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Developing Digital Skills and Competences: A Quick-Scan Analysis of 13 Digital Literacy Models

Catalina Iordache[*]*, Ilse Mariën*[**] *and Dorien Baelden*[***]

Abstract: The development of digital literacy has become a key element on the agenda of scholars, practitioners and policymakers worldwide. To this end, actors in the field often make use of conceptual models on digital literacy. As these models inevitably play a role in shaping the public debate on digital literacy, it is important to gain insights into the concepts and ideas they put forward. This article aims to: (1) unravel the complexity and diversity of concepts regarding digital skills, literacies and competences; (2) identify the concepts promoted in 13 selected models on digital literacy; and subsequently (3) analyse the concepts that shape and/or dominate the scholarly and public debate on digital literacy. The results of this article are based on a literature review and quick-scan analysis of 13 digital literacy models that have been published and used by actors in the field between 2004-2014. The frameworks were mapped in a matrix and compared on the basis of 39 indicators, clustered in five categories: operational, technical and formal; information, cognition; digital communication; digital content creation; and strategic. The results of the analysis point towards an unbalanced focus on certain skills and competences, with particular emphasis on a series of operational, information-searching, and communication skills.

Keywords: digital literacy, digital skills, digital competences, conceptual model

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Introduction

The ongoing digitization of services – both public and private – has led to an increased risk amongst the general population of being or becoming digitally excluded (Helsper & Reisdorf, 2016; Mariën & A. Prodnik, 2014; van Deursen & van Dijk, 2014). This so-called digital turn poses a threat to all individuals who do not have the necessary skills to handle the digitization of the various life domains (Helsper, 2011). Recent studies have shown that the socio-economic background of individuals is no longer solely responsible for digital exclusion, and that mechanisms of digital exclusion go beyond socio-economic vulnerable groups (Schurmans & Mariën, 2013). Moreover, research by experts in the field, such as van Deursen and van Dijk (2014) and Helsper and Eynon (2013), highlights that digital skills and competences, and the ability to make use of digital media in an autonomous and strategic way, are of increasing importance to ensure users' full societal participation.

This emphasis placed on the growing importance of digital skills and digital literacies contrasts with the lack of clarity and the lack of distinction made between the various types of digital skills, literacies and competences used in research, education or the field of e-inclusion: "The most immediately obvious facts about accounts of digital literacy are that there are many of them and that there are significantly different kinds of concepts on offer" (Lankshear & Knobel, 2008, p. 2). The development of digital skills and competences has, however, become a key element on the agenda of scholars, practitioners and policymakers worldwide in order to ensure citizens' ability to fully participate in today's increasingly digitized society. To this end, actors in the field often make use of conceptual models on digital literacy. As these models inevitably play a role in shaping the public debate on digital literacy, it is important to gain insights into the concepts and ideas they put forward.

This article therefore aims to (1) unravel the complexity and diversity of concepts regarding digital skills, digital literacies, and competences; (2) identify the concepts promoted, or chosen to be left out, in 13 selected digital literacy models that have been published and used by actors in the field over the period of ten years, between 2004-2014; and subsequently (3) analyse the concepts that currently shape and/or dominate the scholarly and public debate on digital literacy.

Unravelling digital literacy concepts

Digital literacy, skills, and competences: what's the difference?

A first aspect that requires clarification is the conceptual difference between digital skills, literacies and competences. Too often these concepts are used as synonymous, while they are distinct in meaning (Martin & Grudziecki, 2006, p. 256). Ala-Mutka (2011, p. 18) defines competence as "the ability to apply knowledge and skills to different contexts, such as work, leisure, or learning". According to the work of van Deursen (2010), literacy refers to certain competences and knowledge, whereas skills refer to the more technical aspects of these competences and knowledge. In his dissertation on Internet skills, van Deursen (2010, p. 71) distinguishes between four types of practice-oriented skills: (1) *operational skills*, or the so-called 'button knowledge' that refers to the operational manipulation of computer and Internet software and hardware; (2) *formal skills*, or the ability to understand and use formal characteristics of computer and Internet, such as hyperlinks or move between Internet pages; (3) *information skills*, or the skills required to search, select, handle and critically evaluate Internet and digital media contents; and (4) *strategic skills*, or the capacity to use Internet to one's personal advantage. In his later work on Internet skills, a fifth and sixth type of skills, namely *communication skills* and *content creation skills*, were added to make reference to the skills needed to participate in online networks, online communication strategies and the practical skills needed to create and distribute content on the Internet (van Deursen, Helsper, & Eynon, 2014; van Dijk & van Deursen, 2014). A similar practice-oriented interpretation of skills is used in the European Qualifications Framework (European Commission, 2008, p. 11). In this framework, the distinction is made between knowledge, skills and competence. Knowledge is defined as "the body of facts, principles, theories and practices related to a field of work or study". Skills are referred to as "the ability to apply this knowledge", whereas competence is seen as "the proven ability to use these sets of knowledge and skills for one's personal development".

Digital skills are consequently to be seen as the more practical and measurable outcomes of media, information or digital literacies. The conceptualisation of digital literacy in Martin and Madigan (2006, p. 255) confirms this distinction between skills and literacies: "Digital literacy is the awareness, attitude and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyse and synthesise digital resources, construct new knowledge, create media expressions, and communicate with others, in the context of specific life

situations, in order to enable constructive social action; and to reflect upon this process". However, this interpretation of digital literacy also highlights the overall complexity of the different types of skills that can be classified as digital skills. In the definition discussed above, reference is made to a variety of aspects, ranging from mere access to more sophisticated elements such as integration, evaluation, and analysis of media contents. When studying digital skills, literacies or competences, it is crucial to take into account the conceptual distinction, and their overall complexity and multi-layered character.

A second aspect that adds to the conceptual confusion is the convergence between media literacy, transliteracy and digital literacy. It is clear that, at present, no consensus has been reached on how these different concepts relate to one another, where they overlap and where they may be incorporated by an overarching concept. In this context, media literacy has been defined as "an ability to deal with information formats 'pushed' at the user" (Bawden, 2008, p. 30). However, when users have to deal with information 'pull', other types of literacy may come into play, such as information, or moral and social literacy (Lankshear & Knobel, 2008). Potter (2004, p. 58) defines media literacy as "the set of perspectives from which we expose ourselves to the media and interpret the meaning of the messages we encounter". The conceptual convergence is accentuated again in the four main areas of media literacy action that can be identified: access and usage, understanding, critical evaluation, and creativity (Buckingham, 2003; DTI, EAVI, & European Commission, 2011). These constitute a skills-based approach to media literacy (Livingstone, 2004; Potter, 2004) which guides the large majority of research initiatives on the subject. However, Hoechsmann and Poyntz (2012) claim that the meaning and effects of media extend well beyond questions of skills, and that more fundamental questions regarding the social and political influence of media on our lives are required. Other authors try to integrate the different forms of literacy into one single concept. To this end, Frau-Meigs (2012) introduces the concept of transliteracy, which she defines as: (1) the ability to embrace the full layout of multimedia which encompasses skills for reading, writing and calculating with all the available tools (from paper to image, from book to wiki); (2) the capacity to navigate through multiple domains, which entails the ability to search, evaluate, test, validate and modify information according to its relevant contexts of use (as code, news and document).

