THE SCOPES OF DIGITAL COMPETENCES

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Purpose: The main purpose of this article is to describe the scopes of digital competences as a key type of skills from the point of view of satisfactory functioning in the professional and private domain in the technological environment of human life, characteristic of modern times.

Design/methodology/approach: From the invention of the computer, the Internet and the smartphone as foundational digital technologies to the emergence of their intensification such as cloud solutions, Iot, blockchains, and cognitive technologies, we know that the effective exploitation of these solutions requires the acquisition of competences to use them. As bibliometric research shows, issues of digital competence continue to gain importance. The main aim of this paper is to describe existing competences and models to conceptualise research related to them, identify possible gaps, and attempt to fill them. It is assumed that the models that already exist should be supplemented with a meta-level to ensure that they are constantly updated in accordance with the digital ontology. Due to the anticipatory nature of the investigation, a conceptual analysis was used in the study.

Findings: In this research, the two main concepts 'digital literacy' and 'digital competence' were defined, the notion of 'digital capital' is included, referring to Pierre Bourdieu's concept of capital, helping to realise the role of digital competences as a factor in building social status. Selected competence models are described, possible deficits are recognised, and a possible way of filling them is proposed.

Research limitations/implications: These considerations are merely a conceptual sketch and, as such, call for more in-depth theoretical analyses, which will then be subjected to empirical verification, for example, a pilot study of experts and users' views on the role of a critical attitude towards one's own and digital competences and the need for their further development.

Practical implications: The research carried out in this article has a very practical dimension, as the theoretical analysis undertaken was aimed at producing very concrete results related to education in both individual and systemic terms, as it can provide indications of the scope for self-improvement and the expansion of curricula to include specific competence dimensions.

Social implications: The article is conceptual in nature, which, in line with the research method used, allows for the development of theoretical reflection (basic research), in this case concerning digital competences, their scopes, and areas of development, and as such can provide indications on the substantive content of digital competence subjects recommended for educational systems.

Originality/value: The most significant achievement of the present reflections is the identification of a potential competence gap in existing digital competence models and the attempt to fill this gap by extending the model to include a meta-level, critical attitude towards scope of digital competence, constant updating of competencies.

1. Introduction

The commonly formulated observations about the impact of digital technology on every aspect of our reality now seem to be a truism. For generations to come, the Internet, computers, smartphones, and AI are an integral part of the world as they know it. As with any technology, we design it with a specific intention, and with knowledge we use it to improve our functioning, enhance our quality of life, experiment with the limits of human agency, etc. As homofaber or tool-making animal (McLuhan, M., McLuhan, E., 1988, pp. 93-94), we view technology as an adaptive means to control the environment in which we live (Hall, 2001, p. 35).

We also know from the history of our species, as Yuval Harrari succinctly put it, that humans have always been better at inventing tools than using them wisely (Harari, 2018, p. 7). But in order to use technology wisely, it is necessary to use it fully consciously. And this comes with time, born in experiments, successive attempts, and constant elimination of mistakes. This is how we improve our creations, this is how we increase their efficiency, and this is how we acquire the skills necessary to use them optimally. The same is true of digital technologies, their close integration into our daily lives necessitates a constant upgrading of the competences associated with them, and there is nothing new in this. However, in the case of digital technologies, we have to take into account a significant variable regarding their rate of development, which is aptly captured by the trend recognised by Gordon Moor (Moor's law) of an exponential increase in the number of processors used on a monthly basis (Gregersen, 2024). Leaving aside the debates surrounding the precision of Moor's findings, the trend he recognised illustrates the existence of a correlation occurring between the pace of technical back-end development and the growth of computing power and digital transformation.

Using a metaphor, one could say that it is a technology that "never sleeps", every month brings new technological developments, and in view of this fact, the question of the extent of digital competence cannot remain indifferent. This is, so speak, the first competence imperative - digital competences do not exist, they must be subject to constant development, and this, in turn, requires a critical assessment of their validity. In the present considerations, it is assumed that the competence requirements indicated above constitute a metalevel conditioning the others, concretising around specific digital functionalities.

Two research questions should be considered as the main focus of the deliberations:
1. What competence scopes are currently indicated as digital competencies?
2. Can these competences be regarded as exhaustive of the competences necessary for effective use of digital technology?

