Spante et al., *Cogent Education* (2018), 5: 1519143
https://doi.org/10.1080/2331186X.2018.1519143

cogent education

INFORMATION & COMMUNICATIONS TECHNOLOGY IN EDUCATION | REVIEW ARTICLE

Digital competence and digital literacy in higher education research: Systematic review of concept use

Maria Spante[1]*, Sylvana Sofkova Hashemi[2], Mona Lundin[3] and Anne Algers[3]

Received: 28 June 2018
Accepted: 12 August 2018
First Published: 06 September 2018

*Corresponding author: Maria Spante, School of Business, Economics & IT, Division of Informatics, University West, SE-461 86 Trollhättan, Sweden
E-mail: maria.spante@hv.se

Reviewing editor:
Shuyan Wang, The University of Southern Mississippi, USA

Additional information is available at the end of the article

Abstract: Digital competence and digital literacy are concepts that are increasingly used in public discourse. However, how the concepts are used and how they are defined remains unclear. This paper presents a systematic review of research where these concepts are used in higher education research. The aim is to establish an understanding of referencing strategy to digital literacy and digital competence over time, disciplines, countries, methods and level of analysis. Three databases were used in the systematic literature review: Web of Science, Scopus and Education Resources Information Centre. We delimited the search to title, abstract and keywords in the databases. Inclusion criteria were peer-reviewed publications written in English. Initially 107 publications between 1997 and 2017 were found, with 28 addressing digital competence and 79 digital literacy. Our review demonstrates that there is a range of definitions used in higher education research. They vary depending on if the concepts are defined by policy, research or both and whether they focus on technical skills or social practices. This review

ABOUT THE AUTHORS

Dr Maria Spante is a senior lecturer at the School of Business, Economics and IT, University West, Sweden. Her research interests include digitalization, organization, competence development, socio-technical systems, design and work-integrated learning.

Dr Sylvana Sofkova Hashemi is an Associate Professor in educational science at the Department of Pedagogical, Curricular and Professional Studies, University of Gothenburg, Sweden. Her research interests include technology-mediated teaching and learning, multiliteracies, textual and multimodal competencies and teachers' professional learning.

Dr Mona Lundin is an Associate Professor at the Department of Education, Communication and Learning, University of Gothenburg, Sweden. Her research interests include professional learning, communication and use of social media.

Dr Anne Algers is a Senior lecturer at the Department of Education, Communication and Learning, University of Gothenburg, Sweden. She has an interdisciplinary approach to teaching and learning and uses the framework of cultural historical activity theory.

PUBLIC INTEREST STATEMENT

"Digital competence" and "digital literacy" are terms increasingly used in public discourse. However, the use and definition of these concepts remains unclear. We present a systematic review of peer-reviewed articles where these concepts are used in higher education research. Our review demonstrates that a range of definitions has been used during the period 1997–2017. They vary depending on whether the concepts are defined by policy, research or both, and whether they focus on technical skills or social practices. The review indicates directions for future research to avoid commonsensical use of the concepts and cross-referencing incompatibilities. There is a need for critical investigation that pays attention to the origins of definitions. Furthermore, it is important to clarify the rationale for the specific selection of different definitions. Such clarifications facilitate understanding whether the research effort is linked to investigating policy implementation or a more critical investigation linked to digital competence or digital literacy.

cogent oa

© 2018 The Author(s). This open access article is distributed under a Creative Commons Attribution (CC-BY) 4.0 license.

indicates directions for further research in higher education i) do more research based on critical perspectives to avoid commonsensical use of the concepts, ii) take the development of definitions of these concepts seriously iii) avoid cross-referencing incompatibilities and finally iv) engage in critical investigations regarding the legitimacy of policy over research in the domain of higher education research.

Subjects: Information & Communication Technology (ICT); Higher Education; Information Technology

Keywords: digital literacy; digital competence; higher education; systematic literature review

1. Introduction

Over the last few decades, the concepts *digital competence* and *digital literacy* have been used more frequently and are increasingly discussed, particularly in policy documents and policy-related discussions related to "what kinds of skills and knowing people should have in a knowledge society, what to teach young people and how to do so" (Ilomäki, Paavola and Lakkala, 2016, p. 655). Often, they are used synonymously although they have distinct origins and meanings (se e.g. Iordache, Mariën, & Baelden, 2017; Martin & Grudziecki, 2006). Sometimes they are used to underpin each other, such as the EU framework of key competencies for all citizens (European Commission, 2006) where digital competence as one of eight key competencies is defined as follows:

> "Digital competence involves the confident and critical use of Information Society Technology (IST) for work, leisure and communication. It is underpinned by basic skills in ICT: the use of computers to retrieve, assess, store, produce, present and exchange information, and to communicate and participate in collaborative networks via the Internet" (p. 16)

Here it is indicated that digital competence is underpinned by digital literacy, according to Martin and Grudziecki (2006). In 2013, the European Commission published a Digital Competence Framework based on five areas and 21 competences, which include the notion of digital literacy (Ferrari, 2013). At a systemic level policy documents often emphasize the need to invest in digital skills enhancement for economic growth and competitiveness (European Commission, 2010). Furthermore, it has been argued that in our interconnected world "sustainable development and social cohesion depend critically on the competencies of all of our population—with competencies understood to cover knowledge, skills, attitudes and values" (OECD, 2005, p. 4). In addition, in 2008 UNESCO launched the policy document *ICT competency standard for teachers* with focus on teacher education and digital literacy without defining the concepts (UNESCO, 2008). In Sweden, digital competence is also used as a foundational concept in the currently launched national strategy for the digitalization of education (Swedish Ministry of Education, 2017). The overall aim of this strategy is to provide children and students the opportunity to develop the ability to use and create with digital technology and understand how digitalization affects the individual and society. Three areas in particular are in focus: *Digital competence for all in the school system, Equal access and use, and Research and evaluation of the possibilities of digitalization*. Thus, personnel working with children and students should develop the competence to choose and use appropriate digital tools in education and the opportunity to develop digital competence during their education and through workplace training.

In this review, we are interested in systematically exploring the use of these two concepts in higher education (HE) research to provide an understanding of research and policy approaches to the definitions, and the patterns of how the concepts have been used over time, and with respect to disciplines, countries, methods and level of analysis. HE is, similar to K-12 schooling, becoming increasingly digitalized which has resulted in new challenges for university leadership and teachers in providing high-quality teaching and adapting to the needs of changing student populations. The aim of the review is to identify HE publications that define or discuss the concepts digital

competence and digital literacy and show in a systematic manner how these two concepts have been used in HE research. The following research questions are addressed in this review:

(1) How have the concepts digital competence and digital literacy been defined and used in HE research?

(2) What are the implications of these concepts' definitions and use for HE research?

2. Methods and materials

The review builds on a systematic literature search in selected databases following established recommendations for using several databases, defining inclusion and exclusion criteria for publications selected for the review process as well as transparency in the selection process (Bendermarcher, oude Egbrink, Wolfhagen and Dolmans, 2016; Connolly, Boyle, MacArthur, Hainey, & Boyle, 2012). Our approach to such recommendations is outlined below.

2.1. Database selections and search terms

Three databases were used in this systematic literature review: Web of Science, Scopus and Education Resources Information Center (ERIC). Web of Science and Scopus were selected as the primary databases for international multidisciplinary academic literature (Aghaei Chadegani et al., 2013). ERIC was included as it specializes in educational research publications. The following search terms were used in this systematic review:

(i) "digital competenc*" AND "higher education"

(ii) "digital literac*" AND "higher education"

We delimited the search to title, abstract and keywords in the databases as our deliberate search strategy to decrease the number of publications to read as well as increase the precision of the information search (Guo and Huang 2011; Savolainen, 2016). Our main rationale was to identify publications that explicitly defined or discussed the concepts digital competence and digital literacy the motive for which was that if the authors have included these concepts there, then these concepts are central to the publications as well (Syed & Collins-Thompson, 2017).

2.2. Inclusion and exclusion criteria for selection of publications

We narrowed the number of publications by specifying further selection criteria. The inclusion criteria were that the publications should be peer-reviewed articles, reviews or conference papers written in English. Publications such as policy documents, books, reports, etc. were excluded as the interest was to systematically capture how digital literacy and digital competence is used and defined within HE research. No restrictions on the year of publication were set. The material includes publications from 1997 until 2017. The searches were conducted in September 2017. Initially, 141 publications met the inclusion criteria. However, in our manual screening of the publications 6 papers were excluded (the reasons being that three were not in English, two were book reviews, and one was a duplicate), leaving 135 publications as review material. The 135 publications, 36 concerning digital competence and 99 digital literacy, were divided among the authors for further manual screening.