However, this article does not aim to provide an answer to these conceptual debates on knowledge, skills, competence or the different types of literacy. The goal is to examine and compare 13 existing digital literacy

models, through a common set of indicators. In the context of this article, digital literacy models are comprised of knowledge, skills, and competences. We refer to knowledge as the information, awareness, and understanding that users have of the existence and usage of different digital tools. In line with the literature previously considered, we define digital skills as the more practical, measurable application of certain knowledge and aptitudes in digital usage. Digital competence is discussed as the ability to apply said knowledge and skills to various life contexts, from personal to professional. To this end, digital literacy compiles the awareness, practical skills, and competences necessary for users to access, understand, evaluate, communicate with others, and create digital content in a strategic and applied manner, towards the fulfilment of personal and professional goals.

From operational skills to digital content creation and beyond

The previous section has already pointed towards the difficulty in identifying and defining the different types of skills that can be discussed within the digital literacy framework. The model of van Deursen (2010) was mentioned explicitly because it is one of the few frameworks that is complete and accessible at the same time. The DIGCOMP framework developed by Ferrari (2013) is exhaustive, but less applicable due to its underlining complexity. Whereas the model of van Deursen is built around six types of clear and practice-oriented skills, the DIGCOMP model comprises five areas of digital competences and a total of 21 different types of competences. Each of these 21 competences is subsequently translated into three proficiency levels (cf. foundation, intermediate, and advanced) and a number of practice-oriented interpretations in terms of desired knowledge, skills, and attitudes. The dissertation of van Deursen (2010) is mainly built upon the work of Steyaert (2002) and van Dijk (2005), but mentions a considerable number of existing models and interpretations of digital skills that are subsequently used to provide a detailed description of each type of skill and underpinning activity. The same applies for the DIGCOMP model developed by Ferrari (2013), which refines the mapping exercise on digital competences put forward by Ala-Mutka (2011).

The goal of this article is not to provide a detailed overview and description of all existing types of digital skills. There are however a few interpretations that stand out. A first is the categorisation developed by Jenkins (2006), which is interesting because it approaches digital skills from a participatory and community-based perspective. Instead of solely

highlighting individual attributes, Jenkins (2006, p. 4) frames what he calls *new media literacies* as cultural competences and social skills that are developed through collaboration and networking, and defines eleven different new skills:

- *Play*: the capacity to experiment with one's surroundings as a form of problem-solving;
- *Performance*: the ability to adopt alternative identities for the purpose of improvisation and discovery;
- *Simulation*: the ability to interpret and construct dynamic models of real-world processes;
- *Appropriation*: the ability to meaningfully sample and remix media content
- *Multitasking*: the ability to scan one's environment and shift focus as needed to salient details;
- *Distributed Cognition*: the ability to interact meaningfully with tools that expand mental capacities;
- *Collective Intelligence*: the ability to pool knowledge and compare notes with others toward a common goal;
- *Judgment:* the ability to evaluate the reliability and credibility of different information sources;
- *Transmedia Navigation*: the ability to follow the flow of stories and information across multiple modalities;
- *Networking*: the ability to search for, synthesize, and disseminate information;
- *Negotiation*: the ability to travel across diverse communities, discerning and respecting multiple perspectives, and grasping and following alternative norms.

Jenkins' approach clearly avoids a technologically deterministic viewpoint and, moreover, opens up the skills debate to a number of underpinning but crucial skills and competences such as experimentation, problem-solving capabilities or the ability to pool knowledge and move towards a common goal with others.

A second contribution that is worth mentioning is the categorisation of digital literacy by Eshet-Alkalai (2004, p. 93), which integrates five types of literacies, based upon "a large variety of complex, cognitive, motor, sociological, and emotional skills":

- *Photovisual literacy:* the ability to understand visual representations in online environments, and messages from graphical displays and designs;

- *Reproduction literacy:* the ability to reproduce existing digital content into new meaningful digital content (cf. similar to content-creation skills, but focused on the process of reproduction);
- *Information literacy:* the cognitive skills necessary to critically evaluate media content;
- *Branching literacy:* the ability to read and understand hypermedia and evaluate the quality and validity of media content;
- *Socio-emotional literacy:* the skills needed to understand and apply the rules of online media environments.

The approach promoted by Eshet-Alkalai (2004) also moves away from a mere technology and tool-oriented definition of digital skills. By emphasising cognitive skills and the interpretation of text, image and rules, this approach also opens up the skills debate and brings additional elements into discussion that are crucial to ensure a full take-up and capital-enhancing usage of digital media contents and online environments.

Overall, the models and approaches mentioned above, namely van Deursen (2010), Ferrari (2013), Jenkins (2006), and Eshet-Alkalai (2004), highlight that a broad, but accessible approach is needed, one that simultaneously includes tool-oriented skills such as button knowledge, together with more complex underpinning competences such as collaboration, social, or communication skills. The next section of this article is therefore aimed at identifying the concepts promoted in 13 selected models on digital literacy, and subsequently at analysing which skills, competences, and types of literacies are or are not mentioned across these 13 selected models, and thus shape and/or dominate the scholarly and public debate on digital literacy.

Method: Quick-scan analysis

The research used in the study is the quick-scan analysis. Quick-scan analysis allows for a cross-case exploration of multiple case studies, on the basis of a pre-determined set of variables. The method may be employed at the beginning of a research project in order to determine a set of relevant case studies for the specific field, and obtain a valuable overview of existing research on a topic. A mapping of variables and indicators into a single matrix facilitates the identification and analysis of similarities and variances between them. Consequently, a more in-depth analysis of some of the case studies may be pursued, in order to acquire a deeper understanding of the

interconnections that are suspected or have already been identified between the cases (Van Audenhove, Baelden, & Mariën, 2016).

The method has been chosen for this study as it allows for a fast but systematic way of identifying a set of conceptual models that the field of digital literacy builds upon, as well as the variances between them in terms of the skills and competences they promote. The small case studies in this research are 13 digital literacy models. As they all put forward different sets of skills and competences that individuals require in order to be considered digitally literate, the quick-scan analysis was deemed an efficient method to identify tendencies, similarities, and variances between the models. A close reading of the conceptual models resulted in the identification of 39 indicators, each of which was mentioned in at least one of the models discussed. These indicators were subsequently clustered into a matrix. For each of the indicators, a definition based on the literature review was formulated. The mapping of these indicators into a single matrix enabled a broad overview of the concepts promoted through existing digital literacy models, but also allowed for a cross-case analysis of similarities and variances. In some instances, the matrix also facilitated insights into how these models have conceptually evolved over the years, by tracing certain visual patterns.

