity cannot be packed "neatly" into a cube "in reality". In another model, the field of digital competences may resemble a tree or a circular disc, as mentioned above. Moreover, the models are not mathematically or statistically precise!

Dimension 1 Competence areas (6) and Dimension 2 Competences (27) - from DigComp 2.1 (EU) to DigComp 2.2 AT to DigComp 2.3 AT

In the following presentation of the six competence areas and twenty-seven competences of the DigComp 2.3 AT reference framework, all changes are indicated in colour for the purpose of comparison. The changes between European versions 2.1 and 2.2 and the Austria version DigComp 2.2 AT are shown in blue. Further developments from version 2.2 AT to version 2.3 AT are shown in red. These changes are also described and justified in detail above.

DigComp 2.1 (2017) = DigComp 2.2 (2022)	**à DigComp 2.2 AT (2019) à DigComp 2.3 AT (2022)**
	0. Foundations, access and digital understanding 0.1 Understanding the concepts of digitalisation 0.2 Using digital devices and technologies 0.3 Knowing, using, and providing inclusive forms of access to digital content 0.4 Engaging with the digital world and developing the ability to make judgements
1. information and data literacy 1.1 Browsing, searching and filtering data, information and digital content 1.2 Evaluating data, information and digital content 1.3 Managing data, information and digital content	**1. Information and data literacy** 1.1 Browsing, searching, and filtering data, information, and digital content 1.2. Critically evaluating and interpreting data, information, and digital content 1.3 Managing data, information, and digital content
2 Communication and collaboration 2.1 Interacting through digital technologies 2.2 Sharing through digital technologies 2.3 Engaging in citizenship through digital technologies 2.4 Collaborating through digital technologies 2.5 Netiquette 2.6 Managing digital identity	**2. Communication, interaction and collaboration** 2.1 Interacting through digital technologies 2.2 Using digital technologies to share data and information and to collaborate 2.3 Using digital technologies for social participation 2.4 Carrying out purchases and sales 2.5 Using appropriate forms of expression 2.6 Understanding and managing digital identity
3. 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. Digital content creation, production, and publication** 3.1 Developing digital content and objects 3.2. Integrating and re-elaborating digital content and objects 3.3 Respecting copyright and licences 3.4 Programming and automating processes 3.5. Publishing content and objects digitally in different public spheres in a legally compliant way
4. safety 4.1 Protecting devices 4.2 Protecting personal data and privacy 4.3 Protecting health and well-being 4.4 Protecting the environment	**4. Safety and sustainable use of resources** 4.1 Protecting devices 4.2 Protecting personal or confidential data and privacy 4.3 Protecting health and wellbeing 4.4 Protecting oneself and others from fraud and consumer rights abuse 4.5 Protecting the environment and sustainably operating IT

[63] https://www.fit4internet.at/page/assessment (accessed 1.11.2022)

5. problem solving	**5. Problem solving, innovation and continuous learning**
5.1 Solving technical problems	5.1 Solving technical problems
5.2 Identifying needs and technological responses	5.2 Identifying needs and technological responses
5.3 Creatively using digital technologies	5.3 Creatively and innovatively using digital technologies
5.4 Identifying digital competence gaps	5.4 Identifying and closing digital competence gaps

For a better understanding of what is meant by the competences, they are each briefly described in the following table.

0. Foundations, access and digital understanding **0.1 Understanding the concepts of digitalisation** Understanding of the technical difference between "analogue" and "digital" and of the basic structures, characteristics, and terminology of the Internet.
0.2 Using digital devices and technologies Acquire and be able to use different operating concepts of digital devices and technologies.
0.3 Knowing, using, and providing inclusive forms of access to digital content Understand and be able to use or provide technical implementations of digital accessibility (such as automatic translation, read aloud option). Awareness of gender, diversity, cultural context, and people with special needs such as mental and physical disabilities.
0.4. Engaging with the digital world and developing the ability to make judgements Be aware of the changes in the world and life culture through digitalisation. Consciously seek to engage with these developments in conversation with others and continuously develop one's own capacity for judgement accordingly.
1. Information and data literacy **1.1 Browsing, searching, and filtering data, information, and digital content** Articulate information needs; search for, access, and navigate between data, information, and content in digital environments; create and update personal search strategies.
1.2. Critically evaluating and interpreting data, information, and digital content Analyse, compare, and critically evaluate the credibility and reliability of data sources, information, and digital content; analyse, interpret, and critically evaluate data, information, and digital content.
1.3 Managing data, information, and digital content Organise, store, and retrieve data, information, and content in digital environments; organise and process data, information, and content in a structured environment.
2. Communication, interaction and collaboration **2.1 Interacting through digital technologies** Interact through a variety of digital technologies and understand appropriate digital communication tools for a particular context (also in terms of cultural, social, gender, etc. differences).
2.2 Using digital technologies to share data and information and to collaborate Share data, information, and digital content with others, including machines, using appropriate digital technologies; act as an intermediary; be aware of referencing and mapping practices. Use digital tools and technologies for collaborative processes and for the joint creation and development of resources and knowledge.

2.3 Using digital technologies for social participation Participate in society using public and private digital services; seek opportunities for self-empowerment and participatory citizenship with appropriate digital technologies.
2.4. Carrying out purchases and sales Carry out commercial (purchase and sale, auction) and non-commercial (exchange, gift) transactions involving goods and services of all kinds.
2.5 Using appropriate forms of expression Be aware of behavioural patterns and norms when using digital technologies and interacting in digital environments; adapt communication strategies to the respective stakeholders and be aware of the diversity of cultures and generations in digital environments. Recognise which communication channel is adequate for whom and whether formal or informal communication is preferable. Behave appropriately in online discussions.
2.6 Understanding and managing digital identity Create and manage one or more digital identities; understand the meaning of digital identity in different public spheres and on different communication channels; maintain one's own reputation; take care of the data one generates through different digital tools, environments, and services.
3. Digital content creation, production, and publication **3.1 Developing digital content and objects** Create, edit, model, and produce content and objects in digital mode in different formats; be able to use creation and production apps appropriately for the situation; express oneself through digital means.
3.2 Integrating and re-elaborating digital content and objects Integrate content and objects in digital mode into an existing body of knowledge or artefacts, and modify, refine, and improve them there; create new, original, and relevant content, objects, and knowledge.
3.3 Respecting copyright and licences Understand how copyright and licences apply to data, information, digital content, and objects.
3.4 Programming and automating processes Plan and develop a sequence of understandable instructions for a computer system to solve a specific problem or perform a specific task.
3.5. Publishing content and objects digitally in different public spheres in a legally compliant way Understand that the universal possibility of publication for everyone is the cornerstone of the digital world and culture: digitality. Be able to understand, seek out, and shape different public spheres in a correspondingly conscious and adept manner and produce and publish there in compliance with the law.
4. Safety and sustainable use of resources **4.1 Protecting devices** Protect devices and digital content and understand risks and threats in digital environments; know safety and security measures and give due consideration to reliability and privacy.
4.2 Protecting personal or confidential data and privacy Protect personal or sensitive information, both personal and professional, and privacy in digital environments; understand how to use and share personally identifiable information while protecting oneself and others from harm; understand that digital services use a "privacy policy" to inform the use of personal information.
4.3 Protecting health and wellbeing

Be able to avoid health risks and threats to physical and mental wellbeing when using digital technologies; be able to protect oneself and others from possible dangers in digital environments (e.g., cyberbullying); be aware of digital technologies for social wellbeing and inclusion.
4.4 Protecting oneself and others from fraud and consumer rights abuse Recognise dubious online shops; know the most important legal provisions; apply buyer protection measures and be able to make price comparisons.
4.5 Protecting the environment and sustainably operating IT Be aware of the environmental impact of digital technologies and their use. Be aware of the origin and finiteness of the resources required for IT operations and adapt or design IT acquisition and operations accordingly.
5. Problem solving, innovation and continuous learning
5.1 Solving technical problems Identify and solve technical problems in the operation of equipment and the use of digital environments (from troubleshooting to solving more complex problems).
5.2 Identifying needs and technological responses Recognise and identify needs and evaluate, select, and use digital tools and possible technological responses to address them; adapt digital environments to personal needs (e.g., accessibility).
5.3 Creatively and innovatively using digital technologies Use digital tools and technologies to create knowledge and innovate processes and products; engage in thinking processes individually and with others to understand and solve conceptual problems and problematic situations in digital environments.
5.4 Identifying and closing digital competence gaps Understand where one's own digital competence needs to be improved or updated; support others in their digital competence development; look for opportunities for self-development and keep pace with digital evolution.

Instead of the approach chosen in the European model of further defining 259 descriptors of knowledge, skills, and attitudes, a more "agile", broadly accessible approach was chosen for further detailing (dimensions 4 and 5), namely the "intersection" of transversal scenarios (dimension 4) with the competence model; the resulting items, which are the self-assessment and knowledge questions (dimension 5) that are practically accessible to everyone, easy to understand, and easy to read, take on the role of these descriptors in the Austrian approach.