2.2.1. Screening and eligibility assessment results—digital competence

Initially, 36 publications met the inclusion criteria in regard to papers concerning digital competence. In the manual screening, 8 of these were excluded due to the following reasons: non-HE (3), book chapter (1), not peer-reviewed (4). Finally, 28 HE publications on digital competence were included in the systematic review.

2.2.2. Screening and eligibility assessment results—digital literacy

Initially, 99 publications met the inclusion criteria regarding digital literacy. In the manual screening 20 of these were excluded. The exclusion of the papers was for to two reasons: not regarding

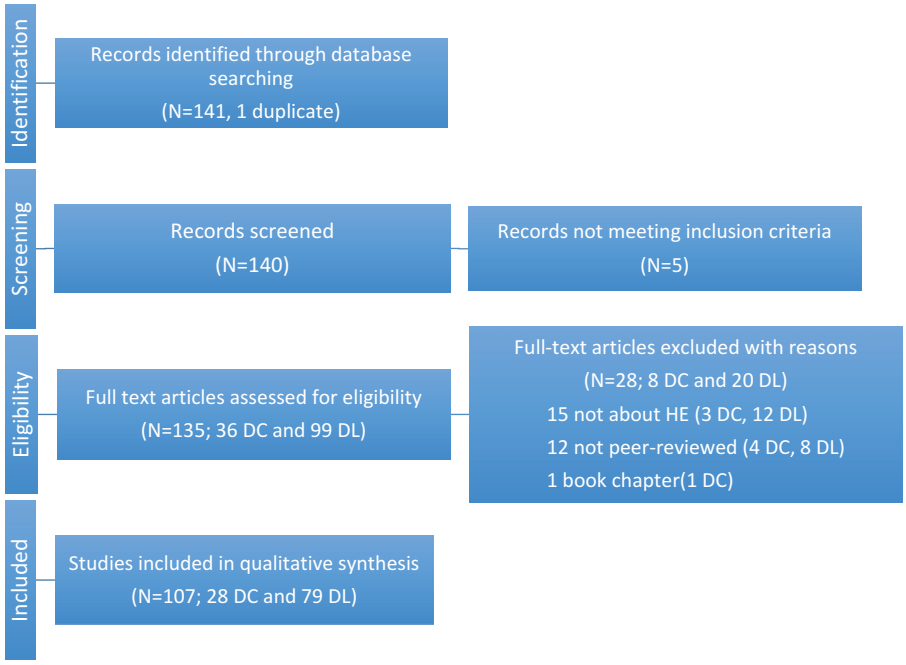


Figure 1. Flowchart of literature selection process.

HE (12), not peer-reviewed (8). Finally, 79 publications on digital literacy and HE were included in the systematic review.

The systematic process of identification, screening, eligibility assessment and final inclusion is visualised in Figure 1 below, resulting in 107 papers to be included in the systematic review.

2.3. Review and coding process

Initially, we divided the publications equally between the four authors for the thorough reading process. In order to systemize the reading, we constructed an initial sorting template to capture the scientific approach in the articles. Besides identifying how the two concepts in each article were defined and used, we wanted to identify the subject discipline for each article to gain an overview of the disciplines addressing the concepts. We were also interested in capturing if the author's aim was to contribute to knowledge on an individual or broader organisational level (typified as micro, meso and macro levels of analysis), what methods were used and what conclusion that was drawn from the study. Our sorting scheme consisted of the following eight categories:

(1) Definition of digital competence
(2) Definition of digital literacy
(3) Subject discipline
(4) Context (country)
(5) Aim (practical didactical change, develop student competence, develop faculty competence, develop educational system)
(6) Level of analysis (micro, meso, macro)
(7) Data collection method (interview, survey, document analysis, content analysis, direct observations, literature review, video analysis, no data collection)
(8) Major conclusion

2.4. Data analysis

After the initial coding and iterative readings of the 107 publications, the authors collaboratively identified six different types of usage of the concepts. The six types that emerged in the material were:

(1) Mentioned only
(2) Used without defining or referencing
(3) Defined with reference to policy document
(4) Defined with reference to research and policy
(5) Defined with reference to research
(6) Discussed or developed definitions

To establish inter-rater reliability in the coding and identification of the use of the key terms, the authors coded a sub-sample of 10 publications independently. In 7 of the 10 publications complete agreement was reached. The inter-rater reliability score (r) was 0,96 showing high level of agreement between the four authors.

In the screening and categorization of the publications according to the six types, 30 publications were identified as *only mentioning* the terms digital competence (3) and digital literacy (27). An additional 20 publications (5 on digital competence and 15 on digital literacy) were identified as using the concepts without defining or referencing (see Supplementary Table S1). This means that almost half of the reviewed publications (50 of 107) demonstrate an implied use of the concepts (publications marked with ** in the reference list) without revealing how the terms were defined. The 57 publications in the four remaining coding types (marked with * in the reference list) required systematic and thorough analysis for the purpose of exploring the definitions of the concepts in more detail.

3. Results

In this section, we present three types of results. First, we present descriptive statistics of the distribution of the selected 107 publications over the six types of usage of the concepts to give an overview of the referencing patterns to research and policy and instances of further development of the concepts. Second, we elaborate further on the definitions of the concepts *digital competence* and *digital literacy* to better understand the impact of referencing strategies on the conceptualization. Third, we present the variations of scholarly focus concerning the research methods used and what level of analysis the publications address.

3.1. Part 1: descriptive statistics on the use of concepts

The reviewed publications and ways in which the definitions of *digital competence* and *digital literacy* were used are summarized in Supplementary Table S1. The distribution of the six distinct types of concept use shown in Figure 2 demonstrates that *digital competence* most often is defined with policy documents (32% of the articles), whereas a majority of the publications on *digital literacy* demonstrate a mention only (34%) strategy or define the concept primarily with reference to scientific research (24%). Overall, there is a striking tendency of using the concepts without any reference to the terms' meanings. In addition, only a few papers develop the concepts further.

Without any time-restriction in the selection phase, the reviewed publications date back to 1997 when the term *digital literacy* was coined by Gilster (1997), published as a book, and referred to in HE literature the same year for instance by Inoue et al. (1997). The distribution of the use of the terms over time is presented in Figure 3 and shows clearly the more recent use of the term *digital competence* starting in 2010 (Lindroth & Bergquist, 2010). From 2010 onwards, the number of publications grows for both concepts, with an exceptional raise in numbers in 2013 and 2016 for *digital literacy*.

Figure 2. Distribution of referencing strategies (percentages of articles focusing on each term).

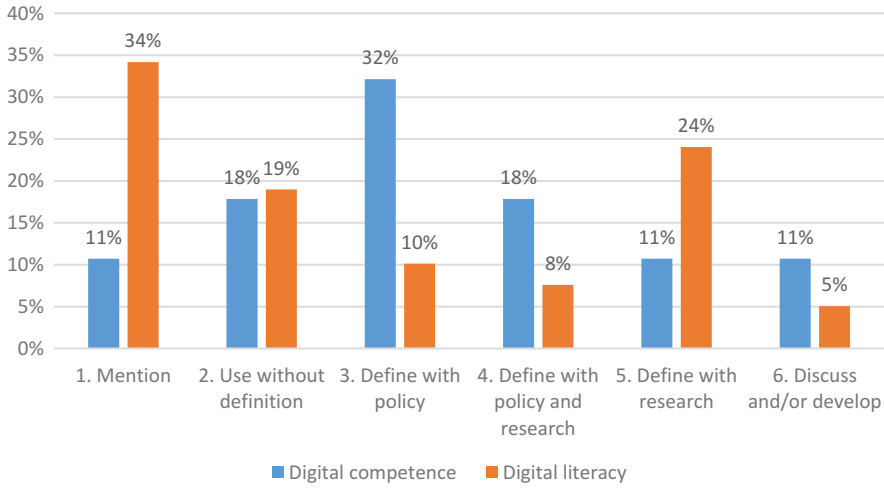


Figure 3. Distribution of concept use over time (percentage of articles).