The 13 digital literacy models were selected on the basis of several criteria. Firstly, the models needed to be consistently referred to and acknowledged in specialised literature. Secondly, the models had to be relevant to the discussion on digital literacy through conceptual novelty and a comprehensive analysis of a wide range of digital skills and competences. Priority was given to works that promoted their own sets of skills and competences, but that also proposed methods for measuring digital skills, implemented empirical studies of their own, or analysed established theory and empirical research within the digital skills framework. Thirdly, the models needed to be presented, to a certain degree, as frameworks, built upon a classification of knowledge, skills, and competences. Finally, the models had to be published over a period of ten years, between 2004 and 2014. This allowed for a prioritisation of more recent publications, but was also considered a wide enough time span for identifying evolutions in the debate.

It should be noted that some of the selected publications are considerably lengthier and more comprehensive than others. It is important to consider that books on the topic (e.g. Van Dijk & Van Deursen, 2014), extensive academic works (e.g. Belshaw, 2011), or institutional reports (e.g. Ala-Mutka, 2011; Hobbs, 2010) discuss the topic in more detail, and thus consider a wider range of indicators, in comparison to more condensed

works, such as journal articles (e.g. Calvani, Cartelli, Fini, & Ranieri, 2008; Hargittai, 2007). The availability of more details in the original works obviously leads to a more detailed description in our analysis. In other words, variations in the length and depth of the selected publications are inevitably reflected in the matrix.

As mentioned above, the quick-scan analysis of the 13 selected cases resulted in a matrix that contains 39 indicators (See: Appendix, Table 1). The cases are mapped in columns, while the indicators are placed in rows. The indicators have been divided into five categories: operational, technical and formal; information, cognition; digital communication; digital content creation; and strategic. An additional column has been introduced in order to count the amount of cases where each indicator is present. The matrix is an efficient tool for the cross-analysis of the cases as it provides a visual statement of which indicators have scored higher, and which lower.

Finally, once the matrix was composed, the 13 cases were analysed. The aim of the analysis was to identify similarities and differences between the models; evolutions over time; and which indicators are well and less well represented. It should be noted that while at times numbers are used (e.g. x number of models mention y indicator), the analysis is not a statistical exercise. Numbers are used strictly to indicate variances between models and indicators more clearly. The study does not make use of any statistical programmes or other techniques to detect correlations; the findings result from a visual analysis of the matrix, which is already based on a thorough literature review, and may be complemented by in-depth knowledge of the case studies.

Conceptual highlights and differences in 13 digital literacy models

The matrix serves for the cross-case analysis of the 13 digital literacy models on two levels (Van Audenhove et al., 2016). A first level of analysis is performed on the horizontal, between the different variables in the cases. This places focus on the indicators themselves, and aims to answer the question: *What indicators score high/low*? The analysis can further lead to questions regarding the reasons behind the findings, but can point towards the right method to answer these questions: *Can this be explained through more in-depth case studies? Can it be explained on the basis of the literature review? Does it confirm what was found in the initial literature review?* (Van Audenhove et al., 2016, p. 7). A second level of analysis asks the question: *Why are certain indicators absent?* (Van Audenhove et al., 2016, p. 7).

Answers to this have also been sought in the extensive literature review, by investigating what the conceptual underpinnings of the models are, and whether they can explain the absence of certain indicators. Similarly, enhanced attention has been paid to the period in which the models had been developed or published, in an attempt to explain the findings through developments in ICT, education, policy or other relevant contextual factors.

Not all the indicators that were identified and integrated into the matrix are discussed in this section. Priority has been given to findings that were deemed most relevant to the discussion on measuring and promoting digital skills and competences. An overview of the indicators, and the degree to which they are present in the different digital literacy models, can be found in the figures inserted after the discussion on each category of skills and competences, while an extended version of the matrix, together with more detailed definitions for each of the indicators used can be found in the report on Reconsidering Digital Skills (Iordache, Baelden, & Mariën, 2016). In the discussion on the findings, reference will be made to the extent to which indicators are mentioned in the different cases. When indicators are mentioned in more than 11 models, they are present in 'many or a large amount' of models. When they are identified by 7 to 10 models, they are part of a 'fair amount' of models and when they are mentioned by less than 7 models they are part of 'some' models (5-6) or 'few to very few' models (less than 5).

Operational, technical, and formal skills and competences

The first category discussed consists of operational, technical, and formal skills and competences (See: Appendix, Table 2). Among these, the indicators 'knowing and using hardware', and 'knowing and using digital tools and software' are at the foundation of virtually all digital literacy models analysed. Although many of the frameworks emphasise the fact that technology, or medium-related skills, are not necessarily the core elements of digital use, these are nevertheless a primary requirement:"Content-related skills somehow depend on the medium-related skills because the absence of medium-related skills means that one will not even come to perform the content-related skills" (van Deursen, 2010, p. 70). "Knowing and using the Internet' is discussed in a fair amount of cases, throughout the entire time span investigated, from the earliest to the most recent models. As the Internet has rapidly become a part of everyday life, most models agree that users require the skills and competences to make full use of the medium. In the

meantime, it is also important for researchers and policy-makers to understand the complexity of factors behind the ways in which people use the Internet, and the motivations behind them" (van Deursen et al., 2014, p. 7).

A fair amount of mentions was also awarded to the indicator 'handle digital structures', which refers to the ability to handle the distinctive structure of digital media, such as successfully working with menus, hyperlinks and associative navigation. In this context, Eshet-Alkalai (2004) discusses 'branching literacy', claiming that users face new challenges in having to deal with 'hypermedia and non-linear thinking', and need the skills to handle the new structures and not get lost in the digital space. Furthermore, we can observe a fair amount of attention given to skills related to 'privacy and the protection of personal data'. Research in the field of privacy has determined a trend that is particularly present in social networking sites (SNSs), where the responsibility is pushed towards the user (De Wolf, Heyman, & Pierson, 2013). In this context, it becomes instrumental for individuals to understand the way their data and personal information is being shared, accessed by others, or used by governments and corporations; and, more importantly, they need to have the necessary skills to protect themselves from disclosing information they may not need, or want to: "it is crucial that users understand that those sites (without the appropriate privacy settings and critical skills) can lead to loss of control of personal data, and to having it delivered to third parties for commercial purposes" (Ala-Mutka, 2011, p. 10).

At the other end of the spectrum, three indicators in this category have received limited attention in the models, having been mentioned in less than five of the cases: 'knowledge of where to seek assistance', 'cross-platform navigation', and 'device safety'. The authors, however, accept that these particular skills or competences may prove to be relevant on different levels of digital knowledge and usage, which could explain for their absence from some of the models. 'Cross-platform navigation', for example, denotes an advanced to proficient level of knowledge and skills that could only prove useful to a smaller percentage of users, while 'device safety' may often be implied by other indicators, such as 'knowing and using hardware', 'knowing and using digital tools and software' or 'knowing and using the Internet'. Nevertheless, we would like to point to 'knowledge of where to seek assistance' as an indicator which could have a positive impact on the initial uptake of digital tools and on finding further support for learning and development. The ability to know where to seek assistance, both online and offline, is related to concepts such as autonomy and problem-solving, which

have been identified as important factors in the development of digital competences (see Iordache et al., 2016). This knowledge could empower individuals to act independently in the development of their digital skills, to search for information, and to solve problems they may encounter (Mariën, 2016).