In the case of the second question, the assumption formulated earlier provides a partial answer, but it seems to need to be made more specific. Addressing the research questions posed requires, first, the identification of currently formulated competency scopes and, secondly, the identification of a possible competency gap. This research will be preceded by a bibliometric introduction, which will help to realise the general trend in research on digital competences. Conceptual analysis will be used to develop theoretical insights from existing knowledge, which can then be verified in the course of empirical work. At this stage of the research, this method seems to be fully justified.

2. Methods

The paper will use two research methods: a bibliometric method and a conceptual analysis.

- Bibliometrics - that is, statistical analysis of books, articles, or other publications, involving the collection of data on the number of scientific articles and publications, classified by author and/or institution, field of study, country, etc., in order to construct productivity indicators for research (OECD Glossary of Statistical Terms). This method will be used to assess researchers' current interest in digital competencies issues and to identify the contexts in which these issues are being studied including domain mappings. These findings are important as an indicator of the advancement of work related to digital competences. The study will include data extracted from one of the largest databases covering peer-reviewed and published articles, monograph chapters, and scholarly monographs – SCOPUS-based, Sciencedirect. Two key terms, 'digital competencies' and 'digital literacy', have been included in the study due to the fact that these terms are treated synonymously by some authors.

- The second method used for consideration will be one of the oldest scientific methods, i.e. conceptual analysis (Furner, 2004; Gilson, Goldberg, 2015; Stuart, 2015; Dickson et al., 2018), whereby further theoretical analyses are conducted on the basis of already existing knowledge. In this method, using the most classical research methods, such as deductive reasoning, initial assumptions, well grounded in theory, are made, and from these initial assumptions, conclusions are formulated that extend knowledge in the field or allow new hypotheses to be put forward, which are then subjected to verification in empirical research. This type of research is typical of the so-called basic research. Conceptual analysis is used to combine theories, adapt theories to new developments, categorise, establish logical relationships between phenomena, and build theoretical models (Jakkolla, 2020). Given the theoretical sophistication of the issues discussed in the considerations, this method seems appropriate. According to the conceptual analytical steps adopted, the study will undertake the following tasks:

o   Defining basic concepts, describing the initial theoretical assumptions, in this case, defining terms such as: "digital capital", "digital competencies", "digital literacy".

o   Establishing the relationships existing between the different concepts, in this study, answering the question: Which competences are currently indicated as digital competences?

o   Conclusions – in this study, an answer to the question – Can these scopes be considered to exhaust the competencies necessary for effective use of digital technology?

The theoretical knowledge obtained in this way can form the basis for empirical research, as hypotheses developed that should be verified in the course of further research work.