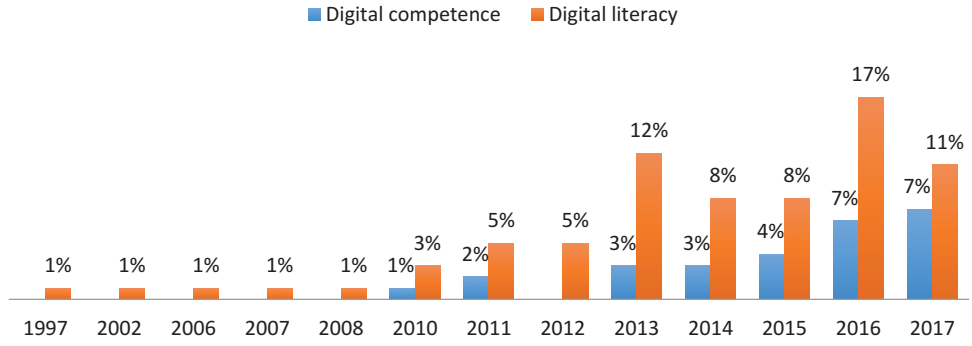
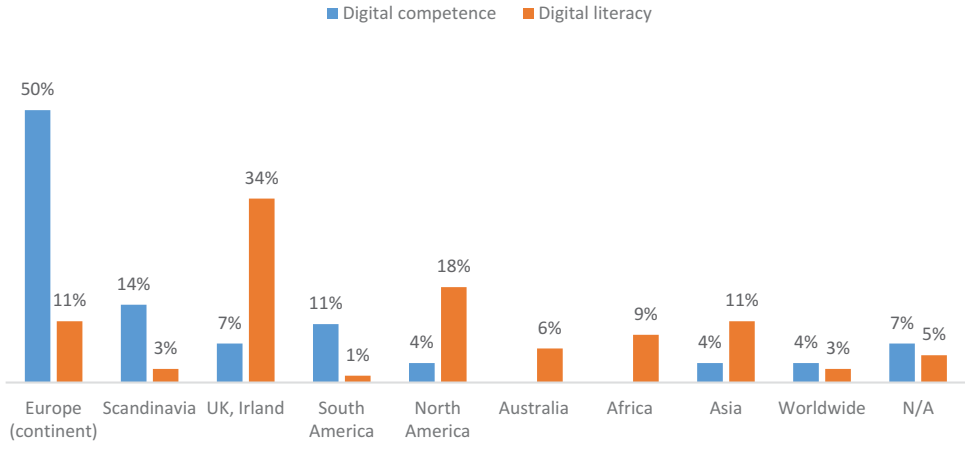


Figure 4. Distribution of concept use over countries and continents (percentages of articles).



Regional differences in the use of the terms in HE research (Figure 4) show a strong emphasis on the use of *digital literacy* in UK/Ireland, US and Asia. Most publications where *digital competence* is defined originate from Continental Europe, dominated by Spain, Italy and Scandinavia, and also from South America.

3.2. Part 2: descriptions of concept definitions

Below we discuss the referencing strategies in regard to the definitions that have been used and/or developed for the concepts of *digital literacy* and *digital competence* in the 57 publications. First, we present the definitions with reference to research and their further development followed by definitions with reference to policy. In the last part of this section, we present and discuss when both research and policy were used as reference for defining the concepts.

3.2.1. Defining and developing the concepts by research

19 of the 37 publications using the term *digital literacy* referred to research as basis for definitions and 4 developed them further. In the 20 publications on *digital competence*, 3 publications used references to research as basis for their definition and in 3 publications the concept definition was discussed and/or developed further.

3.2.1.1. Definitions of digital literacy by research. The majority of the publications defining *digital literacy* in HE research uses research to define the concept. The term *digital literacy* was first introduced by Gilster (1997) in the late 1990s as: "the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers" (p: 1). This definition is acknowledged in several of the reviewed publications as the "know-how" (Goodfellow, 2011; Gourlay et al., 2013; Hall et al., 2013; Joosten et al., 2012). Joosten et al. (2012) uses Pool's (1997) definition of digital literacy as an adaption of "skills to an evocative new medium, [and] our experience of the Internet will be determined by how we master its core competencies" (Joosten et al., 2012, p. 6). This suggests that *digital literacy*, similar to terms such as media literacy and computer literacy, originates in a skill-based understanding of the concept and thus relates to the functional use of technology and skills adaptation, as Gourlay et al. (2013) also argues.

In more recent publications, definitions of digital literacy point towards cognitive skills and competences (Mishra et al., 2017). Bennett (2014) and Traxler and Lally (2016) point out that the individual is in focus as opposed to the social dimensions of learning in Beethams definition that highlights the cognitive perspective of *digital literacy* as "[t]he functional access, skills and practices necessary to become a confident, agile adopter of a range of technologies for personal, academic and professional use" (Beetham & Sharpe, 2011, p. 1). Chan et al. (2017, p. 2) also refer to cognitive skills and define digital literacy as "the ability to understand and use information in multiple formats with emphasis on critical thinking rather than information and communication technology skills".

The concept is further used in its plural form, "digital literacies", which acknowledges new and diverse social practices (Gachago et al., 2014; Gourlay, 2015; Kajee & Balfour, 2011; Machin-Mastromatteo, 2012). The plural form emphasizes the non-generic and multiply situated nature of the term. The articles frame their research by New Literacy Studies (NLS) and literacy is seen as a contextualised practice positioned in relation to social institutions and the power relations that sustain them (Kajee & Balfour, 2011). Machin-Mastromatteo (2012) uses the concept "literacies" as an umbrella term to group information literacy, digital literacy and new literacies developing a categorization in the following ways: "Information literacy is broadly defined as the individual's ability to handle information in general. Digital literacy refers to the ability to handle technological devices (hardware and software). New literacies are a series of new and innovative skills associated with ways of working with online content and social technologies, thus going beyond the concept of digital literacy" (p. 574).

Tan (2013, p. 466) argues for an extension of the definition of *digital literacy* to a multimodal outlook in a "new textual landscape", including social media. In a similar vein, De Wet (2014) and Novakovich (2016) define digital literacy as a social practice and Tang et al. (2016) use Martin's definition of digital literacy as "the awareness, attitude and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyse and synthesize 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." (Martin, 2006, p. 155).

Some of the publications refer to critical digital literacies (CDL) defined originally by Avila and Pandya (2013, p. 3) as "those skills and practices that lead to the creation of digital texts that interrogate the world; they also allow and foster the interrogation of digital, multimedia texts". Hilton (2013) argues that at the same time as CDL acknowledge the language of power, accessing multiple and diverse texts and reconstructing narratives to create transformative possibilities, CDL add a critical analysis of digital sources. Roche (2017) is also referring to CDL and emphasises that "the ability to access, critically assess, use and create information, through digital media in engagement with individuals and communities" (ibid., p. 43) must be considered in the definition of digital literacy.

3.2.1.2. Developing and/or discussing the definition of digital literacy further. In 4 of the 37 publications regarding the term *digital literacy* the researchers attempted to further define, discuss and develop the concept. Kenton and Blummer (2010) problematize the concept in relation to the role of librarians in the development of increasing digital literacy among faculty and students. Lea (2013) presents a critical discussion regarding how using digital literacy defintions from policy documents and organisations potentially runs the risk of reducing the research contribution, thus hindering knowledge development at the expense of policy implementation in HE. Stewart (2013, p. 232) defines digital literacy as "to be able to engage the connections and communications possibilities of digital technologies, in their capacity to generate, remix, repurpose and share new knowledge as well as simply deliver existing information".

Stordy (2015, p. 472) puts forward a literacy framework consisting of six perspectives on literacy, which implies a definition of such literacies as: "[t]he abilities a person or social group draws upon when interacting with digital technologies to derive or produce meaning, and the social, learning and work-related practices that these abilities are applied to". Stordy (2015, p. 472) argues that this definition "captures the complementary nature of literacy as a cognitive ability and a social practice".

3.2.1.3. Definitions of digital competence by research. Whereas a majority of the publications concerning DL used research as a basis for definition of the concept, in the case of defining *digital competence* only 3 of 20 publications draw on research. Tømte et al. (2015) uses the definition by Krumsvik (2011, pp. 44–45) to define digital competence as "the teachers' proficiency in using ICT in a professional context with good pedagogical-didactical judgement and his or her awareness of its implications for learning strategies and the digital *Bildung* of pupils and students". Scuotto and Morellato (2013) refer to Calvani, Cartelli, Fini and Ranieri (2009, p. 186) when defining *digital competence* as "the ability to explore and face new technological situations in a flexible way, to analyze, select and critically evaluate data and information, to exploit technological potentials to represent and solve problems and build shared and collaborative knowledge, while fostering awareness of one's own personal responsibilities and respect of reciprocal rights/obligations". Furthermore, Cazco, González, Abad, Altamirano, et al. (2016), by referring to Gutiérrez (2011, p. 201), defines digital competence as:" Values, beliefs, knowledge, capacity and attitudes to use technology in an adequate way, including computer as well as different programmes and Internet, which allow for the possibility of research, access, organisation and the use of information to produce knowledge".