Dimension 3 Competence Levels (8)

The DigComp framework describes the development and expression of these competences in a total of eight levels. Through this level structure, the DigComp correlates with the European Qualifications Framework (EQF), which also has eight levels, and the referenced national qualifications frameworks derived from it, which usually also have eight levels: in Austria, the eight-level NQF. [64] The terminology chosen for the competence levels addresses the Austrian NQF descriptors.

FOUNDATION	**Level 1 Elementary FOUNDATION** Under direct instruction in a pre-structured context

[64] Simplified, level 1 of the Austrian NQF in the area of formal educational qualifications could be compared, for example, with primary school level and level 8 with a doctorate.

	Level 2 Solid FOUNDATION Under guidance with some degree of independence
INTERMEDIATE	**Level 3 Solid INTERMEDIATE** With responsibility for the completion of work or learning tasks
	Level 4 Upper INTERMEDIATE Taking action within the action parameters of work or learning contexts
ADVANCED	**Level 5 Comprehensively ADVANCED** Leading and supervising in work or learning contexts incl. reviewing own and others' performance
	Level 6 In-depth ADVANCED Leading complex technical or professional activities incl. decision-making responsibility
HIGHLY SPECIALISED	**Level 7 Strategically HIGHLY SPECIALISED** Leading and designing complex, unpredictable work or learning contexts
	Level 8 Innovatively HIGHLY SPECIALISED Professional authority, capacity for innovation, independence, academic and professional integrity, and sustained commitment

This is followed by a comparison of the DigComp key terms in the terminology of the European DigComp Framework with the terminology according to the Austrian NQF Act. While the European concept orients the competence levels to the taxonomy of learning levels according to Bloom, DigComp 2.3 AT describes the competence levels in the three categories knowledge, skills, competence.

The essential key concepts of the European DigComp reference framework are the following:

		Complexity of the task	**Autonomy**	**Cognitive process dimension**[65]
Fundamental	Level 1	Simple task	With instruction	Remember
	Level 2	Simple task	Independently or with guidance where necessary	Remember

[65] The "cognitive domain" is based on the "Revised Bloom's Taxonomy", as explained, for example, here: http://www.celt.iastate.edu/teaching/effective-teaching-practices/revised-blooms-taxonomy (accessed: 1.11.2022)

Intermediate	Level 3	Clearly defined and everyday task	Independent	Understand
	Level 4	Tasks, both clearly defined and not everyday problems	Independent and oriented towards own needs	Understand
Advanced	Level 5	Tasks and problems of any kind	Also instructing others on this	Apply
	Level 6	The best possible solution for tasks and problems	Also able to adapt to the needs of others in a complex context	Evaluate
Highly specialised	Level 7	Complex tasks for which there are only limited possible solutions	Contributes to the practice of the professional community and guides others in doing so	Create new
	Level 8	Complex tasks under the influence of many interacting factors	Suggests new ideas and processes in the respective domain	Create new

According to the NQF Act, the essential key terms of the DigComp 2.3 AT are as follows:

		Knowledge	**Skills**	**Competence**
Fundamental	Level 1	Basic general knowledge	Basic skills required to perform simple tasks	Working or learning under direct guidance in a pre-structured context
	Stage 2	Basic factual knowledge in a field of work or learning	Basic cognitive and practical skills required to use relevant information to perform tasks and solve routine problems using simple rules and tools	Working or learning under guidance with a certain degree of independence
Intermediate	Level 3	Knowledge of facts, principles, procedures, and general terms in a	A range of cognitive and practical skills for completing tasks and solving problems and	Taking responsibility for the completion of work or learning tasks

		field of work or learning	selecting methods and materials	
	Level 4	Broad spectrum of theoretical and factual knowledge in a field of work or learning	A set of cognitive and practical skills required to find solutions to specific problems in a field of work or learning	Acting autonomously within the action parameters of working or learning contexts
Advanced	Level 5	Comprehensive, specialised theoretical and factual knowledge in a field of work or learning, as well as awareness of the limits of this knowledge	Comprehensive cognitive and practical skills required to develop creative solutions to abstract problems	Guiding and supervising in working or learning contexts incl. reviewing and developing one's own and others' performance
	Level 6	Advanced knowledge in a field of work or learning using a critical understanding of theories and principles	Advanced skills that demonstrate mastery of the subject as well as the ability to innovate and solve problems	Management of complex technical or professional activities or projects and assumption of decision-making responsibility
Highly specialised	Level 7	Highly specialised knowledge, partly linked to the latest findings in a field of work or learning, as a basis for innovative thinking and/or research. Critical awareness of knowledge issues in a field and at the interface between different fields	Specialised problem-solving skills in research and/or innovation to gain new knowledge and develop new processes	Managing and designing complex, unpredictable work or learning contexts that require new strategic approaches
	Level 8	Cutting-edge knowledge in a field of work or learning and at the interface between different fields	Improvement or redefinition of existing knowledge or professional practice	Professional authority, innovative ability, independence, academic and professional integrity, and

				sustained commitment

In order to increase the practicability and comprehensibility of the descriptions, the following table was developed for the assignment of learning outcomes to competence levels in Austria:

DigComp 2.3 AT Competence Levels	**How can you tell what level of competence people have in certain areas of competence?** *People ...*
Level 1: Support & Repetition - **Elementary FOUNDATION**	*... begin to understand a topic and can perform their first simple tasks with direct guidance.*
Level 2: Repetition & Routine - **Solid FOUNDATION**	*... can perform simple tasks under guidance with a certain degree of independence.*
Level 3: Routine & Independence - **Solid INTERMEDIATE**	*... manage tasks independently and adapt their own behaviour when solving problems.*
Level 4: Independence & Teamwork - **Upper INTERMEDIATE**	*... can work independently and supervise the routine work of others.*
Level 5: Development, Guidance & Leadership - **Comprehensively ADVANCED**	*... have in-depth expertise that goes together with greater responsibility (e.g., team leadership). They can pass on their digital competence acquired in a course to others in a structured way and lead and supervise work or learning contexts.*
Level 6: Domain Overview, Leadership & Ultimate Responsibility -. **In-depth ADVANCED**	*... have comprehensive, evaluative-consultative knowledge in the specific field of application and lead complex technical or professional activities.*
Level 7: Ultimately Responsible Leadership, Complexity & Strategy -. **Strategically HIGHLY SPECIALISED**	*... have competences that create entirely new solutions for the professional community (e.g., leading an innovation project) and manage complex, unpredictable working or learning contexts that require new strategic approaches.*
Level 8: Professional Authority, Research, Innovation & Advancement -. **Innovatively HIGHLY SPECIALISED**	*... have professional authority, innovativeness, independence, scientific and professional integrity, and sustained commitment to the development of new ideas or processes in leading work or learning contexts, including research (e.g., innovative research and development at PhD/doctoral level).*

Three examples of different levels of competence should make what is outlined here clearer:

1. **Level 1 - Task: learning to use a smartphone:** in order for someone to be able to acquire digital competences at all, a first step must be taken. A simple task (switching on a mobile phone or

opening an app) is set, instructed, and then imitated by the learner. In the course of the learning process, after several repetitions, the learner remembers how "this" works better each time. Soon the learner may only need support from case to case (level 2) or to be able to complete a task reliably on their own (level 3).

2. **Level 5 - Task: teaching software operation**: for some to learn, others must teach and mediate. Turning mobile phones on and off. How to open and use an app. The competent use of office, image editing, or securities management systems. In terms of the respective demands and the required depth of knowledge and skills, these tasks may differ greatly. However, all tasks have one thing in common: they require a certain ability to think outside the box, i.e., to deal with tasks and problems of any kind (particularly in the field of the respective competence or expertise), to guide others and to be able to apply knowledge, skills, and experience.

3. **Level 8 - Task: developing the Digital Competence Framework for Austria - DigComp 2.3 AT**: this is a complex task involving many influential, interacting factors. New things can and may be proposed and created as part of the process.

A concrete example of application for the DigComp 2.3 AT reference framework is the question of adults' everyday digital competences. Adults, who are by definition independent individuals, should be able to place their digital competences at competence levels 3 to 4. In this context, it is less important whether some competences are at level 3, whilst others are at level 4 or perhaps even level 5. What is important for everyday digital competence is to be consistently within a "competence band" at levels 3 or 4 in all *six competence* areas and with regard to all *twenty-seven competences.* The most elaborate knowledge in film editing, i.e., in competence area *3. Digital content creation, production, and publication,* does not relieve me of the responsibility or necessity to know my way around competence area *4. Safety and sustainable use of resources* and to behave in a correspondingly mature and appropriate manner. It is important to understand that mature adults do not necessarily aspire to be at level 8, the highest possible expert level; on the other hand, adults should also not remain at level 1 in any area, but rather strive for a competence band between levels 3 and 4 as already mentioned.

The fully formulated NQF level orientation for mapping learning outcomes and activities to DigComp AT competence levels can be found in Annex 1 (currently only available in German).

Dimension 4 transversal scenarios

As previously stated, developing, and dealing with competence frameworks is not a mathematically precise science, but a discursive process of negotiation and decision-making. Everyday life is also determined by complex, i.e., interrelated and cross-competency demands and tasks. Even a simple search engine query touches on several digital competences, not least basic knowledge of the role of algorithms that display certain search results (and advertisements)—and not others.