Information and cognition skills and competences

The second category discussed is comprised of information and cognition skills and competences (See: Appendix, Table 3). Here, the main focus is placed on critical skills through the indicator 'analyse and evaluate' online information, which is mentioned in all 13 models. Eshet-Alkalai goes as far as claiming that "the ability to evaluate and assess information properly has become a 'survival skill' for scholars and information consumers" (2004, p. 99). In this context, several of the analysed frameworks (Ala-Mutka, 2011; Bawden, 2008; Calvani et al., 2008; Martin & Grudziecki, 2006) integrate elements from Gilster's model (1997), the first to emphasise that digital skills were "about mastering ideas, not keystrokes"(Bawden, 2008, p. 13).

Many of the models also discuss several of the indicators clustered in this category under the construct of 'information literacy', which mainly incorporates the ability to 'search', 'identify/select', 'locate', 'access/retrieve/store', as well as 'disseminate/share' relevant information, thus generally concerned with "how data and information in any format and form are managed, using different technological tools" (UNESCO, 2013, p. 13). Although they are more difficult to acquire, once developed, cognitive skills are not as prone to quick changes as operational, medium-related skills that need to keep up with the rapid and constant development of technical tools (Ala-Mutka, 2011).

In addition to critical skills, the indicator 'digital problem-solving skills' is also discussed by a fair amount of the analysed models. Problem-solving skills can have a positive effect on the development of digital skills and competences, helping users identify the correct digital tools needed to reach their goals, as well as enhance their ability to use digital tools in order to solve conceptual, but also technical problems (Iordache et al., 2016). In the analysed models, problem-solving skills are defined as the ability to "identify digital needs and resources, make informed decisions on most appropriate digital tools according to the purpose or need, solve conceptual problems through digital means, creatively use technologies, solve technical problems, update own and other's competence" (Ferrari, 2013, p. 32).

Scholars have also claimed that the focus should not just be placed on autonomous problem-solving, as is currently the case in the educational system, but on collaborative problem-solving – working together in teams to complete tasks and develop new knowledge (Jenkins, 2006; van Dijk & van Deursen, 2014).

In this second category, the indicators that have been mentioned by few to very few models are: the ability to 'synthesise', 'multitasking', 'transmedia navigation', and 'supporting others in developing digital competence'. We believe that the first three indicators refer to a higher level of use and digital sophistication, the lack of which may have a limited impact on digital uptake and general use, and thus explain their absence from some of the models. However, the limited attention given to the latter has been deemed particularly worrisome, as supporting others in developing digital competence is important in an environment where technology evolves at a fast pace, determining users to constantly update their skills in order to keep up with digital changes. Research has shown that users often depend on various support groups to develop skills and competences, outside of the formal education environment (Hobbs, 2010), thus, family members, teachers, friends, and co-workers all play a part in providing encouragement and hands-on assistance in various contexts (van Dijk, 2005). This can arguably be discussed as an attitude and a contextual element, but also as an ability that users may develop in order to be able to support others.

Digital communication skills and competences

The third category of indicators focuses on digital communication skills and competences (See: Appendix, Table 4). The majority of these indicators are to be found in a large amount of the models discussed. Firstly, all models highlight skills related to indicators 'construct' and 'understand messages': *"*To read well, people need to acquire decoding and comprehension skills plus a base of knowledge from which they can interpret new ideas. To write, it is important to understand how words come together to form ideas, claims and arguments and how to design messages to accomplish the goals of informing, entertaining or persuading" (Hobbs, 2010, p. 31). Secondly, all models discuss the indicator 'exchange messages/share content'. To this end, users are thought to require the knowledge and ability to comment on or respond to material created and shared by others online (Hargittai, 2007), while at the same time be able to share with others the knowledge and content

they have themselves found or created, as well as be proactive in the spreading of news, content and resources (Ferrari, 2013).

Many of the models also discuss users' ability to "interact and collaborate online'. Jenkins claims that a 'participatory culture' is emerging 'as the culture absorbs and responds to the explosion of new media technologies that make it possible for average consumers to archive, annotate, appropriate, and recirculate media content in powerful new ways" (Jenkins, 2006, p. 8). According to this, in addition to communication skills that are necessary to convey messages and interact with online audiences, the skills to 'participate in online communities and networks' are therefore also important. This indicator was mentioned in a fair amount of digital literacy models and can be connected to the critical and privacy management skills discussed in the previous section, as users participating in online communities also need to be able to critically assess the information they consume and distribute.

'Netiquette' has also been discussed in many of the models. Netiquette is necessary for users to identify and follow existing rules on the appropriate and respectful way of communicating with others when using computer networks and the Internet. Belshaw refers to this type of skill as 'cultural' and describes it as a "need to understand the various digital contexts an individual may experience, different codes and ways of operating, things that are accepted and encouraged as well as those that are frowned upon and rejected" (Belshaw, 2011, p. 207). It has also been suggested that netiquette is a mode of online behaviour that must be learned in practice, seen as no formal guidance is readily available (van Dijk & van Deursen, 2014, p. 34). In the new media realm, the notion may also be associated with the concept of 'intimacy capital', formulated by Lambert (2015) in his research on how users negotiate unspoken, collective norms regarding the 'public performance of intimacy' (Lambert, 2015, p. 8) through their Facebook posts.

'Managing a digital identity' was discussed by only very few of the analysed models. Nevertheless, the digital environment provides numerous opportunities for users to create various 'public selves' which they can use in different spaces and contexts (Ala-Mutka, 2011, p. 41). Individuals can take part in a number of online communities using a different identity, avatar, or persona in each space (Belshaw, 2011). Therefore, in order to protect themselves but also to ensure an effective communication with others, it is important that users are aware of the information they share through these images and online personas, and how this information is accessed and traced online. Closely related to the ability to efficiently and safely manage a digital identity is the 'awareness of audience', indicator that was also present in few

of the models, and that will be further discussed in the next category of indicators.

Digital content creation skills and competences

Upon analysing the fourth group of indicators, consisting of digital content creation skills (See: Appendix, Table 5), the indicator 'create and edit new content/ construct new knowledge' is mentioned in a large amount of models. According to this, users should be able to create new knowledge, units of information, media products or other digital outputs which will contribute to task achievement or problem solution (Martin & Grudziecki, 2006, p. 257). The ability to 'produce creative expressions' is mentioned in many of the models, and seen as necessary for present day social participation, personal expression and professional activity: "Creativity with digital tools and media can benefit work, learning or hobbies by providing new and innovative means of carrying out tasks or presenting results. Being open to learn or invent, and to adapt and mould existing ways into new models is necessary" (Ala-Mutka, 2011, p. 52).

A fair amount of digital literacy models also points to the skill users need in order to 'integrate and remix existing content', as a relevant element in the development of digital competences. In this context, Eshet-Alkalai talks about 'reproduction literacy', or the "art of creative recycling of existing material" (Eshet-Alkalai, 2004, p. 96), which requires multi-dimensional synthetic thinking and aims to combine existing material in legitimate, original and creative ways. Often linked to the practice of integrating and remixing existing content is the 'intellectual property rights (IPR) and license awareness and management', an indicator that was also mentioned in a fair amount of the analysed models. As contemporary digital society is considered one where personal communication and mass communication converge (Castells, 2009), awareness and respect of property rights have become highly valued. To this end, users should not only be aware of rules regarding the use of existing work, but they should also be able to understand the various types of licencing, and correctly apply them to their own digital production (Ferrari, 2013).