3. Results

3.1. Bibliometrics

According to the methodological assumptions described above, it is initially necessary to establish to what extent the proposed topic is currently a relevant research topic. Below are the results of a search in the SCOPUS database from the Science Direct website, covering terms such as: "digital competences"; "digital literacy". Data was collected on 14.08.2024. The number of publications by year, type of publication, and scientific discipline was taken into account. The article considers data from when the topics appeared in the SCOPUS database, i.e. 2010 to the current year – 2024. The largest increase in interest in these topics was recorded in 2023. This will allow us to trace the research interest in the problems proposed in the article and to indicate the contexts of existing research, such as the predominant type of publication or the discipline in which digital competences are addressed. The results obtained are presented sequentially in Figure 1 (by year), Figure 2 (by type of publication), Figure 3 (by scientific field).
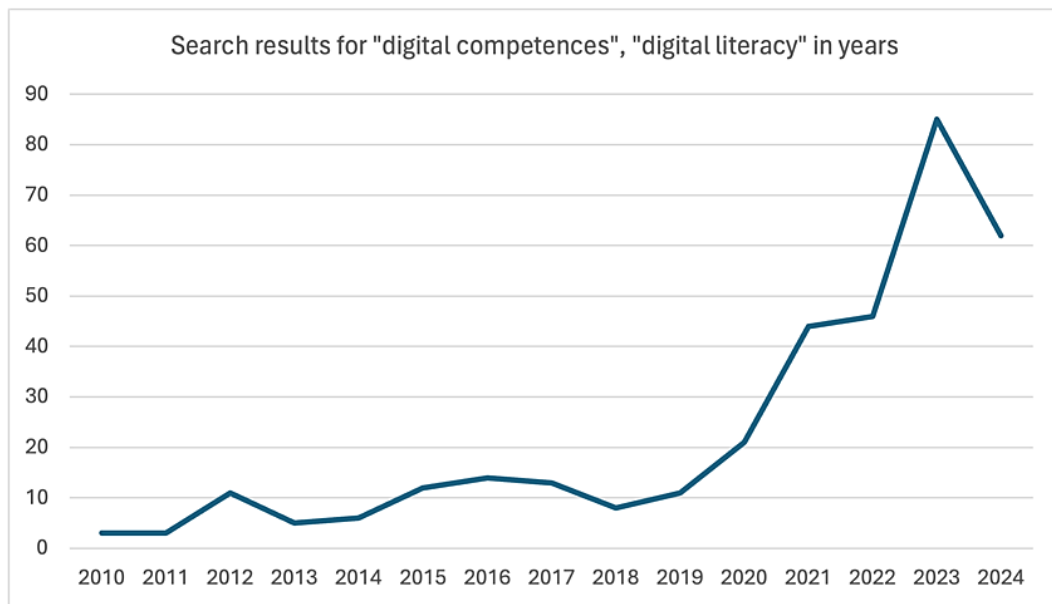
Figure 1. SCOPUS-based Science Direct – number of published articles search for "digital competence" and "digital literacy" in years.
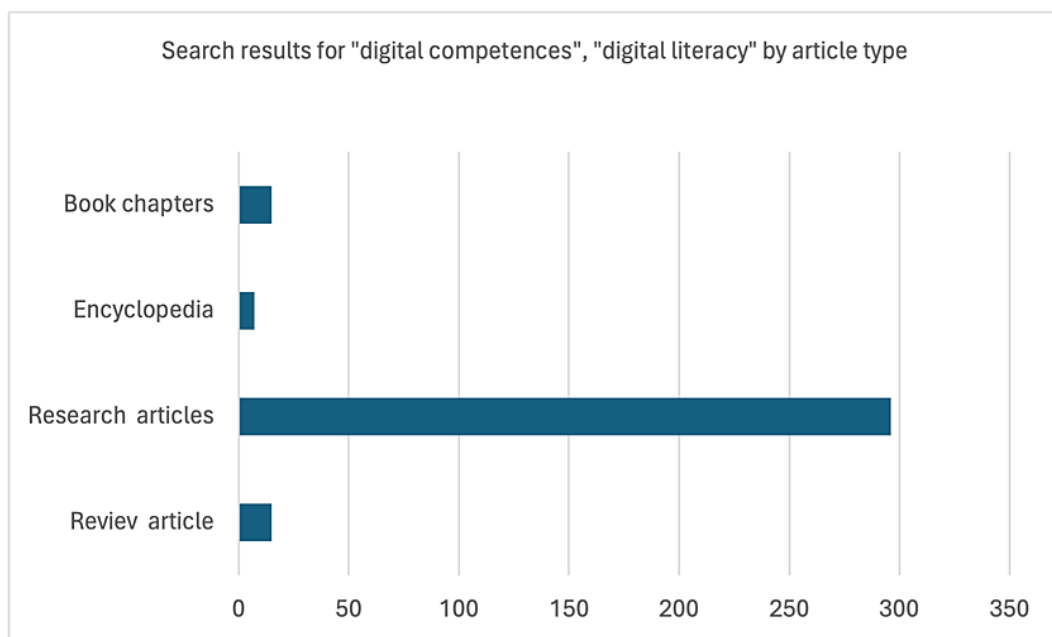
Source: Own elaboration.