For this reason, the Austrian Digital Competence Framework refrained from simply adopting and transferring the large number (currently 259) of descriptors in the European DigComp 2.2 model. In our opinion, it is not possible to even come close to achieving completeness at this level of granularity. Instead, from an attitude of interested and informed observation, we began to identify the respective domain's transversal application scenarios (e.g., everyday life or work or data science) together with experts from that particular domain, to condense them, and to record them as statements in the indicative. This approach also ensures the practical relevance for the application of the DigComp. In the field of everyday life, the following scenarios turned out to be relevant in the third iteration:

Everyday life	You buy a smartphone, put it into operation, and use it.
Everyday life	You search for information and get it online.

Everyday life	You critically examine, alone or together with others, how digitalisation is changing the world we live in and our environment, and draw your own conclusions from this.
Everyday life	You maintain online contact with family members and friends.
Everyday life	You use entertainment, leisure, and fitness services on the Internet.
Everyday life	You use online services for your mobility and travel needs.
Everyday life	You learn online.
Everyday life	You use IoT and AI technologies such as smart homes, drones, robotic lawnmowers, wearables, etc.
Everyday life	You make purchases or sales on the Internet.
Everyday life	You are engaged in politics or civil society on the Internet.
Everyday life	You use online services from offices, authorities, and health services
Everyday life	You research money matters and carry out financial transactions online.
Everyday life	You work at the office, at home, or on the road, depending on your options.
Everyday life	You apply for a job.

In the field of Applied Artificial Intelligence (Applied AI), the list—from the second iteration—looks like this:

Applied AI	You can provide a rough outline of what A.I. means as a sub-field of computer science and give useful as well as risky examples thereof.
Applied AI	You use A.I. applications in your private everyday life.
Applied AI	You can name the principles of ethical use of A.I. and can act accordingly.
Applied AI	You can form an opinion on current legal, economic, social, and political aspects of A.I..
Applied AI	You can describe the difference between human intelligence and A.I. using examples based on the current technology.
Applied AI	You use A.I. applications in your work.

The current set (autumn 2022) of transversal scenarios can be found in Appendix 2 (currently only available in German).

Dimension 5 Self-assessment and knowledge items

Based on transversal application scenarios, self-assessment and knowledge-based questions can be generated at the "intersections" with the digital competence model, which are available on fit4internet's homepage as free assessment tools. For example, the self-assessment question *I can choose a mobile phone provider which allows me access to their network is* at the intersection of the scenario *You buy a new smartphone, put it into operation, and use it* with competence area *0. Foundations, access and digital understanding.*

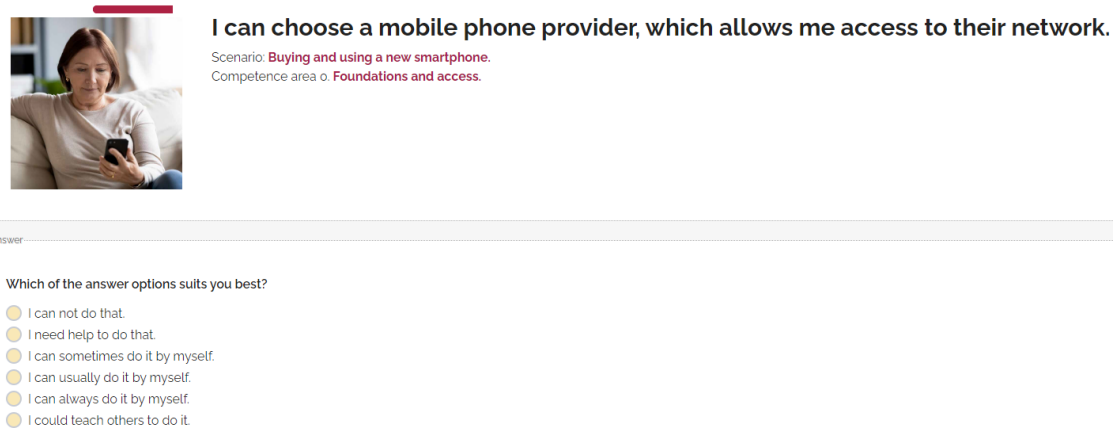

FIGURE 17 A SELF-ASSESSMENT QUESTION IN THE FIT4INTERNET TOOL CONCERNING "EVERYDAY LIFE"

Knowledge-based questions are also created using the same method. At fit4internet, each question is followed by immediate feedback. For each question, there is an indication as to whether it has been

answered correctly or incorrectly and there are short learning snippets with interesting facts about the questions and answers.

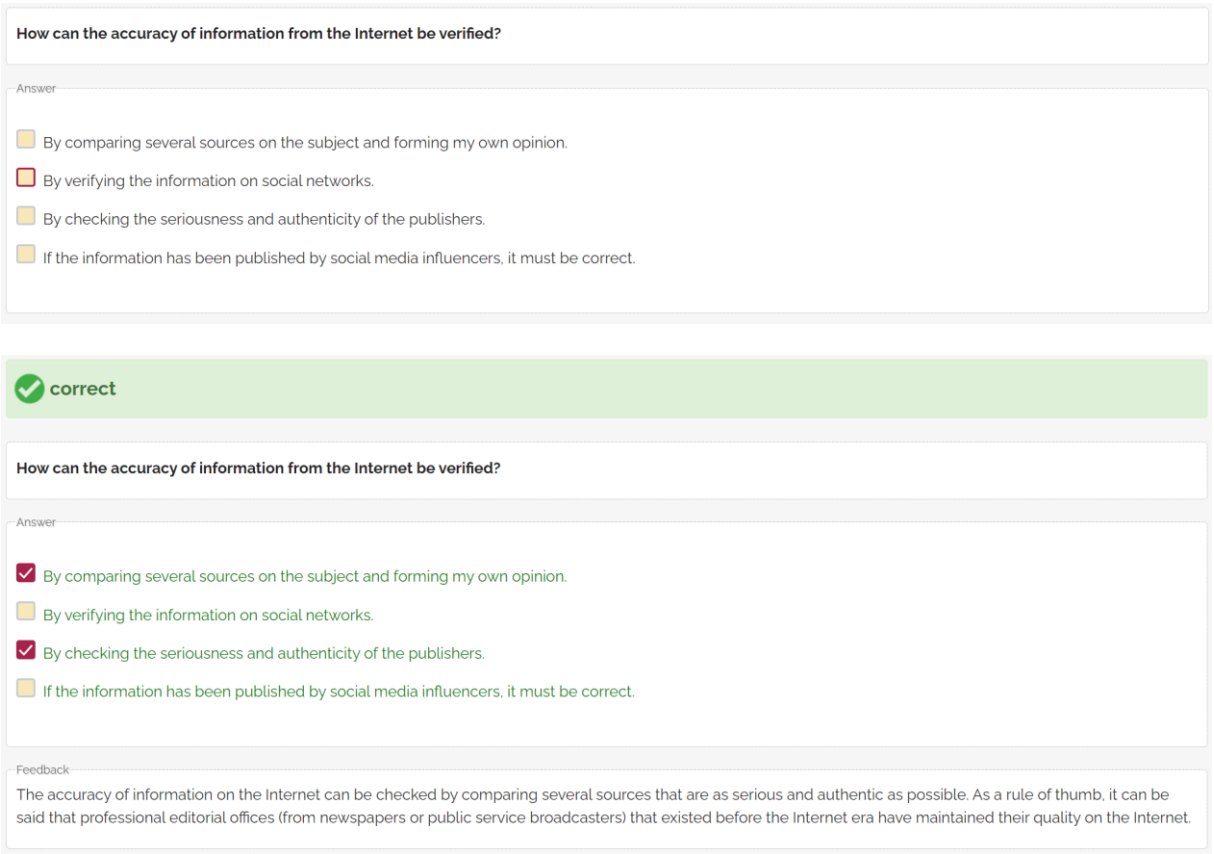

FIGURE 18 A KNOWLEDGE-BASED QUESTION AND THE ANSWER TO IT FROM THE FIT4INTERNET TOOL "THE WORKPLACE"

The combination of scenarios and self-assessment and knowledge-based questions provides all interested parties with an opportunity to examine their digital competences in everyday life. At the same time, cooperation with the respective domains' experts is an opportunity to constantly rethink the digital competence model from new perspectives and, in the event that real "digital action" cannot be depicted in the model, to incorporate it into a further development of the model at the next opportunity.

Outlook - necessary next steps

The integration of the different and complex advancements in the field of digitalisation into the framework of the NQF Act was successful in the course of the development of DigComp 2.3 AT. This lays an updated foundation for the individual development of digital competences in the population according to essential standards (DigComp and NQF).

However, the necessary next steps in order to move from a competence model and standards to *actual* development and possibly certification of digital competences can be manifold and challenging, depending on personal experience. This is why individuals need broad support in acquiring digital competences. It is precisely this complexity of developing and certifying digital competences by learners and clients, as well as the necessary technological, structural, and organisational services, that will soon need to be examined in detail, scaled up, and the central quality criteria secured in the process.