As previously mentioned, the indicator 'awareness of audience' was only mentioned in few of the analysed models. Research in the domain has identified a series of different privacy and audience levels that users need to be aware of in their online activity. Firstly, there are the 'usual' audiences, where matters of interpersonal privacy come into play. Users who are not

knowledgeable about the open design of social media run the risk of downplaying the visibility of their online activity (De Wolf & Heyman, 2015). boyd (2010) claims there are three dynamics caused by social networking sites (SNSs) that users should be aware of: context collapse, invisible audiences, and the merging of the public and private spheres. In the socialisation process, people develop different contexts such as family, friends, and colleagues. However, SNSs make it challenging to clearly differentiate between the three, thus creating difficulties for users to adopt the online behaviour that is appropriate for each context. Research has also referred to 'imagined audiences' – a mental conceptualization of people towards whom a message may be addressed (Litt & Hargittai, 2016), and which may become challenging considering that the "average everyday user has likely not received any audience training so their strategies and cognizance may be somewhat happenstance and spontaneous" (Litt & Hargittai, 2016, p. 9). Affordances of social media create invisible audiences, making users unaware of who is able to access their online performance, while boundaries between the private and public sphere are blurred through social media privacy management strategies (Lampinen, Lehtinen, Lehmuskallio, & Tamminen, 2011). Secondly, people should be aware of who their audience is with regards to third parties. Information that people knowingly or unknowingly publish in the online realm may reach 'silent listeners' through apps (Stutzman, Gross, & Acquisti, 2013; Wang, Xu, & Grossklags, 2011) or advertisers. Research has shown that users are granted more options to control the information flow towards other users, than to third parties and service providers (Heyman, De Wolf, & Pierson, 2014). Thirdly, scholars discuss algorithmic control, which undermines the users' power over their online image and communication, placing the algorithm in charge of aspects of their daily lives (Beer, 2009). Lastly, the matter of online surveillance should also be considered by users, especially in light of recent disclosures regarding state surveillance (Greenwald & MacAskill, 2013), or the manipulation of users for research purposes, as is the case of the 'Facebook experiment' (Chambers, 2014).

Strategic skills and competences

In the strategic skills category (See: Appendix, Table 6), a fair amount of models discusses the skill to 'use information towards personal or professional goals'. van Dijk and van Deursen (2014) consider strategic skills to be the most advanced Internet skills, and claim they should be linked

to notions of empowerment and decision-making. In this context, users should be able to orient themselves, decide and act upon information retrieved online to reach a particular goal, and eventually derive personal or professional benefits. Strategic skills are built upon the previously discussed categories of skills and competences, but are considered to be at a higher stage in achieving educational, professional, and personal goals through the appropriate use of digital means (Martin & Grudziecki, 2006, p. 265).

Within the same category, however, the ability to 'identify digital competence gaps' was only mentioned in few of the analysed models. Nonetheless, as digital literacy needs vary according to particular life situations (Martin & Grudziecki, 2006) and change with the introduction of new technology and communication tools, the development of digital skills and competences is a lifelong process for which each individual needs to take personal responsibility (Ala-Mutka, 2011, p. 42). Users must be able to reflect on their level of competence, in order to identify the direction in which they need to further develop, while aiming to reach personal and professional goals in the current digital age. To this end, the DIGCOMP project proposes a detailed self-assessment grid as a tool for users to describe and understand how to improve their own level of digital competence (see Ferrari, 2013).

Discussion

The quick-scan exercise has confirmed the highly complex nature of identifying and defining digital skills, literacies, and related competences. Although a set of 39 indicators was successfully established based upon the 13 digital literacy models considered, identifying the indicators within the models has proven to be a difficult task, precisely due to the lack of a clear distinction and the overlap between the concepts. Considering the potential application of these models for the measurement, evaluation and comparison of digital literacy levels, there is a clear need for a more integrated conceptual approach, or even more, an overarching unique framework to be used as a common starting point.

Another major challenge lies within the conversion of such an overarching framework, and the extensive number of indicators it would encompass, into survey questions. Issues regarding oversimplification of indicators, technological determinism or limits of self-reporting for measuring digital skills, literacies and related competences have been highlighted extensively in literature (van Deursen, 2010).

First steps in this direction are currently being taken by the Institute for Prospective Technological Studies (IPTS), one of the seven joint research centres (JRC) of the European Commission. This is attempted through the further elaboration of the DIGCOMP framework, developed by Ala-Mutka (2011) and Ferrari (2013), into 'The Digital Competence Framework for Citizens - Update Phase 1: The conceptual reference model' (Vuorikari, Punie, Carretero, & Van den Brande, 2016).

The quick-scan analysis of the 13 digital literacy models has led to a series of interesting findings with regards to the digital skills and competences that are being promoted in recent conceptual models. It is important to note that there is an unbalanced focus on certain skills and competences, to the detriment of others, some of which are, arguably, just as relevant. Firstly, skills related to 'knowing and using hardware', 'knowing and using digital tools and software', and 'knowing and using the Internet' are discussed by nearly all of the digital literacy models analysed. As discussed in the previous section, operational, technical and formal skills and competences are generally regarded as the foundation of digital usage, and are thus widely integrated and discussed in the models. Information and cognition skills and competences, such as being able to 'search', 'identify/select', 'disseminate/share', and 'locate' the information needed, are also mentioned in the majority of the 13 digital literacy models. The ability to 'analyse and evaluate' content is regarded as relevant by all conceptual models, as they collectively stress it is crucial for users to develop the necessary critical skills to make the right decisions with regards to the content they encounter online. Interestingly, the majority of skills and competences in the digital communication category, such as 'construct messages', 'understand messages', 'exchange messages/share content', 'interact/collaborate online', 'netiquette', and 'encode/decode messages', have been discussed by the large majority of the digital literacy models employed in the study. The ability to 'create and edit new content/construct new knowledge' and 'produce creative expressions' were also present in almost all of the models, thus demonstrating that it is important to differentiate between digital communication and digital content creation.

Although seen as instrumental by a fair amount of models, strategic skills are completely left out of several digital literacy models. Users indeed require skills from all of the categories discussed above in order to develop this particular category of competences. However, the importance of users to be able to 'use information towards personal or professional goals' needs to be rethought and, we believe, regarded as highly relevant in future models.

Societal and technological developments provide valuable context for the increased visibility of certain indicators, as well as the reduced attention others have received over time. Thus, an interesting finding refers to indicators 'managing a digital identity' and 'awareness of audience'. Although mentioned in few to very few of the models, these have arguably become more important with the introduction and increasing popularity of new media. This shift of focus can be visually traced on our matrix, as the two indicators are discussed primarily in models developed after 2010. Notions such as 'privacy and protection of personal data' have also become more present and, possibly more valued, in discussions on digital skills and competences over time, for similar reasons associated with the new challenges determined by the introduction and use of new media. Meanwhile, the increase in mentions of content creation and remixing skills can be attributed to a more general availability and accessibility of digital creation tools and content sharing applications.