Figure 2. SCOPUS-based Science Direct – number of published articles search for "digital competence" and "digital literacy" by article type.
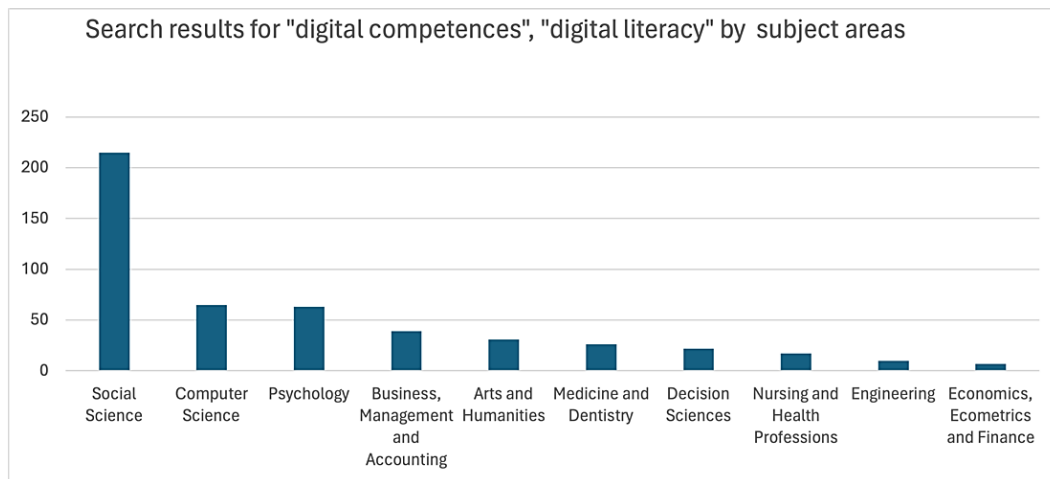
Source: Own elaboration.

Figure 3. SCOPUS-based Science Direct – number of published articles search for "digital competence" and "digital literacy" by subject areas.

Source: Own elaboration.

The data obtained from the bibliometric study allow several conclusions to be drawn, indicating the existence of certain trends related to scientific analyses of issues concerning digital competences. First, an increase in interest in this issue is clearly discernible over the past decade. The decrease in the number of publications in 2024 is the result of a lack of complete data; there are still four months left until the end of the year, and the current number of publications rather indicates a continuation of the trend. The increasing interest of researchers usually indicates that the subject matter is problematised, i.e. that it is becoming the focus of attention, as an issue of importance, and this in turn is the result of increasingly perceived gaps in current knowledge. Secondly, the type of publications that predominate, research articles, tells us that we are at the stage of collecting data that, in time, can be transformed into more general theoretical conclusions. That is, in a sense, we are at the beginning of a research journey. Third, most of these publications are produced within the social sciences, which may indicate a growing understanding of the importance of digital competence for our social functioning, or more radically, an understanding that social life in its various dimensions is now impossible without digital competence. All the above mentioned findings are a basis for further research.

3.2. Conceptual analysis

3.2.1. Definition of digital competences and relationships existing between the different concepts

When we ask about competence, we are by definition referring to the quality of our performance; this is due to the etymology of the term itself. The Latin term *competentia* means conformity, suitability, readiness for something; *competere*, in turn, means to be in tune with something, suitable for something, and *competentes* means suitable, capable. These terms were used in specific contexts related to professional activities. For example, in craftsmanship to emphasise mastery of one's craft, in the judiciary toward officials who were entitled to speak on a given matter, also in the case of gladiators when, after long preparation, they were ready

to fight in the arena (Filipowicz, 2016, pp. 11-12). These hermeneutic analyses reveal three important aspects of the concept of competence:

- they concern a specific action; we are competent in something specific,
- to be competent is to know the methods and to know what their theoretical background is, and it means that to be competent is to have specific ways of making decisions and acting,
- achieving competence requires a conscious process of improvement and time.

According to this scheme, in the case of competences concerning the use of digital technologies, one would have to consider:

- What specific areas of competence might be involved?
- What methods and knowledge should be acquired and what knowledge should be available?
- What kind of reflection should be developed in relation to a specific time frame?