Learners and clients need central private or public digital technologies. Without access to digital devices and the necessary and affordable bandwidth to use learning videos and learning platforms, for example, it is difficult to develop digital skills. In 2020, 10% of households still had no Internet access[66]. Even though smartphones are widely used (97%), only 72% of private households in Austria have a PC[67]. Thus, 28% lack the equipment for the acquisition of more complex digital competences that go beyond the handling of a smartphone.

Even if the equipment is available, many people lack the necessary learning skills or basic digital competences for independent acquisition to participate in the labour market, leisure opportunities, and central e-government services. Without the ability to solve small hardware problems, like with loose power and connection cables, or with a wireless Internet connection, it is difficult to learn and use key software independently. Setting up and using the mobile phone signature or ID Austria to access many e-government services is also not a matter of course. Large-scale assistance is required to set this up so that it does not remain a strong barrier to participation in public services. In order to enable more people to participate in educational opportunities, there is also a need for comprehensive and specific information and low-threshold access to educational, testing, and validation services.

Guidance organisations as well as companies can support this, but they also need targeted funding, ICT equipment including technological and educational know-how, as well as central coordination and support units to assist, train, and advise learners (for example in companies) and to establish and maintain contact with education, testing, and validation organisations.

Networks and collaboration with different stakeholders need to be established and sustained for innovation purposes, specific requirements need to be collected, and new programmes developed and implemented (with collaboration partners).

Collaboration with educational, testing, and validation organisations is key to this. However, these organisations also require support and central coordination units and assistance with developing and rolling out methods, programmes, and measures that meet the various demands of diverse target groups, the DigComp AT 2.3 framework, and central quality criteria for educational institutions, whilst enabling extensive and low-threshold access at the same time. This is not a piece of cake and certainly not a foregone conclusion.

[66] https://www.statistik.at/fileadmin/publications/IKT-Haushalte2020.pdf

[67] https://www.statistik.at/statistiken/bevoelkerung-und-soziales/ausgaben-und-ausstattung-privater-haushalte/ausstattung

The role of quality assurance in education must also not be forgotten. Quality assurance and development procedures need to be re-systematised and reviewed to identify any gaps or further development potential for wider scaling and to put measures for further development and scaling into place. Whether and the extent to which different organisations' existing measures can be merged and transferred into a DigComp quality label for education, testing, and validation organisations needs to be examined. Simultaneously, there needs to be consideration regarding whether and which measures could be continued independently by different bodies, or which additional measures would have to be developed and implemented in order to close existing gaps.

Mag. Dr. phil. Alexander Schmölz, Bakk.
fit4internet Researcher in Residence 2020-22; ÖIBF Managing Director

Annex 1: NQR-Niveau-Orientierung für die Zuordnung zu DigComp AT-Kompetenzstufen (currently only available in German)

Autor*innen: Judith Proinger[68], Thomas Nárosy, Alexander Schmölz

Eine Person im gegebenen Kompetenzbereich auf ...

0. Grundlagen, Zugang und digitales Verständnis			
Kompetenzstufe 1	**Kompetenzstufe 2**	**Kompetenzstufe 3**	**Kompetenzstufe 4**
... verfügt über elementares Basiswissen über Digitalisierung, das Internet als Zugang zu digitalen Inhalten und die Bedienung digitaler Geräte sowie die damit verbundenen Möglichkeiten und Gefahren und ... ... kann unter vorgegebenen Rahmenbedingungen und mit direkter Anleitung einfache, wiederkehrende Aufgabenstellungen im Zusammenhang mit dem Internet als Zugang zu digitalen Inhalten und mit digitalen Geräten durchführen.	... verfügt über solides Basiswissen über Digitalisierung, das Internet als Zugang zu digitalen Inhalten und die Bedienung digitaler Geräte sowie die damit verbundenen Möglichkeiten und Gefahren und ... ... kann unter vorgegebenen Rahmenbedingungen und mit entsprechender Anleitung, wo erforderlich, selbstständig einfache Routinearbeiten im Zusammenhang mit dem Internet als Zugang zu digitalen Inhalten und mit digitalen Geräten unter Verwendung einfacher Regeln und Werkzeuge, durchführen.	... verfügt über grundlegendes Wissen und Verständnis über Digitalisierung, das Internet als Zugang zu digitalen Inhalten und die Bedienung digitaler Geräte sowie die damit verbundenen Möglichkeiten und Gefahren und ... ... kann bei gleichbleibenden Rahmenbedingungen selbstständig und eigenverantwortlich einfache Aufgaben und Herausforderungen im Zusammenhang mit dem Internet als Zugang zu digitalen Inhalten und mit digitalen Geräten durch Anwendung grundlegender Methoden, Werkzeuge, Materialien und Informationen, durchführen und kann in gängigen Routinesituationen ihr Verhalten selbstständig an die jeweiligen Umstände anpassen.	... verfügt über vertieftes Wissen und Verständnis über Digitalisierung, das Internet als Zugang zu digitalen Inhalten und die Bedienung digitaler Geräte sowie die damit verbundenen Möglichkeiten und Gefahren und ... ... kann auch bei wechselnden Rahmenbedingungen selbstständig und eigenverantwortlich Routinearbeiten im Zusammenhang mit dem Internet als Zugang zu digitalen Inhalten und mit digitalen Geräten durchführen, Lösungen für gängige Aufgaben und Herausforderungen finden sowie branchen-/fachübliche Instrumentarien, Verfahren und Methoden eigenverantwortlich, normgerecht und situationsadäquat einsetzen. ... kann Routinearbeiten anderer Personen beaufsichtigen und bewerten.
Kompetenzstufe 5	**Kompetenzstufe 6**	**Kompetenzstufe 7**	**Kompetenzstufe 8**
... verfügt über umfassendes, fortgeschrittenes Wissen über Digitalisierung, das Internet als Zugang zu digitalen Inhalten und die Bedienung digitaler Geräte sowie die damit verbundenen Möglichkeiten und Gefahren als auch dessen Grenzen und ... ... kann auch in nicht vorhersehbaren Situationen kreative Lösungen für abstrakte Probleme finden sowie eigenständig Projekte im Zusammenhang mit dem Internet als Zugang zu digitalen Inhalten und mit digitalen Geräten konzipieren, leiten und beaufsichtigen.	... verfügt über vertieftes, fortgeschrittenes Wissen über Digitalisierung, das Internet als Zugang zu digitalen Inhalten und die Bedienung digitaler Geräte sowie die damit verbundenen Möglichkeiten und Gefahren und kann den Lern-/Arbeitsbereich unter Einsatz eines kritischen Verständnisses von Theorien und Grundsätzen aus verschiedenen Perspektiven erfassen und ... ... kann neue innovative Lösungsansätze für komplexe Probleme in sich ändernden, nicht vorhersehbaren Kontexten entwickeln sowie komplexe fachliche oder berufliche Tätigkeiten oder Projekte im Zusammenhang mit dem Internet als Zugang zu digitalen Inhalten und mit digitalen Geräten leiten.	... verfügt über hoch spezialisiertes, an neueste Erkenntnisse anknüpfendes Wissen über Digitalisierung, das Internet als Zugang zu digitalen Inhalten und die Bedienung digitaler Geräte sowie die damit verbundenen Möglichkeiten und Gefahren und kann und über kritisches Bewusstsein für Wissensfragen in diesem Bereich und an der Schnittstelle zu anderen Bereichen und ... ... kann komplexe, unvorhersehbare Arbeits- oder Lernkontexte im Zusammenhang mit dem Internet als Zugang zu digitalen Inhalten und mit digitalen Geräten leiten und strategisch gestalten und verfügt über spezialisierte Problemlösungsfertigkeiten, um	... verfügt über Spitzenkenntnisse in den Bereichen über Digitalisierung, das Internet als Zugang zu digitalen Inhalten und die Bedienung digitaler Geräte sowie die damit verbundenen Möglichkeiten und Gefahren sowie über umfassendes Wissen aus anderen Disziplinen an den Schnittstellen zu anderen Bereichen und ... ... kann zentrale Fragestellungen im Zusammenhang mit dem Internet als Zugang zu digitalen Inhalten und mit digitalen Geräten unter Einsatz weitest fortgeschrittener und

[68] Judith Proinger ist Mitarbeiterin des ÖIBF.

... kann die eigene sowie die Leistung anderer Personen überprüfen und entwickeln.	... kann Entscheidungsverantwortung sowie die Führung und Entwicklung von MitarbeiterInnen übernehmen.	neue Erkenntnisse zu gewinnen und neue Verfahren zu entwickeln sowie um Wissen aus verschiedenen Bereichen zu integrieren. ... kann Verantwortung für Beiträge zum Fachwissen und zur Berufspraxis übernehmen sowie die strategische Leistung von Teams überprüfen.	spezialisierter Fertigkeiten und Methoden lösen oder vorhandene Kenntnisse oder berufliche Praxis neu definieren. ... kann komplexe Projekte, Funktionsbereiche oder Unternehmen leiten und strategisch entwickeln sowie neue Ideen oder Verfahren in führenden Arbeits- oder Lernkontexten einschließlich Forschung entwickeln, neues Wissen zugänglich machen und damit zur Weiterentwicklung von Lernenden oder MitarbeiterInnen beitragen.