Finally, the analysis emphasises the need to expand the digital skills debate beyond the micro-perspective. Too often digital literacy models refer to individual attributes, without taking into account the social context. Although the framework proposed by Jenkins (2006) clearly demonstrates the need for a community-based approach for the development of digital skills, there is an evident lack of focus on more contextual skills such as 'knowledge of where to seek assistance' and 'supporting others in developing digital competence' in most other frameworks. The importance and potential influence of support mechanisms has however been discussed extensively in the work of Hobbs (2010), van Dijk (2005), and Eynon and Geniets (2015). It is clear that, in the future, there is need for more attention, reflection, and integration of the notion of support networks and the ability to share different knowledge and resources, thus opening up the digital skills debate to the meso- and macro-level.

References

Ala-Mutka, K. (2011). *Mapping Digital Competence: Towards a Conceptual Understanding* (Technical Note No. JRC67075-2011). European Commission Joint Research Centre, Institute for Prospective Technological Studies.

Bawden, D. (2008). Origins and Concepts of Digital Literacy. In C. Lankshear (Ed.), *Digital literacies: concepts, policies and practices* (pp. 17-32). New York, NY: Lang.

Beer, D. (2009). Power through the algorithm? Participatory web cultures and the technological unconscious. *New Media & Society*, *11*(6), 985–1002. https://doi.org/10.1177/1461444809336551

Belshaw, D. (2011). *What is "digital literacy"?* United Kingdom.

boyd, danah (2010). Social Network Sites as Networked Publics: Affordances, Dynamics, and Implications. In Z. Papacharissi (Ed.), *A Networked Self: Identity, Community, and Culture on Social Network Sites* (pp. 39-58). Routledge.

Buckingham, D. (2003). *Media education: literacy, learning, and contemporary culture*. Cambridge, UK : Malden, MA: Polity Press; Distributed in the USA by Blackwell Pub.

Buckingham, D., Banaji, S., Carr, D., Cranmer, S., & Willett, R. (2005). *The media literacy of children and young people: A review of the research literature.* Retrieved from http://eprints.ioe.ac.uk/145/1/Buckinghammedialiteracy.pdf

Calvani, A., Cartelli, A., Fini, A., & Ranieri, M. (2008). Models and Instruments for Assessing Digital Competence at School. *Journal of E-Learning and Knowledge Society*, *4*(3), 183–193.

Castells, M. (2009). *Communication Power*. OUP Oxford.

Chambers, C. (2014, July 1). Facebook fiasco: was Cornell's study of "emotional contagion" an ethics breach? *The Guardian*. Retrieved from http://www.theguardian.com/science/head-quarters/2014/jul/01/facebook-cornell-study-emotional-contagion-ethics-breach

De Wolf, R., & Heyman, R. (2015). Privacy and Social Media. In P. H. Ang & R. Mansell (Eds.), *The International Encyclopedia of Digital Communication and Society* (pp. 1-6). Hoboken, NJ, USA: John Wiley & Sons, Inc. Retrieved from http://doi.wiley.com/10.1002/9781118767771.wbiedcs118

De Wolf, R., Heyman, R., & Pierson, J. (2013). Privacy by Design Through a Social Requirements Analysis of Social Network Sites form a User Perspective. In S. Gutwirth, R. Leenes, P. de Hert, & Y. Poullet (Eds.), *European Data Protection: Coming of Age* (pp. 241-265). Springer Netherlands. https://doi.org/10.1007/978-94-007-5170-5_11

DTI, EAVI, & European Commission. (2011). *Testing and Refining Criteria to Assess Media Literacy Levels in Europe. Final Report*.

Eshet-Alkalai, Y. (2004). Digital literacy: a conceptual framework for survival skills in the digital era. *Journal of Educational Multimedia and Hypermedia*, *13*(1), 93–106.

European Commission (2008). *The european qualifications framework for lifelong learning (EFQ)*. Luxembourg: Office for Official Publications of the European Communities.

Eynon, R., & Geniets, A. (2015). The digital skills paradox: how do digitally excluded youth develop skills to use the internet? *Learning, Media and Technology*, 1–17. https://doi.org/10.1080/17439884.2014.1002845

Ferrari, A. (2013). *DIGCOMP a framework for developing and understanding digital competence in Europe.* Luxembourg: Publications Office. Retrieved from http://dx.publications.europa.eu10.2788/52966

Frau-Meigs, D. (2012). Transliteracy as the new research horizon for media and information literacy. *Media Studies - Critical Insights in European Media Literacy Research and Policy Special Issue*, *3*(6).

Gilster, P. (1997). *Digital literacy*. New York, NY: Wiley.

Greenwald, G., & MacAskill, E. (2013, June 7). NSA Prism program taps in to user data of Apple, Google and others. *The Guardian*. Retrieved from http://www.theguardian.com/world/2013/jun/06/us-tech-giants-nsa-data

Hargittai, E. (2007). A framework for studying differences in people's digital media uses. In K. I. Bildung (Ed.), *Grenzenlose Cyberwelt?* (pp. 121-136). VS Verlag für Sozialwissenschaften. https://doi.org/10.1007/978-3-531-90519-8_7

Helsper, E. J. (2011). The Social Dynamics of Information and Communication Technology. *Information, Communication & Society*, *14*(2), 295–297. https://doi.org/10.1080/1369118X.2010.539245

Helsper, E. J., & Eynon, R. (2013). Pathways to digital literacy and engagement. *European Journal of Communication*, *28*(6).

Helsper, E. J., & Reisdorf, B. C. (2016). The emergence of a "digital underclass" in Great Britain and Sweden: Changing reasons for digital exclusion. *New Media & Society*. https://doi.org/10.1177/1461444816634676

Heyman, R., De Wolf, R., & Pierson, J. (2014). Evaluating social media privacy settings for personal and advertising purposes. *Info*, *16*(4), 18-32. https://doi.org/10.1108/info-01-2014-0004

Hobbs, R. (2010). *Digital and Media Literacy: A Plan of Action. A White Paper on the Digital and Media Literacy Recommendations of the Knight Commission on the Information Needs of Communities in a Democracy*. Aspen Institute.

Hoechsmann, M., & Poyntz, S. R. (2012). *Media literacies: a critical introduction*. Malden, MA: Wiley-Blackwell.

Iordache, C., Baelden, D., & Mariën, I. (2016). *Reconsidering digital skills: A theoretical questioning of the skills that define e-inclusion.* https://doi.org/10.13140/RG.2.1.3229.4007

Jenkins, H. (2006). *Confronting the Challenges of Participatory Culture: Media Education for the 21st Century* (Occasional paper on digital media and learning). The John D. and Catherine T. MacArthur Foundation. Retrieved from www.digitallearning.macfound.org

Lambert, A. (2015). Intimacy and social capital on Facebook: Beyond the psychological perspective. *New Media & Society*. https://doi.org/10.1177/1461444815588902

Lampinen, A., Lehtinen, V., Lehmuskallio, A., & Tamminen, S. (2011). We'Re in It Together: Interpersonal Management of Disclosure in Social Network Services. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 3217-3226). New York, NY, USA: ACM. https://doi.org/10.1145/1978942.1979420

Lankshear, C., & Knobel, M. (2008). *Digital Literacies: Concepts, policies and practices*. New York, Bern, Berlin, Bruxelles, Frankfurt am Main, Oxford, Wien: Peter Lang, International Academic Publishers.