Two terms to describe digital literacy dominate the research already conducted on digital competence: 'digital literacy' and 'digital competence', some authors advocate treating these terms as synonyms (Pangrazio et al., 2020), but it is worth trying to distinguish their potential designations, this can contribute to a clearer picture of the scope of the issue under analysis (Fallon, 2020). In the case of 'digital literacy', it is helpful to trace the etymology of the term 'literacy' itself. According to the Oxford Dictionary and Oxford Reference, literacy is 'the ability to read and write, contrasted to illiteracy.' In looser usage, this also includes basic arithmetical competence' (Oxford Dictionary, Oxford Reference, 20.08.2024). In a similar vein, the OECD defines the term 'literacy' as the ability to understand, evaluate, use and engage with written text to participate in society and achieve goals' (OECD, 20.08.2024). As can be seen, these original meanings refer to competencies related to communication through a specific medium; in this case writing, over time the term came to refer to media literacy in a broad sense - 'media literacy' in the context of the ability to understand, evaluate, use and engage in the use of media to participate in society and achieve one's goals, and in the digital media age transforming to 'digital literacy'(Buckingham, 2007; Burke, 2008; Rintaningrum, 2009; Roodney, Hafner, 2012; Pilgrim, Martinez, 2013; Kamerer, 2013; Wilson et al., 2015; Potter, Mcdougall, 2017; Ptaszek, 2019; Ross et al., 2024). Some authors point out that the concept of 'digital literacy' describes reading and writing tasks utilising technology-powered media. Digital literacy is the ability to find, evaluate, utilise, share, and create content using information technologies and the Internet (Pilgrim, Martinez, 2013, p. 63), whereas, in the view of others, it is about the optimal use of media in general, not just reading and writing (Glister, 1997; Kamerer, 2013; Pangrazio et al., 2020; Osika, 2021b; Ross et al., 2024). Whereas one of the strands developing within 'media literacy' is the critical approach, which places a strong emphasis on three components: the first is 'metaknowledge' of 'meaning systems and the sociocultural contexts in which they are produced and embedded'; the second involves the

technical skills to negotiate these systems; and the final 'involves the capacity to understand how these systems and skills operate in the interests of power' (Pangrazio, 2016, p. 164). The critical trend with the development of digital technologies also emphasises the importance of 'critical data literacy' (Hinrichsen, Coombs, 2013; Maybee, Zilinski, 2015; Kleppman, 2017; Osika, 2021a, 2022a), which includes skills such as: '(1) Awareness: understanding data and their role in society; (2) Access: understanding how to identify, locate and appropriately use structured data in datasets and databases; (3) Engagement: evaluate, analyse, organise and interpret data to make evidence-based decisions; (4) Management: organise and manage data; (5) Communication: synthesise and create visualisations and representations; (6) Data Ethics: identify diversified data sources, considering the risks of managing such data and the issues implicit in the use of data; (7) Preservation: awareness of long-term practices of storing, using and reusing data (Atenas et al., 2020, p. 7). And recently, the importance of AI literacy is increasing, which is defined as 'a set of competencies that enable individuals to critically evaluate AI technologies, communicate and collaborate effectively with AI, and use AI as a tool online, at home, and in the workplace' (Long, Magerko, 2020; Hjorth, Chrysostomou, 2022; Knoth et al., 2024; Stolpe, Hallström, 2024).

Studies also talk about more specific types of literacy, such as 'information literacy', i.e., 'the ability to recognise when information is needed and to have the ability to locate, evaluate, and effectively use the needed information' (Pilgrim, Martinez, 2013, p. 67). Multiliteracies – namely 'the multiple ways of communicating and making meaning, including such modes as visual, audio, spatial, behavioral, and gestural (Pilgrim, Martinez, 2013, p. 67) and web literacy, i.e. 'the knowledge and use of specific skills needed to locate, analyse and communicate information found online (Pilgrim, Martinez, 2013, p. 67).

However, as researchers point out (Janssen et al., 2013; Fallon, 2020), the term 'literacy' does not fully capture the entire spectrum of competences required to make optimal use of digital technology. 'Digital competency clearly involves more than knowing how to use devices and applications […], which is intricately connected with skills to communicate with ICT, as well as information skills. Sensible and healthy use of ICT requires particular knowledge and attitudes regarding legal and ethical aspects, privacy, and security, as well as understanding the role of ICT in society and a balanced attitude towards technology (Fallon, 2020, p. 2451, from: Janssen et al. 2013, p. 480). Rather, our focus should therefore be on developing holistic models of digital competence that allow us to delineate the ranges necessary to assimilate as equipment to enable us to function in a reality heavily influenced by digital technologies.