1. Umgang mit Informationen und Daten			
Kompetenzstufe 1	Kompetenzstufe 2	Kompetenzstufe 3	Kompetenzstufe 4
... verfügt über elementares Basiswissen über das Recherchieren, Suchen und Filtern, Bewerten, Interpretieren und Verwalten von Daten, Informationen und digitalen Inhalten im Internet und auf digitalen Geräten und ... ... kann unter vorgegebenen Rahmenbedingungen und mit direkter Anleitung einfache, wiederkehrende Aufgaben im Zusammenhang mit dem Recherchieren, Suchen und Filtern, Bewerten, Interpretieren und Verwalten von Daten, Informationen und digitalen Inhalten durchführen.	... verfügt über solides Basiswissen über das Recherchieren, Suchen und Filtern, Bewerten, Interpretieren und Verwalten von Daten, Informationen und digitalen Inhalten im Internet und auf digitalen Geräten und ... ... kann unter vorgegebenen Rahmenbedingungen und mit entsprechender Anleitung, wo erforderlich, selbstständig einfache Routinearbeiten im Zusammenhang mit dem Recherchieren, Suchen und Filtern, Bewerten, Interpretieren und Verwalten von Daten, Informationen und digitalen Inhalten unter Verwendung einfacher Regeln und Werkzeuge durchführen.	... verfügt über grundlegendes Wissen und Verständnis über das Recherchieren, Suchen und Filtern, Bewerten, Interpretieren und Verwalten von Daten, Informationen und digitalen Inhalten im Internet und auf digitalen Geräten und ... ... kann bei gleichbleibenden Rahmenbedingungen selbstständig einfache Aufgaben und Herausforderungen im Zusammenhang mit dem Recherchieren, Suchen und Filtern, Bewerten, Interpretieren und Verwalten von Daten, Informationen und digitalen Inhalten durch Anwendung grundlegender Methoden, Werkzeuge, Materialien und Informationen durchführen, Lösungen für alltägliche Herausforderungen aufzeigen und ihr Verhalten in gängigen Routinesituationen eigenverantwortlich und selbständig an die jeweiligen Umstände anpassen.	... verfügt über vertieftes Wissen und Verständnis über das Recherchieren, Suchen und Filtern, Bewerten, Interpretieren und Verwalten von Daten, Informationen und digitalen Inhalten im Internet und auf digitalen Geräten und ... ... kann auch bei wechselnden Rahmenbedingungen selbstständig und eigenverantwortlich Routinearbeiten im Zusammenhang mit dem Recherchieren, Suchen und Filtern, Bewerten, Interpretieren und Verwalten von Daten, Informationen und digitalen Inhalten durchführen, Lösungen für gängige Aufgaben und Herausforderungen finden sowie branchen-/fachübliche Instrumentarien, Verfahren und Methoden eigenverantwortlich, normgerecht und situationsadäquat einsetzen.
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			Lernkontexten einschließlich Forschung entwickeln, neues Wissen zugänglich machen und damit zur Weiterentwicklung von Lernenden oder MitarbeiterInnen beitragen.

2. Kommunikation, Interaktion und Zusammenarbeit			
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... verfügt über elementares Basiswissen über die Möglichkeiten, Ausdrucksformen, Verhaltensregeln und Zwecke der digitalen Kommunikation, Interaktion, Kollaboration sowie Teilhabe und der dafür vorhandenen bzw. notwendigen Apps, Tools und Plattformen und ... ... kann unter vorgegebenen Rahmenbedingungen und mit direkter Anleitung einfache, wiederkehrende Aufgaben im Zusammenhang mit digitalen Kommunikations- und Kollaborationstools, Apps und Plattformen durchführen.	... verfügt über solides Basiswissen über die Möglichkeiten, Ausdrucksformen, Verhaltensregeln und Zwecke der digitalen Kommunikation, Interaktion, Kollaboration sowie Teilhabe und der dafür vorhandenen bzw. notwendigen Apps, Tools und Plattformen und ... ... kann unter vorgegebenen Rahmenbedingungen und mit entsprechender Anleitung, wo erforderlich, selbstständig einfache Routinearbeiten im Zusammenhang mit digitalen Kommunikations- und Kollaborationstools, Apps und Plattformen unter Verwendung einfacher Regeln und Werkzeuge durchführen.	... verfügt über grundlegendes Wissen und Verständnis über die Möglichkeiten, Ausdrucksformen, Verhaltensregeln und Zwecke der digitalen Kommunikation, Interaktion, Kollaboration sowie Teilhabe und der dafür vorhandenen bzw. notwendigen Apps, Tools und Plattformen und ... ... kann bei gleichbleibenden Rahmenbedingungen selbstständig einfache Aufgaben und Herausforderungen im Zusammenhang mit digitalen Kommunikations- und Kollaborationstools, Apps und Plattformen durch Anwendung grundlegender Methoden, Werkzeuge, Materialien und Informationen durchführen, Lösungen für alltägliche Herausforderungen aufzeigen und ihr Verhalten in gängigen Routinesituationen eigenverantwortlich und selbständig an die jeweiligen Umstände anpassen.	... verfügt über vertieftes Wissen und Verständnis über die Möglichkeiten, Ausdrucksformen, Verhaltensregeln und Zwecke der digitalen Kommunikation, Interaktion, Kollaboration sowie Teilhabe und der dafür vorhandenen bzw. notwendigen Apps, Tools und Plattformen und ... ... kann auch bei wechselnden Rahmenbedingungen selbstständig und eigenverantwortlich Routinearbeiten im Zusammenhang mit digitalen Kommunikations- und Kollaborationstools, Apps und Plattformen durchführen, Lösungen für gängige Aufgaben und Herausforderungen finden sowie branchen-/fachübliche Instrumentarien, Verfahren und Methoden eigenverantwortlich, normgerecht und situationsadäquat einsetzen.
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3. Kreation, Produktion und Publikation			
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... verfügt über elementares Basiswissen über die Entwicklung, Integration bzw. Kompilation und Variation digitaler Inhalte und Objekte, deren lizenzrechtliche Verwendung und über die Automatisierung von Abläufen und ... ... kann unter vorgegebenen Rahmenbedingungen und mit direkter Anleitung einfache, wiederkehrende Aufgaben im Zusammenhang mit der Entwicklung, Integration bzw. Kompilation, Variation, Produktion und Publikation digitaler Inhalte und Objekte und der Automatisierung von Abläufen durchführen.	... verfügt über solides Basiswissen über die Entwicklung, Integration bzw. Kompilation und Variation digitaler Inhalte und Objekte, deren lizenzrechtliche Verwendung und über die Automatisierung von Abläufen und ... ... kann unter vorgegebenen Rahmenbedingungen und mit entsprechender Anleitung, wo erforderlich, selbstständig einfache Routinearbeiten im Zusammenhang mit der Entwicklung, Integration bzw. Kompilation und Variation, Produktion und Publikation digitaler Inhalte und Objekte und der Automatisierung von Abläufen unter Verwendung einfacher Regeln und Werkzeuge durchführen.	... verfügt über grundlegendes Wissen und Verständnis über die Entwicklung, Integration bzw. Kompilation und Variation digitaler Inhalte und Objekte, deren lizenzrechtliche Verwendung und über die Automatisierung von Abläufen und ... ... kann bei gleichbleibenden Rahmenbedingungen selbstständig einfache Aufgaben und Herausforderungen im Zusammenhang mit der Entwicklung, Integration bzw. Kompilation, Variation, Produktion und Publikation digitaler Inhalte und Objekte und der Automatisierung von Abläufen durch Anwendung grundlegender Methoden, Werkzeuge, Materialien und Informationen durchführen, Lösungen für alltägliche Herausforderungen aufzeigen und ihr Verhalten in gängigen Routinesituationen eigenverantwortlich und selbständig an die jeweiligen Umstände anpassen.	... verfügt über vertieftes Wissen und Verständnis über die Entwicklung, Integration bzw. Kompilation und Variation digitaler Inhalte und Objekte, deren lizenzrechtliche Verwendung und über die Automatisierung von Abläufen und ... ... kann auch bei wechselnden Rahmenbedingungen selbstständig und eigenverantwortlich Routinearbeiten im Zusammenhang mit der Entwicklung, Integration bzw. Kompilation, Variation, Produktion und Publikation digitaler Inhalte und Objekte und der Automatisierung von Abläufen durchführen, Lösungen für gängige Aufgaben und Herausforderungen finden sowie branchen-/fachübliche Instrumentarien, Verfahren und Methoden eigenverantwortlich, normgerecht und situationsadäquat einsetzen.
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		die strategische Leistung von Teams überprüfen.	Unternehmen leiten und strategisch entwickeln sowie neue Ideen oder Verfahren in führenden Arbeits- oder Lernkontexten einschließlich Forschung entwickeln, neues Wissen zugänglich machen und damit zur Weiterentwicklung von Lernenden oder MitarbeiterInnen beitragen.