Litt, E., & Hargittai, E. (2016). The Imagined Audience on Social Network Sites. *Social Media + Society*, *2*(1). https://doi.org/10.1177/2056305116633482

Livingstone, S. (2004). Media Literacy and the Challenge of New Information and Communication Technologies. *The Communication Review*, *7*(1), 3-14. https://doi.org/10.1080/10714420490280152

Mariën, I. (2016). *De Dichotomie van de Digitale Kloof Doorprikt: Een Onderzoek naar de Oorzaken van Digitale Uitsluiting en naar Strategieën voor een Duurzaam e-Inclusie Beleid* (Unpublished dissertation). Department of Communication Sciences, Vrije Universiteit Brussel.

Mariën, I., & Prodnik, J. (2014). Digital inclusion and user (dis)empowerment: a critical perspective. *Info*, *16*(6), 35-47. https://doi.org/10.1108/info-07-2014-0030

Martin, A., & Grudziecki, J. (2006). DigEuLit: Concepts and Tools for Digital Literacy Development. *Innovation in Teaching and Learning in Information and Computer Sciences*, *5*(4), 249-267. https://doi.org/10.11120/ital.2006.05040249

Martin, A., & Madigan, D. (Eds.). (2006). *Digital literacies for learning*. London: Facet.

Potter, W. J. (2004). *Theory of media literacy: a cognitive approach*. Thousand Oaks, Calif: SAGE Publications.

Schurmans, D., & Mariën, I. (2013). *Naar gebruikersprofielen van jongeren in maatschappelijk kwetsbare situaties: Over digitale media, sociale contacten en digitale ongelijkheden* (p. 44). Brussels: Vlaams Kenniscentrum voor Mediawijsheid, Mediawijs.be.

Steyaert, J. (2002). Inequality and the digital divide: myths and realities. *Advocacy, Activism and the Internet*, 199-211.

Stutzman, F., Gross, R., & Acquisti, A. (2013). Silent Listeners: The Evolution of Privacy and Disclosure on Facebook. *Journal of Privacy and Confidentiality*, *4*(2). Retrieved from http://repository.cmu.edu/jpc/vol4/iss2/2

UNESCO. (2013). *Global Media and Information Literacy Assessment Framework: Country Readiness and Competencies*. Paris, France.

Van Audenhove, L., Baelden, D., & Mariën, I. (2016). Quick-Scan Analysis of Multiple Case Studies. https://doi.org/10.13140/RG.2.1.4501.8649

van Deursen, A. (2010). *Internet skills vital assets in an information society*. Enschede: University of Twente [Host].

van Deursen, A., Helsper, E. J., & Eynon, R. (2014). *Measuring Digital Skills. From Digital Skills to Tangible Outcomes project report.* Retrieved from www.oii.ox.ac.uk/research/projects/?id=112

van Deursen, A., & van Dijk, J. (2014). The digital divide shifts to differences in usage. *New Media & Society*, *16*(3), 507–526.

van Dijk, J. (2005). *The deepening divide: inequality in the information society*. Thousand Oaks, Calif.: Sage.

van Dijk, J., & van Deursen, A. (2014). *Digital skills: unlocking the information society*.

Vuorikari, R., Punie, Y., Carretero, S., & Van den Brande, L. (2016). *DigComp 2.0: The Digital Competence Framework for Citizens. Update Phase 1: The Conceptual Reference Model* (p. 44). Luxembourg: Publication Office of the European Union.

Wang, N., Xu, H., & Grossklags, J. (2011). Third-party Apps on Facebook: Privacy and the Illusion of Control. In *Proceedings of the 5th ACM Symposium on Computer Human Interaction for Management of Information Technology* (p. 1-10). New York, NY, USA: ACM. https://doi.org/10.1145/2076444.2076448

Appendix

Table 1. Matrix digital skills and competences

	Totals	ESHET-ALKALAI (2004)	JENKINS (2006)	MARTIN & GRUDZIECKI (2006)	HARGITTAI (2007)	BAWDEN (2008)	CALVANI ET AL. (2008)	HOBBS (2010)	BELSHAW (2011)	ALA-MUTKA (2011)	FERRARI (2013)	UNESCO (2013)	VAN DIJK & VAN DEURSEN (2014)	VAN DEURSEN, HELSPER & EYNON (2014)
INDICATORS														
DIGITAL SKILLS and COMPETENCES														
OPERATIONAL, TECHNICAL AND FORMAL		6	4	3	5	3	4	5	5	8	8	4	6	6
Knowing and using hardware	13	x	x	x	x	x	x	x	x	x	x	x	x	x
Knowing and using digital tools and software	12	x	x	x	x		x	x	x	x	x	x	x	x
Knowing and using the Internet	11	x	x	x	x			x	x	x	x	x	x	x
Knowledge of where to seek assistance	4				x					[x]	x		(x)	
Cross-platform navigation	3								x	x	x			
Handle digital structures	10	x				x	x	x	x	x	x	x	x	x
Device safety	4	x								x	x			x
Privacy | protection of personal data	10	x	x		x	x	x	x		x	x		x	x
INFORMATION | COGNITION		11	11	9	5	4	5	8	4	9	12	8	8	7
Search	12	x	x	x	x	x	x	x		x	x	x	x	x
Identify/Select	12	x	x	x	x	x	x	x		x	x	x	x	x
Locate	11	x	x	x	x	x		x		x	x	x	x	x
Access/Retrieve/Store	9	x	x	x				x		x	x	x	x	x
Organise	6	x		x						x	x	x	x	x
Synthesise	5	x	x	x							x	x		
Disseminate | Share	11	x	x	x	x			x	x	x	x	x	x	x
Distributed cognition	6	x	x				x		x	x	x			
Multitasking	1		x											
Digital problem-solving skills	8	x	x	x			x	x	x	x	x			
Support others in developing digital competence	2										x		x	
Analyse and evaluate	13	x	x	x	x	x	x	x	x	x	x	x	x	x
Transmedia navigation	4	x	x					x			x			
DIGITAL COMMUNICATION		7	9	4	6	5	6	8	8	8	9	8	9	7
Encode/decode messages	11	x	x			x	x	x	x	x	x	x	x	x
Construct messages	13	x	x	x	x	x	x	x	x	x	x	x	x	x
Understand messages	13	x	x	x		x	x	x	x	x	x	x	x	x
Exchange messages/Share content	13	x	x	x	x	x	x	x	x	x	x	x	x	x
Interact/Collaborate online	12	x	x	x	x		x	x	x	x	x	x	x	x
Participate in online communities & networks	10	x	x		x			x	x	x	x	x	x	x
Efficiency in communication	6		x		x			x			x	x	x	
Managing a digital identity	5		x						x	x	x		x	
Netiquette	12	x	x		x	x	x	(x)	x	x	x	x	x	x
DIGITAL CONTENT CREATION		5	5	3	1	1	2	6	4	4	7	3	6	7
Create and edit new content/Construct new knowledge	12	x	x	x		x	x	x	x	x	x	x	x	x
Integrate and remix existing content	8	x	x	x					x	x	x		x	x
Produce creative expressions	11	x	x	x			x	x	x	x	x	x	x	x
Awareness of purpose	4							x			x		x	x
Awareness of audience	4							x			x		x	x
Awareness of composition techniques	7	x	x		x			x			x		x	x
IPR and license awareness and management	8	x	x					x	x	x	x	x		x
STRATEGIC		1	0	2	0	1	1	1	0	2	2	1	1	0
Use information towards personal or professional goals	9	x		x		x	x	x		x	x	x	x	
Identify digital competence gaps	3			x						x	x			