While the first definition focuses more on HE teachers' proficiency in using ICT for professional purposes and implications for students' learning, the latter two publications use more general defintions of *digital competence* by listing numerous cognitive abilities, including the ability to solve moral problems, to develop or even exploit to achieve digital competence.

3.2.1.4. Developing and/or discussing the definition of digital competence further. In 3 of 20 publications concerning digital competence, there are attempts at developing and/or discussing

the concept further. Krumsvik (2014) starts with one definition of *digital competence* but then argues for the need to contextualize the concept further. Krumvik's (2014, p. 275) attempt at developing the definition further pinpoints that teachers' digital competence operate in the intersection between a "mental digital competence journey" (self-awareness) and a "practical competence journey" (proficiency). In this manner, such a definition attempts to combine teachers' individual traits with a layered model of digital competence incorporating the micro, meso and macro levels in which the teachers work. Tsankov and Damyanov (2017) initially draw on the report from the European Comission (2006) defining digital competence as one of the eight key competences for lifelong learning as "the confident and critical use of information society technologies for work, leisure and communication". Then they elaborate on the definition towards professional development of teachers: "Digital competence implies connectivity with the skills to use digital technologies that allow teaching professionals to work with modern information and communication technology, computers, software applications and databases, helping them to realize their ideas and objectives in the context of their work. It is important for education majors to have the ability to search, collect and process information and approach it critically and systematically as well as the skills to use the design tools for media information and the capacity to access, search and use Internet-based services, especially in the context of their future activities and opportunities for continuous professional qualification." (Tsankov & Damyanov, 2017, p. 204). In this manner digital competence becomes strongly related to the professional expertise of teachers and central to teacher professional development.

Some researchers claim that the current definitions of digital competence do not suite the purpose of assessment and force them to create new constructs. Castaño-Muñoz et al. (2017, p. 33) argue that "Due to the lack of an existing validated scale, we constructed a six-item scale, which deals with information skills (three items) and interaction skills (three items)". Still, little is known about the validation of these items.

3.2.2. Definitions of the concepts by policy

In the reviewed material, 8 publications referred to policy documents in their definition of *digital literacy* and 9 publications defined *digital competence* by referring to policy documents.

3.2.2.1. Definitions of digital literacy by policy. In the 8 publications where *digital literacy* is defined using policy documents, four sources are used: reports from the Joint Information Systems Committee (JISC, 2011, 2014, 2015), the European Commission (2010), the OECD work on Technology and Education (Instance & Kools, 2013) and the Horizon Reports: Higher education edition (Johnson et al. 2010; Johnson, Adams Becker, Estrada, & Freeman, 2015).

A major source is the reports by JISC which is a UK organisation that provides digital solutions for UK education and research. Four of the publications (Bell & Secker, 2014; Covey, 2013; Crearie, 2016; Cronin, 2017) draw on 2011, 2014 and 2015 guidelines from JISC when defining digital literacy. *Digital literacy* is defined here as the "capabilities which fit an individual for living, learning and working in a digital society" and as the "integration of computer literacy, information literacy, media literacy, the ability to communicate and collaborate using digital networks, to participate in research and scholarship dependent on digital systems, to study and learn using technology, and to use digital tools and media to make informed decisions and achieve goals" (JISC, 2011, p. 2). In more recent JISC reports aspects such as digital behaviors, practices and identities (JISC, 2014) as well as wellbeing (JISC, 2015) are added to the definition.

Drawing on the 2010 report from the European Commission, Littlejohn et al. (2012) argue that full political and social participation in society requires digital skills, thus *digital literacy* is key to what HE and further education can offer. *Digital literacy* is thus defined as "the capabilities required to thrive in and beyond education, in an age when digital forms of information and communication predominate" (Littlejohn et al., 2012, p. 547). Istance and Kools (2013, p. 43) base their definition on the OECD work on Technology and Education (2013) stating that *digital literacy* is "a

fundamental learning objective including information-handling skills, and the capacity to judge the relevance and reliability of web-based information". Pates and Sumner (2016) point out that "digital literacy must necessarily be less about tools and more about ways of thinking and seeing" as defined in the 2010 Horizon Report (Johnson et al., 2010, p. 5). They continue with the recognition in the most recent edition (Johnson et al., 2015) on that faculty needs to be better equipped in order for digital literacies to be instilled in their students, but that there remains an absence of consensus as to what digital literacy comprises of.

3.2.2.2. Definitions of digital competence by policy. In our literature review, defining digital competence by reference to EU policy documents or reports was rather common. Policy is used 9 of the 20 publications to define the concept. 3 of the publications referred to the Key Competences for Lifelong Learning European Reference Framework (Cinque & Bortoluzzi, 2013; Torres-Coronas & Vidal-Blasco, 2011, 2015), where *digital competence* is defined as one of eight key competences for lifelong learning including "the confident and critical use of information society technology (IST) for work, leisure and communication" (European Commission, 2006).

Another EU policy document is used when Lindroth and Bergquist (2010) define *digital competence* as requiring "a sound understanding and knowledge of the nature, role and opportunities of IST in everyday context: in personal and social life as well as work" (Official Journal of the European Union, 2006, p. 16). This understanding is also related to everyday context for personal and social life as well as work. Sound understanding is required if digital competence is to be obtained according to this definition.

In several of the publications EU reports written by Ferrari (2012, 2013) have also attracted attention and been used to define digital competence (English, 2016; Guzman-Simon et al., 2017; Moncada Linares and Díaz Romero 2016; Mattila, 2015; Pérez-Mateo et al., 2014). In the 2012 Ferrari report *digital competence* is defined as a "set of knowledge, skills, attitudes, strategies and awareness which are required when ICT and digital media are used to perform tasks, resolve problems, communicate, manage information, collaborate, create and share content, and build knowledge in an effective, efficient and adequate way, in a critical, creative, autonomous, flexible, ethical and a sensible form for work, entertainment, participation, learning, socialization, consumption and empowerment" (p. 3). Mattila (2015) as well as Moncada Linares and Díaz Romero (2016) draws on this report and digital competence is seen as a key competence, which helps acquiring other key competencies such as language, math, learning to learn and cultural awareness, and can broadly be defined as the confident, critical and creative use of ICT to achieve e.g. work related goals.Digital competence is thus considered an essential skill for today's teachers, since they have to manage several aspects from the subject being taught to pedagogical tools. Digital competence helps teachers to acquire and update skills needed in their work according to this definition.

3.2.3. Definitions of the concepts by policy and research

In 6 of the 37 publications on *digital literacy*, both policy documents and research were drawn on to define the concept. 5 of the 20 publications used both policy documents and research to define *digital competence*.

3.2.3.1. Definitions of digital literacy by policy and research. Parvathamma and Pattar (2013, p. 159) define *digital literacy* as the "[a]bility to use ICT tools and internet access, manage, integrate, evaluate, create and communicate information to function in a knowledge society", referring both to the New Zealand Digital strategy glossary of key terms and Jones-Kavalier and Flannigan (2006). Radovanović et al. (2015, p. 1737) use the definition by the European Framework for Digital Literacy described by Martin (2006, p. 155): "the awareness, attitude and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyse and synthesize 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". Radovanović et al. (2015) also draws on Haythornthwaite (2007) when defining the concept and her definition of new literacies requirements as including competencies in finding, processing, producing, and communicating information as well as fluency in online technologies, communication norms, application, and programming environments. There is an interesting difference in the two definitions provided in the publications referred to above. One of the publications focuses on the abilities, or skills, necessary to develop to be able to use ICT tools (Parvathamma & Pattar, 2013). In the other publication, such abilities are also stressed (e.g. identify, access, evaluate, synthesize) but their definition also includes individual awareness of and attitude to using such tools appropriately, and ability to reflect on the process of using such tools.

Bancroft (2016) combines policy document with research when using the following definition of digital literacy as encompassing: "a continuum of skills, beginning with basic operational tasks progressing to more complex critical production and consumption of digital material" (p. 49). In a similar vein, Tuamsuk et al. (2017, p. 237) refer to both US and EU policy documents as well as research when using the following definition of digital literacy: "digital literacy is composed of technical skill, cognitive skill and emotional-social skills.

Kühn (2017, pp. 12–13) also uses both policy and research when she defines digital literacy: "The Horizon Report argues that finding effective ways to teach these skills is not a simple task (…) "Because digital literacy is less about tools and more about thinking, skills and standards based on tools and platforms have proven to be somewhat ephemeral". (ibid. p. 24).