4. Sicherheit und nachhaltige Ressourcennutzung			
Kompetenzstufe 1	Kompetenzstufe 2	Kompetenzstufe 3	Kompetenzstufe 4
... verfügt über elementares Basiswissen über den Schutz digitaler Geräte, Zugänge, Daten und Rechte vor Verlust, Missbrauch und Betrug sowie über den umfassenden Schutz von Gesundheit und Umwelt im Kontext der Digitalisierung und ... ... kann unter vorgegebenen Rahmenbedingungen und mit direkter Anleitung einfache, wiederkehrende Aufgaben im Zusammenhang mit dem Schutz digitaler Geräte, Zugängen, Daten und Rechten vor Verlust, Missbrauch und Betrug, mit dem umfassenden Schutz von Gesundheit und Umwelt sowie dem nachhaltigen IT-Betrieb im Kontext der Digitalisierung durchführen.	... verfügt über solides Basiswissen über den Schutz digitaler Geräte, Zugänge, Daten und Rechte vor Verlust, Missbrauch und Betrug sowie über den umfassenden Schutz von Gesundheit und Umwelt im Kontext der Digitalisierung und ... ... kann unter vorgegebenen Rahmenbedingungen und mit entsprechender Anleitung, wo erforderlich, selbstständig einfache Routinearbeiten im Zusammenhang mit dem Schutz digitaler Geräte, Zugängen, Daten und Rechten vor Verlust, Missbrauch und Betrug, mit dem umfassenden Schutz von Gesundheit und Umwelt sowie dem nachhaltigen IT-Betrieb im Kontext der Digitalisierung unter Verwendung einfacher Regeln und Werkzeuge durchführen.	... verfügt über grundlegendes Wissen und Verständnis über den Schutz digitaler Geräte, Zugänge, Daten und Rechte vor Verlust, Missbrauch und Betrug sowie über den umfassenden Schutz von Gesundheit und Umwelt im Kontext der Digitalisierung und ... ... kann bei gleichbleibenden Rahmenbedingungen selbstständig einfache Aufgaben und Herausforderungen im Zusammenhang mit dem Schutz digitaler Geräte, Zugängen, Daten und Rechten vor Verlust, Missbrauch und Betrug, mit dem umfassenden Schutz von Gesundheit und Umwelt sowie dem nachhaltigen IT-Betrieb im Kontext der Digitalisierung durch Anwendung grundlegender Methoden, Werkzeuge, Materialien und Informationen durchführen, Lösungen für alltägliche Herausforderungen aufzeigen und ihr Verhalten in gängigen Routinesituationen eigenverantwortlich und selbständig an die jeweiligen Umstände anpassen.	... verfügt über vertieftes Wissen und Verständnis über den Schutz digitaler Geräte, Zugänge, Daten und Rechte vor Verlust, Missbrauch und Betrug sowie über den umfassenden Schutz von Gesundheit und Umwelt im Kontext der Digitalisierung und ... ... kann auch bei wechselnden Rahmenbedingungen selbstständig und eigenverantwortlich Routinearbeiten im Zusammenhang mit dem Schutz digitaler Geräte, Zugängen, Daten und Rechten vor Verlust, Missbrauch und Betrug, mit dem umfassenden Schutz von Gesundheit und Umwelt sowie dem nachhaltigen IT-Betrieb im Kontext der Digitalisierung durchführen, Lösungen für gängige Aufgaben und Herausforderungen finden sowie branchen-/fachübliche Instrumentarien, Verfahren und Methoden eigenverantwortlich, normgerecht und situationsadäquat einsetzen.
Kompetenzstufe 5	Kompetenzstufe 6	Kompetenzstufe 7	Kompetenzstufe 8
... verfügt über umfassendes, fortgeschrittenes Wissen über den Schutz digitaler Geräte, Zugänge, Daten und Rechte vor Verlust, Missbrauch und Betrug sowie über den umfassenden Schutz von Gesundheit und Umwelt im Kontext der Digitalisierung und ... ... kann auch in nicht vorhersehbaren Situationen reflektierte und kreative Lösungen für abstrakte Probleme finden sowie eigenständig Projekte im Zusammenhang mit dem Schutz digitaler Geräte, Zugängen, Daten und Rechten vor Verlust, Missbrauch und Betrug, mit dem umfassenden Schutz von Gesundheit und Umwelt sowie dem nachhaltigen IT-Betrieb im Kontext der Digitalisierung konzipieren, leiten und beaufsichtigen.	… verfügt über vertieftes, fortgeschrittenes Wissen über den Schutz digitaler Geräte, Zugänge, Daten und Rechte vor Verlust, Missbrauch und Betrug sowie über den umfassenden Schutz von Gesundheit und Umwelt im Kontext der Digitalisierung und kann den Lern-/Arbeitsbereich unter Einsatz eines kritischen Verständnisses von Theorien und Grundsätzen aus verschiedenen Perspektiven erfassen und ... ... kann neue innovative Lösungsansätze für komplexe Probleme in sich ändernden, nicht vorhersehbaren Kontexten entwickeln sowie komplexe fachliche oder berufliche Tätigkeiten oder Projekte im Zusammenhang mit dem Schutz digitaler Geräte, Zugängen, Daten und Rechten vor Verlust, Missbrauch und Betrug, mit dem umfassenden Schutz von Gesundheit und Umwelt sowie dem nachhaltigen IT-Betrieb im Kontext der Digitalisierung leiten. ... kann Entscheidungsverantwortung sowie die Führung und	… verfügt über hoch spezialisiertes, an neueste Erkenntnisse anknüpfendes Wissen über den Schutz digitaler Geräte, Zugänge, Daten und Rechte vor Verlust, Missbrauch und Betrug sowie über den umfassenden Schutz von Gesundheit und Umwelt im Kontext der Digitalisierung und über kritisches Bewusstsein für Wissensfragen in diesem Bereich und an der Schnittstelle zu anderen Bereichen und ... … kann komplexe, unvorhersehbare Arbeits- oder Lernkontexte im Zusammenhang mit dem Schutz digitaler Geräte, Zugängen, Daten und Rechten vor Verlust, Missbrauch und Betrug, mit dem umfassenden Schutz von Gesundheit und Umwelt sowie dem nachhaltigen IT-Betrieb im Kontext der Digitalisierung leiten und strategisch gestalten und verfügt über spezialisierte Problemlösungsfertigkeiten, um neue Erkenntnisse zu gewinnen und neue Verfahren zu entwickeln sowie um Wissen aus	… verfügt über Spitzenkenntnisse in den Bereichen Schutz digitaler Geräte, Zugänge, Daten und Rechte vor Verlust, Missbrauch und Betrug sowie über den umfassenden Schutz von Gesundheit und Umwelt im Kontext der Digitalisierung sowie über umfassendes Wissen aus anderen Disziplinen an den Schnittstellen zu anderen Bereichen und ... … kann zentrale Fragestellungen im Zusammenhang mit dem Schutz digitaler Geräte, Zugängen, Daten und Rechten vor Verlust, Missbrauch und Betrug, mit dem umfassenden Schutz von Gesundheit und Umwelt sowie dem nachhaltigen IT-Betrieb im Kontext der Digitalisierung unter kreativem und reflektiertem Einsatz weitest fortgeschrittener und spezialisierter Fertigkeiten

... kann die eigene sowie die Leistung anderer Personen überprüfen und entwickeln.	Entwicklung von MitarbeiterInnen übernehmen.	verschiedenen Bereichen zu integrieren. ... kann Verantwortung für Beiträge zum Fachwissen und zur Berufspraxis übernehmen sowie die strategische Leistung von Teams überprüfen.	und Methoden lösen oder vorhandene Kenntnisse oder berufliche Praxis neu definieren. ... kann komplexe Projekte, Funktionsbereiche oder Unternehmen leiten und strategisch entwickeln sowie neue Ideen oder Verfahren in führenden Arbeits- oder Lernkontexten einschließlich Forschung entwickeln, neues Wissen zugänglich machen und damit zur Weiterentwicklung von Lernenden oder MitarbeiterInnen beitragen.