Table 2. Operational, technical and formal skills and competences

INDICATORS	Totals	ESHET-ALKALAI (2004)	JENKINS (2006)	MARTIN & GRUDZIECKI (2006)	HARGITTAI (2007)	BAWDEN (2008)	CALVANI ET AL. (2008)	HOBBS (2010)	BELSHAW (2011)	ALA-MUTKA (2011)	FERRARI (2013)	UNESCO (2013)	VAN DIJK & VAN DEURSEN (2014)	VAN DEURSEN, HELSPER & EYNON (2014)
DIGITAL SKILLS and COMPETENCES														
OPERATIONAL, TECHNICAL AND FORMAL		6	4	3	5	3	4	5	5	8	8	4	6	6
Knowing and using hardware	13	x	x	x	x	x	x	x	x	x	x	x	x	x
Knowing and using digital tools and software	12	x	x	x	x		x	x	x	x	x	x	x	x
Knowing and using the Internet	11	x	x	x	x			x	x	x	x	x	x	x
Knowledge of where to seek assistance	4				x					[x]	x		(x)	
Cross-platform navigation	3								x	x	x			
Handle digital structures	10	x				x	x	x	x	x	x	x	x	x
Device safety	4	x								x	x			x
Privacy | protection of personal data	10	x	x		x	x	x	x		x	x		x	x

Table 3. Information, cognition skills and competences

INDICATORS	Totals	ESHET-ALKALAI (2004)	JENKINS (2006)	MARTIN & GRUDZIECKI (2006)	HARGITTAI (2007)	BAWDEN (2008)	CALVANI ET AL. (2008)	HOBBS (2010)	BELSHAW (2011)	ALA-MUTKA (2011)	FERRARI (2013)	UNESCO (2013)	VAN DIJK & VAN DEURSEN (2014)	VAN DEURSEN, HELSPER & EYNON (2014)
DIGITAL SKILLS and COMPETENCES														
INFORMATION | COGNITION		11	11	9	5	4	5	8	4	9	12	8	8	7
Search	12	x	x	x	x	x	x	x		x	x	x	x	x
Identify/Select	12	x	x	x	x	x	x	x		x	x	x	x	x
Locate	11	x	x	x	x	x		x		x	x	x	x	x
Access/Retrieve/Store	9	x	x	x				x		x	x	x	x	x
Organise	6	x		x						x	x	x	x	x
Synthesise	5	x	x	x							x	x		
Disseminate | Share	11	x	x	x	x			x	x	x	x	x	x	x
Distributed cognition	6	x	x				x		x	x	x			
Multitasking	1		x											
Digital problem-solving skills	8	x	x	x			x	x	x	x	x			
Support others in developing digital competence	2										x		x	
Analyse and evaluate	13	x	x	x	x	x	x	x	x	x	x	x	x	x
Transmedia navigation	4	x	x					x			x			

Table 4. Digital communication skills and competences

INDICATORS	Totals	ESHET-ALKALAI (2004)	JENKINS (2006)	MARTIN & GRUDZIECKI (2006)	HARGITTAI (2007)	BAWDEN (2008)	CALVANI ET AL. (2008)	HOBBS (2010)	BELSHAW (2011)	ALA-MUTKA (2011)	FERRARI (2013)	UNESCO (2013)	VAN DIJK & VAN DEURSEN (2014)	VAN DEURSEN, HELSPER & EYNON (2014)
DIGITAL SKILLS and COMPETENCES														
DIGITAL COMMUNICATION		7	9	4	6	5	6	8	8	8	9	8	9	7
Encode/decode messages	11	x	x			x	x	x	x	x	x	x	x	x
Construct messages	13	x	x	x	x	x	x	x	x	x	x	x	x	x
Understand messages	13	x	x	x		x	x	x	x	x	x	x	x	x
Exchange messages/Share content	13	x	x	x	x	x	x	x	x	x	x	x	x	x
Interact/Collaborate online	12	x	x	x	x		x	x	x	x	x	x	x	x
Participate in online comunities & networks	10	x	x		x			x	x	x	x	x	x	x
Efficiency in communication	6		x		x			x			x	x	x	
Managing a digital identity	5		x						x	x	x		x	
Netiquette	12	x	x		x	x	x	(x)	x	x	x	x	x	x

Table 5. Digital content creation skills and competences

INDICATORS	Totals	ESHET-ALKALAI (2004)	JENKINS (2006)	MARTIN & GRUDZIECKI (2006)	HARGITTAI (2007)	BAWDEN (2008)	CALVANI ET AL. (2008)	HOBBS (2010)	BELSHAW (2011)	ALA-MUTKA (2011)	FERRARI (2013)	UNESCO (2013)	VAN DIJK & VAN DEURSEN (2014)	VAN DEURSEN, HELSPER & EYNON (2014)
DIGITAL SKILLS and COMPETENCES														
DIGITAL CONTENT CREATION		5	5	3	1	1	2	6	4	4	7	3	6	7
Create and edit new content/Construct new knowledge	12	x	x	x		x	x	x	x	x	x	x	x	x
Integrate and remix existing content	8	x	x	x					x	x	x		x	x
Produce creative expressions	11	x	x	x			x	x	x	x	x	x	x	x
Awareness of purpose	4							x			x		x	x
Awareness of audience	4							x			x		x	x
Awareness of composition techniques	7	x	x		x			x			x		x	x
IPR and license awareness and management	8	x	x					x	x	x	x	x		x

Table 6. Strategic digital skills and competences

INDICATORS	Totals	ESHET-ALKALAI (2004)	JENKINS (2006)	MARTIN & GRUDZIECKI (2006)	HARGITTAI (2007)	BAWDEN (2008)	CALVANI ET AL. (2008)	HOBBS (2010)	BELSHAW (2011)	ALA-MUTKA (2011)	FERRARI (2013)	UNESCO (2013)	VAN DIJK & VAN DEURSEN (2014)	VAN DEURSEN, HELSPER & EYNON (2014)
DIGITAL SKILLS and COMPETENCES														
STRATEGIC		1	0	2	0	1	1	1	0	2	2	1	1	0
Use information towards personal or professional goals	9	x		x		x	x	x		x	x	x	x	
Identify digital competence gaps	3			x						x	x			