One of the proposals for a broader approach to digital competence is to define it as a set of competences composed of information competences including the ability to search for information, understand it, assess its reliability and usefulness, and digital competence, which includes the ability to use a computer and other electronic devices (hardware literacy), use the Internet, use various types of applications (applications literacy) and software (software literacy), and create digital content. There is also mention of functional competences related to

the use of digital and information literacy in eight key areas of life - work and professional development, relationships with relatives, pursuing interests, health, finances, religion and spiritual needs, everyday life, civic engagement (Plebańska, 2021; Kompetencje cyfrowe 4.0). The competence model described above is part of the Polish Digital Competence Development Programme, which was developed in 2020. Its aim was to identify a framework covering competences to be developed from pre-school and early school education to senior age. By design, the strategy aims to significantly reduce areas of digital exclusion.

The Development Agenda for the EU, in turn, has developed a DigComb 2.2. The oldest version of this competency model is version 1.0, which was created in 2013, with subsequent updates being DigComp 2.0 (2016), 2.1 (2017), 2.2 (2022). DigComp 2.2 covering five competence areas: **information and data literacy** (browsing, searching and filtering data, information and digital content, evaluating data, information and digital content, managing data, information and digital content), **communication and collaboration** (interacting through digital technologies, sharing through digital technologies, engaging in citizenship through digital technologies, collaborating through digital technologies, netiquette, managing digital identity), **digital content creation** (developing digital content, integrating and re-elaborating digital content, copyright and licences, programming), **safety** (protecting devices, protecting personal data and privacy, protecting health and well-being, protecting the environment), *problem solving* (solving technical problems, identifying needs and technological responses, creatively using digital technologies, identifying digital competence gaps) (Vourikari et al., 2016). Another proposal for a set of digital competences is adopted by the UK Department for Education: *Essential digital skills framework,* developed in 2018, in this case the key is to set a baseline level that allows the use of digital technology.

In the competence models cited, the ranges of skills that need to be acquired have been accurately identified, so it can be said that they provide object-orientated indications of particular types of competence. However, the acquisition of competences also requires the adoption of a specific attitude towards these object-related references, which is why this discussion proposes as a basis for analysis the model by José Janssen, Slavi Stoyanov Anusca Ferrari, Yves Punie, Kees Pannekeet, Peter Sloep, its visualisation showing **Figure 4**.
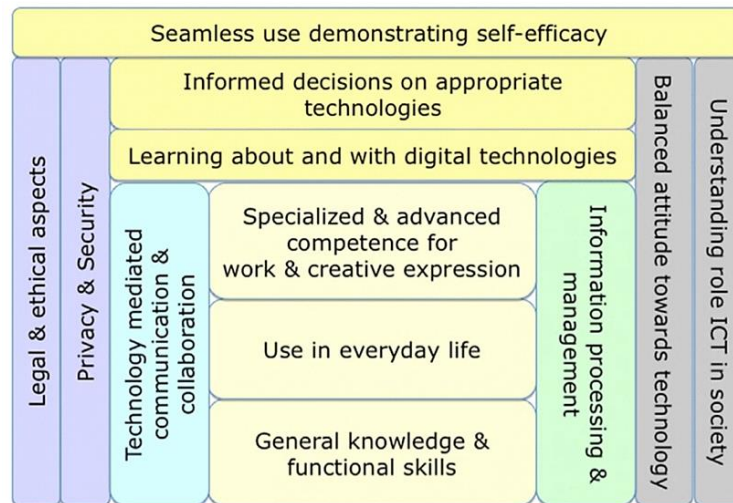
Figure 4. Areas of digital competence.

Source: Janssen, 2013, p. 478.

In this model, alongside the subject scopes described, there is also an indication of a balanced attitude towards the technology itself, the role of this attitude being crucial as a support for informed decision-making in relation to the use of certain functionalities. Protecting privacy, for example, requires knowing the contexts associated with the technological backdrop of its violation, when we know this, we can try to build our own privacy policy, but this requires a more distanced attitude towards the technology, because we have to want to take such a step. Similarly, deciding to turn off notifications puts me back in control of my digital device use habits. As indicated earlier, these considerations are decisive in the choice of this model for further analysis.