3.2.3.2. Definitions of digital competence by policy and research. In 5 of 20 publications on digital competence both policy documents and research were used as basis for definitions. Morellato (2014, p. 187) draws on the research by Calvani et al. (2009) and Krumsvik (2008) when defining the concept: "digital competence incorporates a more complex and holistic proficiency in the use of ICT with pedagogical judgment in educational contexts. This means that the focus is directed towards pedagogy and subject matter, while technical skills are only a part of this complex digital competence concept". Morellato (2014, p. 185) then combines this definition with a definition from the European Commission, where digital competence as one of the key competences for citizens is defined as adapting "flexibly in a rapidly changing and highly interconnected world" (European Commission, 2006, p. 13).

Furhermore, Mengual-Andrés et al. (2016, p. 1) use the term literacy to define digital competence as "a means of achieving a degree of literacy suited to present-day society's needs", referring to policy document and the political agenda of EU and UN and in connection to that they list several studies and make reference to research that currently addresses the concept. Khan et al. (2017) refer both to policy report and research when defining digital competence as the knowledge, skills, attitudes and digital literacy that are needed for developing and managing digital information systems. (p. 574).

Also From (2017) applies this strategy and refers to the Key competences introduced in the policy documents by EU (European Comission, 2006). Furthermore, From refers to previous scientific studies about digital competence and concludes that the meaning, depth and breadth of the concept varies between authors. From (2017) summarized the conceptual review with a suggested definition "A rough definition of the concept of Digital Competence (DC) would be that it refers to the ability to use ICT" (p.44).

3.3. Part 3: scholarly focus in the aim, methods and analysis

In this part of the analysis we address the aim of the reviewed articles, the methods that have been used and the level of analysis. As concerns the aim of the studies in the body of publications reviewed here, we found four main foci being investigated:

(1) Practical/Didactial change
(2) Develop students regarding their DL or DC
(3) Continuous professional development of DL or DC in HE teachers
(4) Develop the educational system for DL or DC (see Figure 5).

Figure 5. Aims of studies in the publications and their concept use (percentages of articles focusing each term).

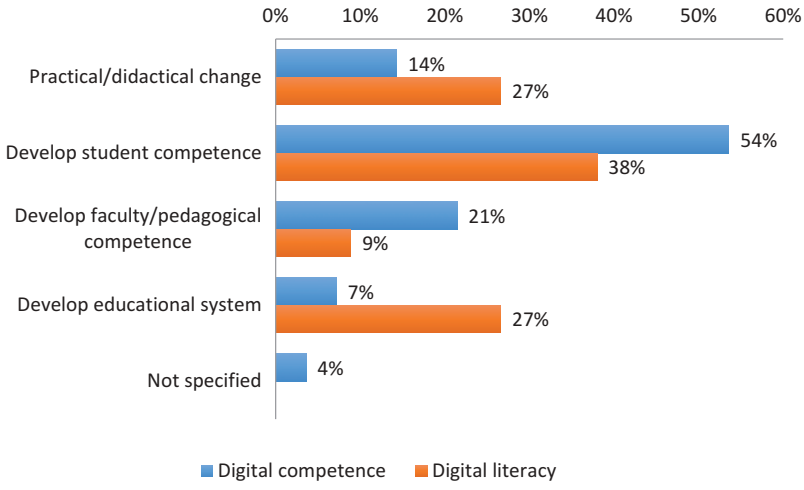
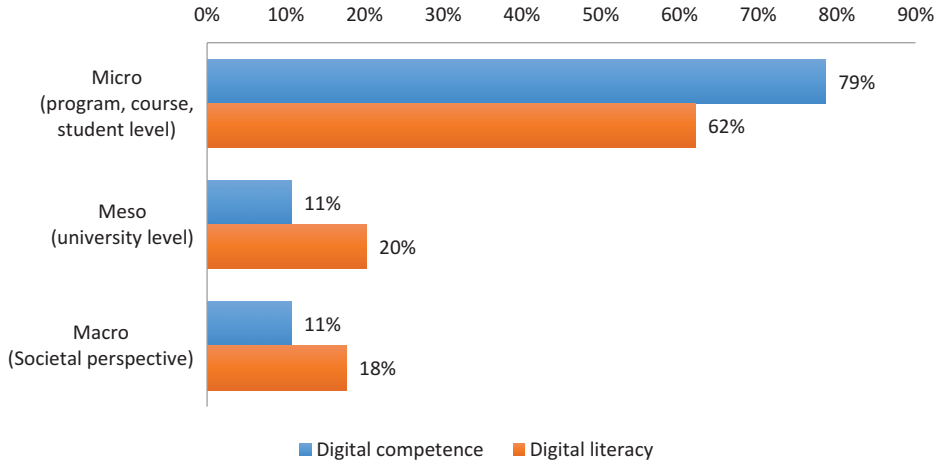


Figure 6. Distribution of research focus level and their concept use (percentages of articles focusing each term).



Most of the studies aimed to change individual capacities (both student's and teacher's) based on the concept of *digital competence*. Studies with the aim to change HE (both small-scale and broad change) were primarily based on the concept of *digital literacy*.

A majority of the papers aimed to develop the competencies of students at micro levels (individual, course, program) regardless of whether they used the term digital literacy (79%) or digital competence (62%) (See Figure 6). Publications aimed at the micro level more often referred to the concept of *digital competence* whereas research aimed at meso- and macro levels more often used the concept of *digital literacy*.

The majority of the reviewed publications used mixed methods for data collection, approximately 40% of *digital competence* (see Figure 7). In the case of studies based on the definition of *digital literacy*, surveys, reviews and interviews were predominant. "Close-up studies", using case studies, analysis of content, documents and video were found in the *digital competence* publications.

When it comes to research areas and dsciplines, the majority of the reviewed publications adress no specific discipline. In studies without reference to any specific discipline, the notion of digital literacy is most often used (see Figure 8). Digital competence dominates in teacher education, economics and to a small extent also in language and informatics. Digital literacy is exclusively used in health and artistic education. Table 1 below summarizes the findings.

Figure 7. Data collection method in the publications and their concept use (percentages of articles focusing each term).

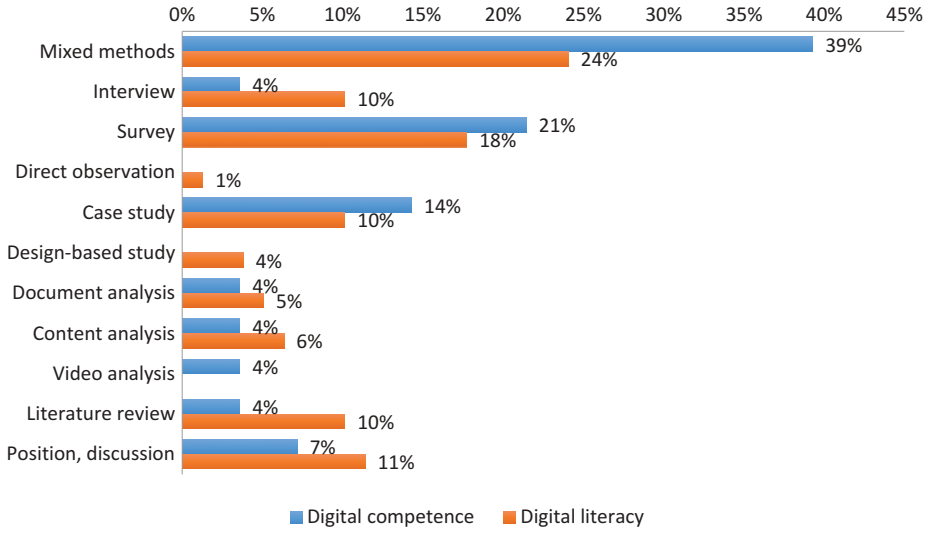


Figure 8. Subject discipline in the publications.