5. Problemlösung, Innovation und Weiterlernen			
Kompetenzstufe 1	Kompetenzstufe 2	Kompetenzstufe 3	Kompetenzstufe 4
... verfügt über elementares Basiswissen zur Lösung technischer Probleme von und mit digitalen Geräten und Apps, zur Identifikation von Bedarfen und technologischer Antworten, zum kreativen und innovativen Umgang mit digitalen Technologien und zur Identifikation digitaler Kompetenzlücken und ... ... kann unter vorgegebenen Rahmenbedingungen und mit direkter Anleitung einfache, wiederkehrende Aufgaben im Zusammenhang mit der Lösung technischer Probleme von und mit digitalen Geräten und Apps, der Identifikation von Bedarfen und technologischer Antworten, dem kreativen und innovativen Umgang mit digitalen Technologien und der Identifikation digitaler Kompetenzlücken durchführen.	... verfügt über solides Basiswissen zur Lösung technischer Probleme von und mit digitalen Geräten und Apps, zur Identifikation von Bedarfen und technologischer Antworten, zum kreativen und innovativen Umgang mit digitalen Technologien und zur Identifikation digitaler Kompetenzlücken und ... ... kann unter vorgegebenen Rahmenbedingungen und mit entsprechender Anleitung, wo erforderlich, selbstständig einfache Routinearbeiten im Zusammenhang mit der Lösung technischer Probleme von und mit digitalen Geräten und Apps, der Identifikation von Bedarfen und technologischer Antworten, dem kreativen und innovativen Umgang mit digitalen Technologien und der Identifikation digitaler Kompetenzlücken unter Verwendung einfacher Regeln und Werkzeuge durchführen.	... verfügt über grundlegendes Wissen und Verständnis zur Lösung technischer Probleme von und mit digitalen Geräten und Apps, zur Identifikation von Bedarfen und technologischer Antworten, zum kreativen und innovativen Umgang mit digitalen Technologien und zur Identifikation digitaler Kompetenzlücken und ... ... kann bei gleichbleibenden Rahmenbedingungen selbstständig einfache Aufgaben und Herausforderungen im Zusammenhang mit der Lösung technischer Probleme von und mit digitalen Geräten und Apps, der Identifikation von Bedarfen und technologischer Antworten, dem kreativen und innovativen Umgang mit digitalen Technologien und der Identifikation digitaler Kompetenzlückendurch Anwendung grundlegender Methoden, Werkzeuge, Materialien und Informationen durchführen, Lösungen für alltägliche Herausforderungen aufzeigen und ihr Verhalten in gängigen Routinesituationen eigenverantwortlich und selbständig an die jeweiligen Umstände anpassen.	... verfügt über vertieftes Wissen und Verständnis zur Lösung technischer Probleme von und mit digitalen Geräten und Apps, zur Identifikation von Bedarfen und technologischer Antworten, zum kreativen und innovativen Umgang mit digitalen Technologien und zur Identifikation digitaler Kompetenzlücken und ... ... kann auch bei wechselnden Rahmenbedingungen selbstständig und eigenverantwortlich Routinearbeiten im Zusammenhang mit der Lösung technischer Probleme von und mit digitalen Geräten und Apps, der Identifikation von Bedarfen und technologischer Antworten, dem kreativen und innovativen Umgang mit digitalen Technologien und der Identifikation digitaler Kompetenzlücken durchführen, Lösungen für gängige Aufgaben und Herausforderungen finden sowie branchen-/fachübliche Instrumentarien, Verfahren und Methoden eigenverantwortlich, normgerecht und situationsadäquat einsetzen.
Kompetenzstufe 5	Kompetenzstufe 6	Kompetenzstufe 7	Kompetenzstufe 8
... verfügt über umfassendes, fortgeschrittenes Wissen zur Lösung technischer Probleme von und mit digitalen Geräten und Apps, zur Identifikation von Bedarfen und technologischer Antworten, zum kreativen und innovativen Umgang mit digitalen Technologien und zur Identifikation digitaler Kompetenzlücken und ... ... kann auch in nicht vorhersehbaren Situationen reflektierten und kreative Lösungen für abstrakte Probleme finden sowie eigenständig Projekte im Zusammenhang mit der Lösung technischer Probleme von und mit digitalen Geräten und Apps, der Identifikation von Bedarfen und technologischer Antworten, dem kreativen und innovativen Umgang mit digitalen Technologien und der Identifikation digitaler	... verfügt über vertieftes, fortgeschrittenes Wissen zur Lösung technischer Probleme von und mit digitalen Geräten und Apps, zur Identifikation von Bedarfen und technologischer Antworten, zum kreativen und innovativen Umgang mit digitalen Technologien und zur Identifikation digitaler Kompetenzlücken und kann den Lern-/Arbeitsbereich unter Einsatz eines kritischen Verständnisses von Theorien und Grundsätzen aus verschiedenen Perspektiven erfassen und ... ... kann neue innovative Lösungsansätze für komplexe Probleme in sich ändernden, nicht vorhersehbaren Kontexten entwickeln sowie komplexe fachliche oder berufliche Tätigkeiten oder Projekte im Zusammenhang mit der Lösung technischer Probleme von und	… verfügt über hoch spezialisiertes, an neueste Erkenntnisse anknüpfendes Wissen zur Lösung technischer Probleme von und mit digitalen Geräten und Apps, zur Identifikation von Bedarfen und technologischer Antworten, zum kreativen und innovativen Umgang mit digitalen Technologien und zur Identifikation digitaler Kompetenzlücken und über kritisches Bewusstsein für Wissensfragen in diesem Bereich und an der Schnittstelle zu anderen Bereichen und ... … kann komplexe, unvorhersehbare Arbeits- oder Lernkontexte im Zusammenhang mit der Lösung technischer Probleme von und mit digitalen Geräten und Apps, der Identifikation von Bedarfen und technologischer Antworten,	… verfügt über Spitzenkenntnisse in den Bereichen zur Lösung technischer Probleme von und mit digitalen Geräten und Apps, zur Identifikation von Bedarfen und technologischer Antworten, zum kreativen und innovativen Umgang mit digitalen Technologien und zur Identifikation digitaler Kompetenzlücken sowie über umfassendes Wissen aus anderen Disziplinen an den Schnittstellen zu anderen Bereichen und ... … kann zentrale Fragestellungen im Zusammenhang mit der Lösung technischer Probleme von und mit digitalen Geräten und

Kompetenzlückenkonzipieren, leiten und beaufsichtigen. ... kann die eigene sowie die Leistung anderer Personen überprüfen und entwickeln.	mit digitalen Geräten und Apps, der Identifikation von Bedarfen und technologischer Antworten, dem kreativen und innovativen Umgang mit digitalen Technologien und der Identifikation digitaler Kompetenzlückenleiten. ... kann Entscheidungsverantwortung sowie die Führung und Entwicklung von MitarbeiterInnen übernehmen.	dem kreativen und innovativen Umgang mit digitalen Technologien und der Identifikation digitaler Kompetenzlückenleiten und strategisch gestalten und verfügt über spezialisierte Problemlösungsfertigkeiten, um neue Erkenntnisse zu gewinnen und neue Verfahren zu entwickeln sowie um Wissen aus verschiedenen Bereichen zu integrieren. ... kann Verantwortung für Beiträge zum Fachwissen und zur Berufspraxis übernehmen sowie die strategische Leistung von Teams überprüfen.	Apps, der Identifikation von Bedarfen und technologischer Antworten, dem kreativen und innovativen Umgang mit digitalen Technologien und der Identifikation digitaler Kompetenzlücken unter kreativem und reflektiertem Einsatz weitest fortgeschrittener und spezialisierter Fertigkeiten und Methoden lösen oder vorhandene Kenntnisse oder berufliche Praxis neu definieren. ... kann komplexe Projekte, Funktionsbereiche oder Unternehmen leiten und strategisch entwickeln sowie neue Ideen oder Verfahren in führenden Arbeits- oder Lernkontexten einschließlich Forschung entwickeln, neues Wissen zugänglich machen und damit zur Weiterentwicklung von Lernenden oder MitarbeiterInnen beitragen.

Annex 2: Transversale Anwendungsszenarien digitaler Kompetenz (currently only available in German)