3.2.2. Meta-digital competence

Javeir A. Rodriguez-Camacho et al. referring to Pierre Bourdieu's concept of capital argue that the digital transformation of contemporary society has resulted in the increased status of those with knowledge and skills in the use of digital technologies. In this sense, we can consider digital competences as digital capital, i.e. a value that is socially attributed to members of society because of the level of knowledge and skills they possess in this area (Rodriguez-Camacho et al., 2024, p. 1). However, we know, as mentioned in the 'Introduction', that one of the characteristics of digital technology is that it develops at an exponential rate, requiring constant updating of software and sometimes even hardware, so the mere fact of mastering a certain range of competences at a given time, from the point of view of digital capital, seems insufficient. Therefore, it is worth adding a meta-level to the already existing competency scopes mentioned with the models described extending digital competences not so much by additional types of competences, but rather by a certain attitude one takes towards the competences one already has, i.e. that they are only temporary.

In general, therefore, it is about adopting a critical attitude towards the already identified skills that make up digital capital, and this, in turn, will make it possible to constantly update them, i.e., what we consider to be digital competences and what is included in their scope. For example, two decades ago it was very important to operate specific programmes; now we rather talk about the ability to perform tasks, and in which programme it will be performed has become secondary. The inclusion of a meta - level of competence will allow an ontological adaptation to the nature of digital technology, and this will help to develop a conscious attitude to the need to continuously work on one's digital capital, carried out in the spirit of 'lifelong learning'. This competence complementation can also help to overcome various types of digital exclusion, as it helps to realise that, in a sense, everyone has a competence deficit, so everyone needs to learn something. Figure 5 shows a visualisation of the completed digital competency model below.
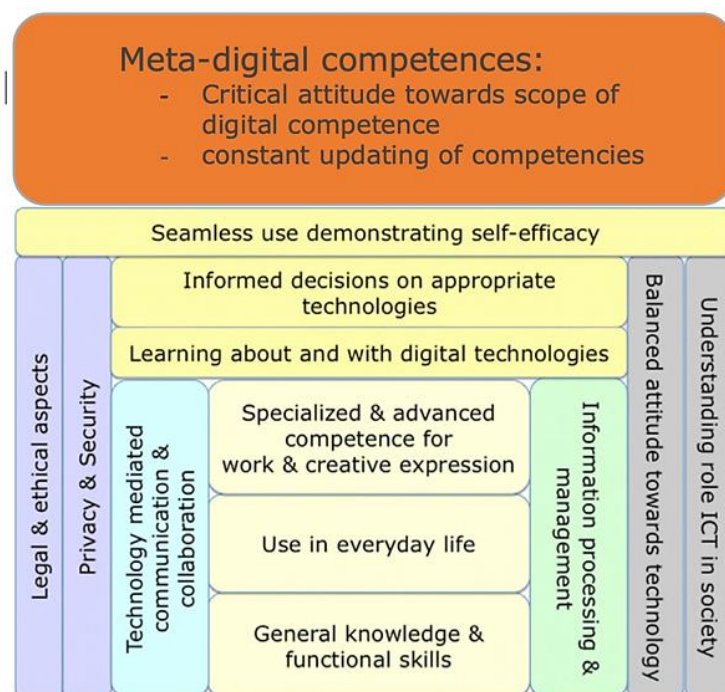

Figure 5. Concept of new areas of digital competence.

Source: Own elaboration based on Janssen, 2013, p. 478.

3.3.   **Application potential of the extended competence model**

The proposed extended model of digital competence is intended to raise awareness of the level of skills we have and the skills we need to add, and this applies to both educators and suggestions for self-development. While the extent of what we need to use digital technology is to a greater extent verified in everyday life, to put it succinctly, life imposes on us what we need to learn, the attitudes we adopt towards technology and our own skills remain in the background, hence the need to take into account the meta-level of competence.

At the same time, we know that the scopes described must become elements of development strategies that consider digitality as an integral part of reality. In Poland, the *Digital Competences Development Programme* has been under development since 2020, which is a direct reference to the EU Digital Education Action Plan 2021-2027, together with the more general *Path to the Digital Decade* programme, which is part of the digital transformation policy for the EU. Under these programmes, it is envisaged that at least 80% of 16-74 year olds will have basic digital skills and at least 20 million working people in EU countries will be ICT specialists (Path..., 2022). Given the specificity of digital technology, the realisation of these assumptions implies the need for a continuous update of the competency scopes, allowing to keep the strategies up to date and the educational assumptions adapted to them helping to create curriculum frameworks for all levels of education. The addition to the competency model proposed in the article can be seen as an expert voice to improve the expected scopes, which is how its application potential is understood.