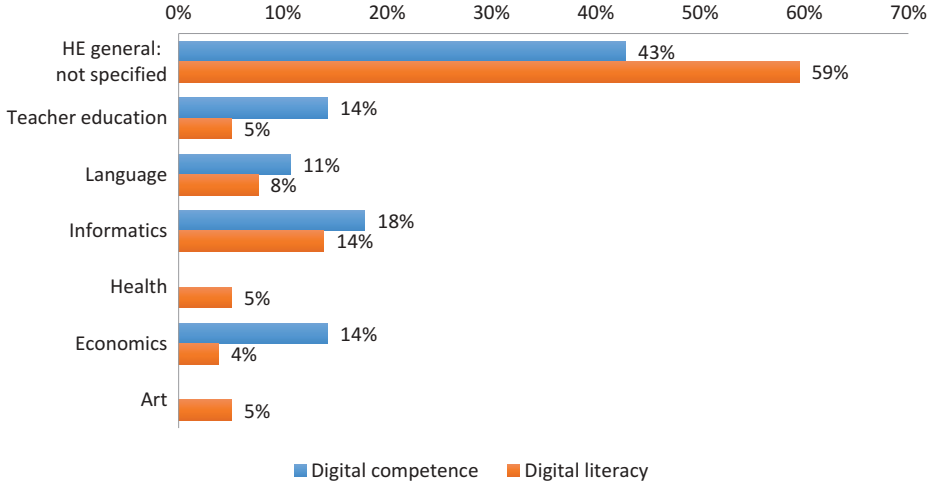


Table 1. Summaraized findings

	Digital literacy	Digital competence
First appearance in findings (in general)	1997 (1997)	2010 (2006)
Main region	UK, US, Asia	Continental Europe, South America
Main disciplines	Health and arts	Teacher education and economics
Dominating aim	Practical/Didactical change Develop educational system	Develop student competence Develop faculty competence
Most common Data collection method	Mixed, survey, interview, case studies, position papers	Mixed, survey, case studies, video analysis
Dominating referencing strategy	Research	Research and policy

4. Discussion

By systematically reviewing how the concepts *digital literacy* and *digital competence* are defined and used in HE publications, we have demonstrated that in HE-research *digital literacy* has been used more frequently and over a longer period of time, thus revealing a historically more established use of *digital literacy* compared to *digital competence*. Regional differences of use appear in that studies concerning digital literacy are often conducted in English speaking countries (UK, US) and those on digital competence in European countries outside the UK (Spain, Italy and Scandinavia). A general finding is that the majority of the reviewed publications, both on digital literacy and digital competence, use the concepts without any reference to neither previous research or policy documents, i.e. the concepts are either just mentioned or used in a more commonsensical manner. The systematic review reveals further a tendency of HE publications defining digital literacy by referring to research rather than to policy documents; while publications defining digital competence, are more diverse in relation to referencing strategies. In addition, only a few publications develop the concepts further.

As both concepts are increasingly used in a range of disciplines in most parts of the world, in our view this indicates a broad interest for research addressing issues related to digital literacy and digital competence. However, the diversity in how the concepts are defined and used is still evident and thus, we will argue, complicates cross-disciplinary comparisons of research findings. We will first discuss the definitions and use of the concepts separately to finally discuss the implications for HE research.

4.1. Digital literacy

The publications on digital literacy have been linked to many different research agendas and perspectives, everything from concrete descriptions of HE practices to more normative approaches and how teachers should use digital technologies in HE teaching practices (c.f. Lea, 2013, for a thorough critical discussion). Reference to research dominates over policy with primarily three different perspectives appearing: the skill-oriented operational approach of know-how that originates from the initial definition of the concept (Gilster, 1997), the plural form *digital literacies* put forward by New Literacy Studies (NLS) that emphasizes the non-generic and multiply situated nature of the concept, and the third more critical perspective defining CDL as a reflective approach "interrogating the world" (Hilton, 2013). Discussions about and development of the definition of digital literacy outline different stages or areas of digital literacy, i.e., social practices and open practices in digital spaces or a taxonomy as a more effective way to distinguish salient differences between literacies and literacy types (Stordy, 2015).

When digital literacy is defined by policy, primarily EU and OECD policy documents are used, strongly focusing on digital literacy as the individual's capabilities for living, learning and working in a digital society; capabilities with regard to communication and collaboration, studying and learning to use digital tools and media to make informed decisions and achieve goals. A problem identified in the latter Horizon report is that there seems to be little consensus about what digital literacy comprises, which can be understood as a critique of how the concepts are currently defined and thus used. In conclusion, the concept digital literacy has been linked to many different agendas and perspectives, from technical "know-how" via cognitive skills to social practices and proactive engagement with digital content. In some publications, it is argued that the concept of "digital literacy is still ill-defined and misunderstood term" (cf. Coldwell-Neilson, 2017, p. 79).

4.2. Digital competence

Our review demonstrates that publications on *digital competence* are strategic and politically underpinned by means of definitions used from policy reports, and oriented towards use of technology in professionally purposeful ways in various contexts. The concept caught attention when the European Union had a strong focus on Key Competencies for Lifelong Learning (c.f.

European Commission, 2006) and on capabilities, or opportunities, to use digital information for different purposes in life (cf. Ferrari, 2012). When digital competence is defined by reference to research, a broad range of competencies, not least competencies related to values and ethics, are embraced (Calvani et al., 2009). Digital competence also becomes aligned to specific contexts of HE, such as teacher education (Krumsvik, 2014). When digital competence is defined with regard to teachers' professional development, the concept is considered in regard to the individual teacher's ability to implement ICT into learning activities to improve students' development of knowledge and understanding (Krumsvik, 2009). From this, Krumsvik (2014) elaborates and expands on the definition of digital competence by introducing a holistic model combining analytical levels and prerequisites for individual capacity. Thus, the expansion of the concept digital competence concerns inclusion of other areas and development of the concept towards professional contexts.

4.3. Implications for HE research

This systematic research review provides an understanding of research and policy approach to the definitions of *digital literacy* and *digital competence* in HE research revealing the evolution of the concepts and referencing strategy over time, disciplines, countries, methods and level of analysis. A general characteristic for both concepts is that over time they have transformed from a solely operational and technical focus on technology use towards knowledge-oriented cognitive, critical and responsible perspectives. The review demonstrates further that the concepts are used in a variety of subject areas in HE-research and in many cases used without definitions, which on one side signals the broad proliferation of the concepts and on the other the inconsistency in referencing strategies.

Similar compatibility problems emerged in publications where definitions from both research and policy were drawn upon. In this review, we found such ambiguous and incompatible instances in publications that combined scientific references to specific critical abilities and judgements (e.g. Calvani et al., 2009; Krumsvik, 2009) with EU policy documents (e.g. European Comission, 2006) that define digital competence as a competence to adapt flexibly (ibid p. 13). These findings thus demonstrate a need for informed and conscious referencing to the established definitions of the concepts to avoid these mismatches and validation problems. This involves being aware of the development of the concepts and policies, organizations and theories behind them in the selection of sources and paying attention to the origins of definitions—when and for what purposes the definitions are employed. Otherwise combining definitions from sources that use incompatible definitions of the concepts run the risk for unrealiable cross-referencing. If such incompatible definitions are used in research, then the contribution of the research becomes less valid. Interestingly, although digital literacy has been used in research for a longer time than digital competence (see Figure 3), definitions of digital literacy and digital competence originating from policy documents have gained legitimacy and this certainly needs further critical investigations, which is also emphazised in Lea (2013).

Another tension revealed in our systematic review is that definitions of digital competence sometimes involve digital literacy and vice versa. This mostly occurs when the concepts are considered from the operational perspective of technical knowledge which is problematic. Furthermore, the focus on assessment in later years and an ambition to suggest new items for measurement demonstrates another direction in policy and research in HE that also needs to develop towards a common understanding of the concepts. Based on what has been found and discussed, this review indicates directions for further research in HE with the following suggestions:

- More research based on critical perspectives.
- Reduce the commonsensical use of the concepts and take the development of definitions of these concepts seriously due to their importance for HE.

- Avoid cross-referencing incompatabilities
- Critical investigations into the legitimacy of policy over research

5. Conclusion

Future research in HE addressing digital literacy or digital competence needs to pay more attention to the origin of definitions. Furthermore, research needs to analyze how the different definitions might complement or contradict each other. It also becomes important to clarify the rationale for the preference of the specific selection of different definitions. Such clarifications facilitate the understanding if the research effort is linked to investigating policy implementation or a more critical investigation linked to digital competence or digital literacy in HE.

Supplementary material
Supplemental material for this article can be accessed here https://doi.org/10.1080/2331186X.2018.1519143

Acknowledgements
This work was supported by the project DigitaL: Learning in the digitalized region, a collaboration between University West, University of Gothenburg and Region Västra Götaland, Sweden. Special thanks to Elisabeth Näverå at University West Library and Camilla Olsson at Gothenburg University Library, for their help during our work.

Funding
The authors received no direct funding for this research.