Themenbereich	Überarbeitetes Szenario oder neues Szenario im Einsatz
Alltag	Sie kaufen ein neues Smartphone und nehmen es in Betrieb.
Alltag	Sie suchen online nach Informationen und informieren sich online.
Alltag	Sie setzen sich allein oder gemeinsam mit anderen kritisch mit der Veränderung der Lebenswelt und Umwelt durch die Digitalisierung auseinander und ziehen daraus Ihre Konsequenzen.
Alltag	Sie kommunizieren online mit Ihrer Familie, Freundinnen und Freunden.
Alltag	Sie nutzen Unterhaltungs-, Freizeit- und Gesundheitsangebote im Internet.
Alltag	Sie nutzen Online-Services für Ihre Mobilität und Reisen.
Alltag	Sie lernen online.
Alltag	Sie nutzen IoT- und KI-Technologien wie Smart-Home, Drohnen, Rasenmäh-Roboter, Wearables usw.
Alltag	Sie führen Ein- oder Verkäufe im Internet durch.
Alltag	Sie engagieren sich im Internet politisch oder zivilgesellschaftlich.
Alltag	Sie nutzen Online-Angebote von Ämtern, Behörden und Gesundheitsservices.
Alltag	Sie erledigen Finanzgeschäfte online.
Alltag	Sie arbeiten je nach Möglichkeit in der Firma, zu Hause oder unterwegs.
Alltag	Sie bewerben sich um einen Job.
Beruf	Sie arbeiten in Ihrem beruflichen Alltag mit verschiedenen digitalen Geräten, Apps und dem Internet - je nach Möglichkeit in der Firma, zu Hause oder unterwegs.
Beruf	Sie verwenden digitale Geräte, Apps sowie IoT- und KI-Technologien zur Unterstützung der Arbeits-, Service- und Produktionsprozesse.
Beruf	Sie gestalten die Online-Zusammenarbeit mit anderen im Bewusstsein um Möglichkeiten und Grenzen der digitalen Kommunikation.
Beruf	Sie arbeiten mit Daten und beachten dabei gültige Regeln und Rechtsnormen.
Beruf	Sie aktualisieren und vertiefen laufend Ihr Wissen und Können im Hinblick auf digitale Geräte, Programme und Technologien.
Beruf	Sie lösen berufliche oder geschäftliche Probleme und Herausforderungen mit den Möglichkeiten der Digitalisierung in Abwägung der damit verbundenen Chancen und Risiken.
Blockchain	Sie setzen sich mit Entwicklungen im Bereich Blockchain auseinander.
Blockchain	Sie verwenden Kryptowährungen (z.B. Bitcoin) als Zahlungsmittel.
Blockchain	Sie treten in Smart Contracts als Vertragspartei auf oder erstellen selbst Smart Contracts.
Blockchain	Sie verwenden Tokens, um Besitzverhältnisse abzubilden.
Blockchain	Sie beteiligen sich an der Absicherung eines Blockchain-Netzwerks mittels Mining oder Staking.
Data Science	Sie haben ein ungefähres Verständnis für den Begriff "Data Science" und können nützliche wie riskante Alltagsbeispiele dafür nennen.
Data Science	Sie beziehen statistische Informationen in Ihre privaten und beruflichen Entscheidungen mit ein.
Data Science	Sie hinterfragen Daten und deren Aufbereitung hinsichtlich Qualität und Aussagekraft, um sie adäquat einordnen zu können.
Data Science	Sie bilden sich mit Hintergrundwissen über Data Science Ihre Meinung zu gesellschaftspolitischen, wirtschaftlichen und ethischen Themen.
Data Science	Sie bereiten Daten aussagekräftig auf und können damit anderen Sachverhalte verständlich erklären.
Data Science	Sie sind sich dessen bewusst, dass laufend Daten von Ihnen gesammelt und ausgewertet werden und dass Ihre Funde im Internet damit zusammenhängen können.
Data Science	Sie können anderen vermitteln, wie aus Daten bedeutsame Erkenntnisse gewonnen und Innovationen sowie Geschäftsideen entwickelt werden können.
Data Science	Sie haben ein fortgeschrittenes Verständnis für den Bereich Data Science und können Ihre fachlichen Kompetenzen in diesem Bereich weitergeben.
Data Science	Sie könnten ein Data Science Team leiten, Data Science Projekte konzipieren und gemeinsam im Team umsetzen.
Data Science	Sie wissen über die Vorteile sowie Limitationen von Data Science Methoden Bescheid und können einschätzen, welche Data Science Methoden für konkrete Problemstellungen zielführend sind.
Data Science	Sie verfolgen aktuelle Entwicklungen im Bereich Data Science und können sich selbständig Methodenwissen aneignen.
Data Science	Sie kennen gängige Werkzeuge und Frameworks zum Umgang mit großen Datenmengen und können geeignete Einsatzmöglichkeiten identifizieren.
Data Science	Sie können den finanziellen, personellen und technischen Ressourcenaufwand zur adäquaten Lösung einer Problemstellung abschätzen.
Data Science	Sie sind sich Ihrer rechtlichen und ethischen Verantwortung im Umgang mit Daten bewusst und berücksichtigen diese bei Ihren Tätigkeiten

Data Science	Sie können umgesetzte Prozesse und die daraus abgeleiteten Ergebnisse verständlich darstellen und Fachfremden erklären.
Industrie 4.0	Sie vollziehen die Logik von komplexen Datenanalysen nach und verstehen deren Einbettung in automatisierte IT-Anwendungen.
Industrie 4.0	Sie bewerten den korrekten Einsatz von IoT-Devices für Zustandsanalysen/für das Retrofitting von Maschinen basierend auf Daten, die mit geeigneten Methoden untersucht werden.
Industrie 4.0	Sie verknüpfen Virtual Private Network (VPN) Technologien mit Technologien zur Datenanonymisierung und -verschlüsselung.
Industrie 4.0	Sie planen und bewerten Logistik-Systeme mit geeignetem Automatisierungsgrad zur Prozessverbesserung und zur Unterstützung der Werker.
Industrie 4.0	Sie planen den Einsatz und implementieren Cobots im Rahmen von Mensch-Maschine-Interaktionen zur Prozessverbesserung.
Industrie 4.0	Sie planen den Einsatz und implementieren digitale Assistenzsysteme im Rahmen von Mensch-Maschine-Interaktionen zur Prozessverbesserung.
Industrie 4.0	Sie kennen Methoden zur Analyse von Material- und Informationsflüssen eines Unternehmens sowie Maßnahmen zur Optimierung und wenden diese an.
Industrie 4.0	Sie beurteilen und optimieren den Einsatz der additiven Fertigung von Bauteilen durch Nutzung von/basierend auf Datenanalysen.
Industrie 4.0	Sie sind mit dem Begriff „Industrie 4.0“ vertraut und haben sich bereits mit dem Thema auseinandergesetzt.
IoT & Robotics	Sie wissen, was IoT ist, und wenden IoT-Geräte im privaten oder beruflichen Bereich an.
IoT & Robotics	Sie haben von Virtual Reality oder Augmented Reality gehört und kennen verschiedene Anwendungsbeispiele.
IoT & Robotics	Sie wissen, wo in Ihrem Umfeld Sensoren eingebaut sind und welche Daten diese sammeln.
IoT & Robotics	Sie haben von IoT im Industriebereich gehört und kennen die Einsatzgebiete.
IoT & Robotics	Sie haben von Intelligenten Systemen (IS) und Autonomen Intelligenten Systemen (A/IS) gehört und wissen, welche Technologien damit gemeint sind.
IoT & Robotics	Sie unterscheiden zwischen Service- und Industrierobotern und kennen Anwendungsbereiche von beiden.
IoT & Robotics	Sie wissen, was ein Roboter definitionsgemäß ist und wie Roboter funktionieren.
IoT & Robotics	Sie unterscheiden zwischen Human-Machine Interface (HMI) und Human-Robot Interaction (HRI).
Angewandte KI	Sie können in groben Zügen umreißen, was K.I. als Teilbereich der Informatik in etwa meint und nützliche, wie auch riskante Beispiele dafür nennen.
Angewandte KI	Sie nützen K.I.-Anwendungen in Ihrem privaten Alltag.
Angewandte KI	Sie können Prinzipien des ethischen Einsatzes von K.I. nennen und können danach handeln.
Angewandte KI	Sie können sich zu aktuellen rechtlichen, ökonomischen, gesellschaftlichen und politischen Aspekten von K.I. eine Meinung bilden.
Angewandte KI	Sie können den Unterschied zwischen menschlicher Intelligenz und K.I. auf dem derzeitigen Stand der Technik beispielhaft beschreiben.
Angewandte KI	Sie nützen K.I.-Anwendungen in Ihrer Arbeit.
Kinder-Sicherheit	Sie können die Chancen und Risiken der Online - Welt für Ihre Kinder einschätzen und Ihre Kinder entsprechend begleiten.
Kinder-Sicherheit	Sie können die digitalen Geräte, mit denen Ihre Kinder zu tun haben, altersgerecht bereitstellen.
Kinder-Sicherheit	Regeln und Kommunikation rund um den Umgang mit digitalen Tools und Inhalten gehören zu Ihrem familiären Alltag.
Kinder-Sicherheit	Sie achten die Rechte der anderen in der Online-Welt.
Medienkompetenz	Sie selektieren Ihre Informationsquellen kritisch und nutzen unterschiedliche Medienquellen, um sich über politische, gesellschaftliche und persönlich relevante Themen zu informieren.
Medienkompetenz	Sie verwenden unterschiedliche Medientechnologien und passen diese gegebenenfalls Ihren Bedürfnissen an.
Medienkompetenz	Sie unterscheiden zwischen Werbung und redaktionellen Inhalten.
Medienkompetenz	Sie beherrschen mehrere Techniken, um Fake News und tatsächliche Nachrichten voneinander zu unterscheiden.
Medienkompetenz	Sie kommunizieren angemessen und gesetzeskonform.
Medienkompetenz	Sie kennen digitale Gefahrenquellen und schützen sich vor kriminellen und betrügerischen Angriffen.
Medienkompetenz	Sie aktualisieren und vertiefen laufend Ihr medienkundliches und digitales Wissen.
Medienkompetenz	Sie gestalten und veröffentlichen unterschiedlich lange und unterschiedlich komplexe Medienartefakte (Emojis, Texte, Bilder, Videos …).
Sicherheit	Sie schützen Ihre Geräte und Accounts vor unerwünschtem Zugriff.
Sicherheit	Sie sichern sich gegen Datenverlust ab.
Sicherheit	Sie sichern Ihre Geräte und Daten gegen Diebstahl, Verlust und Schäden ab.
Sicherheit	Sie nützen Ihre persönlichen Rechte und schützen Ihre Privatsphäre bewusst und aktiv.
Sicherheit	Sie handeln im Umgang mit digitalen Geräten und Programmen gesundheits- und umweltbewusst.
Sicherheit	Sie beschäftigen sich mit den Chancen und Risiken der digitalen Welt.