4. Discussion

Digital technology has become an integral part of our lives, and this applies to all forms of life (Webb, 2019; Lee Kai-Fu, 2019; Śledziewska, Włoch, 2020; Osika, 2022a; Rogacka, 2022). Therefore, everyday life, both professional and private, requires members of society to have a high level of proficiency in using this technology. As is pointed out, it is the extent of our competence in this regard that builds our social status, hence the term digital capital (Rodriguez-Camacho et al., 2024), which consists of both knowledge and skills. The development of technology necessitates the acquisition of competences related to it and analyses concerning their optimal scope from the point of view of its application. In the case of digital competence, these analyses are carried out around the two key terms 'digital literacy' and 'digital competence', although some researchers treat them synonymously (Pangrazio et al., 2020). The term 'digital literacy', according to its etymology, is related to literacy and directs research attention to the proficient use of a particular medium in the communication process (Oxford Dictionary, 20.08.2024; Oxford Reference, 20.08.2024; OECD, 20.08.2024; Buckingham, 2007; Burke, 2008; Rintaningrum, 2009; Roodney, Hafner, 2012; Pilgrim, Martinez, 2013; Kamerer, 2013; Wilson et al., 2015; Potter, Mcdougall, 2017; Ptaszek, 2019; Ross et al., 2024). Within this research strand, critical analysis is also undertaken () and is currently trying to develop with new scopes such as 'data literacy' (Hinrichsen, Coombs, 2013; Maybee, Zilinski, 2015; Kleppman, 2017; Osika, 2021a, 2022a) or 'AI literacy'. The term 'digital literacy', according to its etymology, is related to literacy and directs research attention towards the proficient use of a specific medium in the communication process, hence its further elaboration on 'media literacy' or 'digital literacy', in relation to digital media. Within this

research strand, critical analysis is also undertaken (Glister, 1997, Kamerer, 2013; Pangrazio et al., 2020; Osika, 2021b; Ross et al., 2024) and is currently attempting to develop with new scopes such as 'data literacy' or 'AI literacy' (Long, Magerko, 2020; Hjorth, Chrysostomou, 2022; Knoth et al., 2024; Stolpe, Hallström, 2024). The second concept, which has a slightly broader meaning (Janssen et al., 2013; Fallon, 2020), is 'digital competence' in this case; the research carried out is concerned with the wider use of digital technology and the conditions that guarantee proficiency in this area. Three competency models are highlighted in this discussion, one of which was chosen for further analysis due to its more holistic approach (Plebańska, 2021; Kompetencje cyfrowe 4,0; DigComb 2.0 reference model; José Janssen, Slavi Stoyanov Anusca Ferrari, Yves Punie, Kees Pannekeet, Peter Sloep).

In the course of further research work, the Janssen et al. model has been extended to include meta-competences concerning the attitudes we should adopt towards the digital competencies we already possess. It seems that this addition will allow us to continuously update our competence base and maintain a high level of digital capital, in line with the digital technology ontology. Of course, theoretical analyses must be verified by empirical research, for example, in the form of pilot studies to test the solutions developed, in the opinion of experts or users themselves.

5. Conclusions

According to the assumptions made in the 'Introduction', as beings living in a world shaped by digital technologies in all its aspects, to function optimally in such an environment, we must have the competences needed to use them. This fact has been indisputable since the very beginning of the emergence and spread of digital technologies. Therefore, with their development, we began to ask questions about the scope of digital competences. Research in this area has focused on the two key concepts of 'digital literacy' and 'digital competence', the first directing analyses towards media competence and the latter toward a greater use of digital technologies in accordance with their full functionality.

In the present discussion, following a bibliometric analysis indicating a continuous growth of interest in this issue over the past decade, both key concepts and selected competence models were examined according to the research questions posed.

1. What competence scopes are currently indicated as digital competencies?
2. Can these competences be regarded as exhaustive of the competences necessary for effective use of digital technology?

In response to the questions, the three selected competence models are briefly described, one of which was chosen for further analysis and extended to a meta-level covering not so much the subject areas, but relating to the postures that foster competence development and,

at the same time, the building of digital capital, crucial from the point of view of shaping one's position and role in society. This strand should be considered as a contribution to research dedicated to this issue. The theoretical solutions developed were sketchy in nature and, as such, should be subjected to further analysis including empirical.

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