Author details
Maria Spante[1]
E-mail: maria.spante@hv.se
ORCID ID: http://orcid.org/0000-0003-3203-7062
Sylvana Sofkova Hashemi[2]
E-mail: sylvana.sofkova.hashemi@gu.se
ORCID ID: http://orcid.org/0000-0001-5248-771X
Mona Lundin[3]
E-mail: mona.lundin@ped.gu.se
ORCID ID: http://orcid.org/0000-0002-8072-5786
Anne Algers[3]
E-mail: anne.algers@gu.se
ORCID ID: http://orcid.org/0000-0002-9694-676X
[1] School of Business, Economics & IT, Division of Informatics, University West, SE-461 86 Trollhättan, Sweden.
[2] Department of Pedagogical, Curricular and Professional Studies, University of Gothenburg, PO Box 300, SE- 405 30 Göteborg, Sweden.
[3] Department of Education, Communication and Learning, University of Gothenburg, PO Box 300, SE-405 30 Göteborg, Sweden.

Citation information
Cite this article as: Digital competence and digital literacy in higher education research: Systematic review of concept use, Maria Spante, Sylvana Sofkova Hashemi, Mona Lundin & Anne Algers, *Cogent Education* (2018), 5: 1519143.

References

*Reviewed articles that define the concepts with reference to research and/or policy
**Reviewed articles that mention only the concepts or use them without defining or reference

Aghaei Chadegani, A., Salehi, H., Yunus, M. M., Farhadi, H., Fooladi, M., Farhadi, M., & Ale Ebrahim, N. (2013). A comparison between two main academic literature collections: Web of science and scopus databases. *Asian Social Science*, *9*(5), 18–26.

**Alvarez, I. (2013). High aspirations: *Transforming Dance Students from Print Consumers to Digital Producers. Journal of Interactive Media in Education*, *492*, 1–16.

**Altinay, Z., Ossiannilsson, E., Kalaç, M. O., Basari, G., Aktepebasi, A., & Altinay, F. (2016). Establishing a framework on OER practices for ICT competence of disabled citizens. *TOJET: the Turkish Online Journal of Educational Technology*, *15*(3).

Ávila, J., & Pandya, J. Z. (2013). *Critical digital literacies as social praxis: Intersections and challenges. New literacies and digital epistemologies*. 54. Peter Lang New York, USA.

*Bancroft, J. (2016). Multiliteracy centers spanning the digital divide: Providing a full spectrum of support. *Computers and Composition*, *41*, 46–55. doi:10.1016/j.compcom.2016.04.002

**Barbas, M., Branco, P., Loureiro, A., & Matos, P. (2017) NEETin with ICT. *Universal Journal of Educational Research*, *5*(4), 537–543. doi:10.13189/ujer.2017.050402

**Barlow-Jones, G., & van der Westhuizen, D. (2011) Situating the student: Factors contributing to success in an information technology course. *Educational Studies*, *37* (3), 303–320. doi:10.1080/03055698.2010.506329

**Barnes, V. (2015). Telling timber tales in higher education: A reflection on my journey with digital storytelling. *Journal of Pedagogical Development*, *5* (1), 72–83.

Beetham, H., & Sharpe, R. (2011). Digital literacies workshop. *Paper presented at the JISC learning literacies workshop*, Birmingham [online]. Retrieved December 7, 2017 from http://jiscdesignstudio

*Bell, M., & Secker, J. (2014). Transitions from school to higher education: Understanding the needs of undergraduates at LSE. In *European conference on information literacy*, 309–318. Springer International Publishing.

Bendermacher, G. W. G., Oude Egbrink, M. G. A., Wolfhagen, I. H. A. P., & Dolmans, D. H. J. M. (2017). Unravelling quality culture in higher education: A realist review. *Higher Education*, *73*(1), 39-60.

*Bennett, L. (2014). Learning from the early adopters: Developing the digital practitioner. *Research in Learning Technology*, *22*, 21453–21466. doi:10.3402/rlt.v22.21453

**Bhatti, R., Chohan, T. M., & Asghar, M. B. (2014). HEC digital library and higher education: Trends and opportunities for faculty members at the Islamia University of Bahawalpur, South Punjab, Pakistan. In e-journal Library Philosophy and Practice, 1, art. no. 1059.

Biel, P., Perez, E., Rodrigo, C., & Serrano, A. (2016). Use of Symbaloo Edu for improving information management processes in work by modules. *Journal of Cases on Information Technology*, *18*(4), 22-35.

**Braga, D. B. (2007). Developing critical social awareness through digital literacy practices within the context of higher education in Brazil. *Language and Education*, *21* (3), 180–196. doi:10.2167/le746.0

**Brooks, A. W. (2015). Using connectivism to guide information literacy instruction with tablets. *Journal of Information Literacy*, *9*(2), 27–36. doi:10.11645/9.2.2007

**Buchanan, T., Sainter, P., & Saunders, G. (2013). Factors affecting faculty use of learning technologies: Implications for models of technology adoption. *Journal of Computing in Higher Education*, *25* (1), 1–11. doi:10.1007/s12528-013-9066-6

Calvani, A., Cartelli, A., Fini, A., & Ranieri, M. (2009). Models and instruments for assessing digital competence at school. *Journal of E-Learning and Knowledge Society*, *4*(3), 183–193.

Carl, A., & Strydom, S. (2017). e-Portfolio as reflection tool during teaching practice: The interplay between contextual and dispositional variables. *South Africa Journal of Education*, *37*(1), 1-10.

*Castan˜o-Mun˜oz, J., Kreijns, K., Kalz, M., & Punie, Y. (2017). Does digital competence and occupational setting influence MOOC participation? Evidence from a cross-course survey. *Journal of Computing in Higher Education*, *29*(1), 28–46. doi:10.1007/s12528-016-9123-z

**Cazco, G. H. O., González, M. C., Abad, F. M., Altamirano, J. E. D., & Mazón, M. E. S. (2016). Determining factors in acceptance of ICT by the university faculty in their teaching practice. In: Proceedings of the Fourth International Conference on Technological Ecosystems for Enhancing Multiculturality (pp. 139–146).

*Cazco, G. H. O., González, M. C., Abad, F. M., & Mercado-Varela, M. A. (2016). Digital competence of the university faculty: case study of the universidad nacional de Chimborazo. In *Proceedings of the fourth international conference on technological ecosystems for enhancing multiculturality* (pp. 147–154).

Challinor, J. Marin, V. I., & Tur, G. (2017) The development of the reflective practitioner through digital storytelling. *International Journal of Technology Enhanced learning*, 9 (2/3), 186–203

*Chan, B. S., Churchill, D., & Chiu, T. K. (2017). Digital literacy learning in higher education through digital storytelling approach. *Journal of International Education Research (JIER)*, *13*(1), 1–16. doi:10.19030/jier.v13i1.9907

*Cinque, M., & Bortoluzzi, M. (2013). Navigating complex challenges: Digital competence and personal knowledge management in university education to foster skills for lifelong learning. *International Journal of Technology Enhanced Learning*, *5* (3–4), 284–298. doi:10.1504/IJTEL.2013.059496

*Coldwell-Neilson, J. (2017). Assumed digital literacy knowledge by Australian Universities: Are students informed? In *Proceedings of the Nineteenth Australasian Computing Education Conference* (pp. 75–80).

Connolly, T. M., Boyle, E. A., MacArthur, E., Hainey, T., & Boyle, J. M. (2012). A systematic literature review of empirical evidence on computer games and serious games. *Computers & Education*, *59*(2), 661–686. doi:10.1016/j.compedu.2012.03.004

*Covey, D. T. (2013). Opening the dissertation: Overcoming cultural calcification and agoraphobia. *TripleC*, *11* (2), 543–557. doi:10.31269/triplec.v11i2.522

*Crearie, L. (2016). Human computer interaction (HCI) and internet residency: Implications for both personal life and teaching/learning. *International association for development of the information society*. 13th international conference on cognition and exploratory learning in digital age. Retrieved December 7, 2017 fromhttp://files.eric.ed.gov/fulltext/ED571424.pdf

*Cronin, C. (2017). Openness and praxis: Exploring the use of open educational practices in higher education. *The International Review of Research in Open and Distributed Learning*, *18*(5), 15–34. Retrieved December 7, 2017 from: http://www.irrodl.org/index.php/irrodl/article/view/3096

*De Wet, C. (2014). Trends in digital pedagogies: Implications for South African universities expanding through hybrid online education. *Mediterranean Journal of Social Sciences*, *5* (23), 859–867.

Di Lauro, F., & Johinke, R. (2017). Employing wikipedia for good not evil: Innovative approaches to collaborative writing assessment. *Assessment & Evaluation in Higher Education*, *42*(3), 478-491.

*Dodge, H. (2013). “Hi, r u there?” Adventures in chat reference librarianship. *Public Services Quarterly*, *9*(1), 81–88. doi:10.1080/15228959.2013.759010

*English, J. A. (2016). A digital literacy initiative in honors: Perceptions of students and instructors about its impact on learning and pedagogy. *Journal of the National Collegiate Honors Council*. Online Archive. 533. http://digitalcommons.unl.edu/nchcjournal/533

European Commission. (2010). A Digital Agenda for Europe. Brussels, 26.8.2010. Available at: http://ec.europa.eu/information_society/digital-agenda/index_en.html

European Commision. (2006). Recommendation on key competences for lifelong learning. *Council of 18 December 2006 on key competences for lifelong learning, 2006/962/EC, L. 394/15*. Retrieved December 7, 2017, from http://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:32006H0962&qid=1496720114366.

European Commission. (2001). The e-learning action plan. Designing tomorrow’s education

Ferrari, A. (2012). *Digital competence in practice: An analysis of frameworks*. JRC Technical Reports. Institute for Prospective Technological Studies, European Union.

Ferrari, A. (2013). DIGCOMP: A framework for developing and understanding digital competence in Europe (Report EUR 26035 EN). JRC Technical Reports. Seville: Institute for Prospective Technological Studies, European Union.

**Fombona, J., Pascual-Sevillano, M. A., & Gonzalez-Videgaray, M. (2017). M-learning and augmented reality: A review of the scientific literature on the wos repository. *Comunicar*, *25*(52), 63. doi:10.3916/C52-2017-06

*From, J. (2017). Pedagogical digital competence—between values, knowledge and skills. *Higher Education Studies*, *7*(2), 43. doi:10.5539/hes.v7n2p43

*Gachago, D., Ivala, E., Barnes, V., Gill, P., Felix-Minnaar, J., Morkel, J., & Vajat, N. (2014). Towards the development of digital storytelling practices for use in resource-poor environments, across disciplines and with students from diverse backgrounds. *South African Journal of Higher Education*, *28*(3), 961–982.

**Garcia-Gutierrez, J., Ruiz-Corbella, M., & Del Pozo Armentia, A. (2017). Developing civic engagement in distance - higher education: A case study of virtual service-learning (vSL) - programme in Spain. *Open Praxis*, *9*(2), 235–244. doi:10.5944/openpraxis.9.2.578

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

*Goodfellow, R. (2011). Literacy, literacies and the digital in higher education. *Teaching in Higher Education*, *16* (1), 131–144. doi:10.1080/13562517.2011.544125

**Gourlay, L., Hamilton, M., & Lea, M. R. (2013). Textual practices in the new media digital landscape: Messing with digital literacies. *Research in Learning Technology*, *21*, 21438.

*Gourlay, L. (2015). Posthuman texts: Nonhuman actors, mediators and the digital university. *Social Semiotics*, *25*(4), 484–500. doi:10.1080/10350330.2015.1059578

Guo, J., & Huang, J. (2011) Subject headings and subject search: A comparative study. Chinese Librarianship: An International Electronic Journal, 31, Retrieved from http://www.iclc.us/cliej/cl31GH.pdf

Gutiérrez, I. (2011). Competencias del profesorado universitario en relación al uso de tecnologías de la información y comunicación: análisis de la situación en España y propuesta de un modelo de formación. Doctoral Thesis. University Rovira I Virgili.

*Guzman-Simon, F., Garcia-Jimenez, E., & Lopez-Cob, I. (2017) Undergraduate students' perspectives on digital competence and academic literacy in a Spanish University. *Computers in Human Behavior*, *74*, 196–204. doi:10.1016/j.chb.2017.04.040

*Hall, M., Nix, I., & Baker, K. (2013). Student experiences and perceptions of digital literacy skills development: Engaging learners by design? *Electronic Journal of e-Learning*, *11*(3), 207–225.

**Habib, L., Johannesen, M., & Øgrim, L. (2014). Experiences and challenges of international students in technology-rich learning environments. *Educational Technology and Society*, *17*(2), 196–206.

Harper, G. (2016). An ethics of the academy's embrace: The writer, the screen and the new literacies. *New Writing-the International Journal for the Practice and Theory of Creative Writing*, *13*(1), 145-152.

Haythornthwaite, C. (2007) Social facilitators and inhibitors to online fluency. In: 40th annual Hawaii international conference on system sciences (HICSS '07).

*Hilton, J. T. (2013). digital critical dialogue: A process for implementing transformative discussion practices within online courses in higher education. *Journal of Online Learning & Teaching*, *9*(4), 602–614.

**Hori, M., Ono, S., Yamaji, K., Kobayashi, S., Kita, T., & Yamada, T. (2015). Developing an E-book-based learning platform toward higher education for all. In: *International Conference on Computer Supported Education* (pp. 618–634). Springer International Publishing.

Ilomäki, L., Paavola, S., Lakkala, M., & Kantosalo, A. (2016). Digital competence–An emergent boundary concept for policy and educational research. *Education and Information Technologies*, *21*(3), 655–679. doi:10.1007/s10639-014-9346-4

**Inoue, H., Naito, E., & Koshizuka, M. (1997). Mediacy: What it is? Where to go? *International Information and Library Review*, *29*(3–4), 403–413. doi:10.1006/iilr.1997.0059

Iordache, C., Mariën, I., & Baelden, D. (2017). Developing digital skills and competences: A quick- scan analysis of 13 digital literacy models. *Italian Journal of Sociology of Education*, *9*(1), 6–30.

*Istance, D., & Kools, M. (2013). OECD work on technology and education: Innovative learning environments as an integrating framework. *European Journal of Education*, *48*(1), 43–57. doi:10.1111/ejed.12017

*Jefferies, A., Monett, D., & Kornbrot, D. (2016). Digital learners in higher education: Exploring technology ownership patterns and learning engagement. In *ECEL 2016-Proceedings of the 15th European Conference on e-Learning* (pp. 315-322).

JISC. (2011). Developing Digital Literacies: BriefingPaper in Support of JISC Grant Funding. April 2011. Retrieved from http://www.jisc.ac.uk/media/documents/funding/2011/04/Briefingpaper.pdf

JISC (2014). Developing Digital Literacies:March 2014. Available at: https://www.jisc.ac.uk/guides/developing-digital-literacies

JISC. (2015). *Developing students' digital literacy*. Retrieved from https://www.jisc.ac.uk/guides/developing-students-digital-literacy

Johnson, L., Adams Becker, S., Estrada, V., & Freeman, A. (2015). *Horizon report: 2015 higher education edition. reading*. Retrieved December 7, 2017 from http://cdn.nmc.org/media/2015-nmc-horizon-report-HE-EN.pdf

*Jones-Kavalier, B. R., & Flannigan, S. L. (2006). Connecting the digital dots: Literacy of the 21st century. *Educause Quarterly*, *2*, 8–10.

**Jones, S., & Lea, M. R. (2008). Digital literacies in the lives of undergraduate students: Exploring personal and curricular spheres of practice. *Electronic Journal of E-Learning*, *6*(3), 207–215.

Joosten, T., Pasquini, L., & Harness, L. (2012). Guiding social media at our institutions. *Planning for Higher Education*, *41*(1), 125–135.

*Kajee, L., & Balfour, R. (2011). Students' access to digital literacy at a South African university: Privilege and marginalisation. *Southern African Linguistics and Applied Language Studies*, *29*(2), 187–196. doi:10.2989/16073614.2011.633365

*Kenton, J., & Blummer, B. (2010). Promoting digital literacy skills: Examples from the literature and implications for academic librarians. *Community and Junior College Libraries*, *16*(2), 84–99. doi:10.1080/02763911003688737

**Kennedy, D. M. (2014). M-learning to support learning English in a Hong Kong University. *Journal of Online Learning & Teaching*, *10*(4), 640–656.

**Kelsey, L., & Uytterhoeven, L. (2017). Scratch nights and hash-tag chats: Creative tools to enhance choreography in the higher education dance curriculum. *Research in Dance Education*, *18*(1), 34–47. doi:10.1080/14647893.2016.1264381

**Kivunja, C. (2015). Teaching students to learn and to work well with 21st century skills: Unpacking the career and life skills domain of the new learning paradigm. *International Journal of Higher Education*, *4*(1), 1–11.

*Khan, S. A., & Bhatti, R. (2017) Digital competencies for developing and managing digital libraries an investigation from university librarians in Pakistan. *Electronic Library*, *35*(3), 573–597. doi:10.1108/EL-06-2016-0133

**Kolle, S. R. (2017). Global research on information literacy: A bibliometric analysis from 2005 to 2014. *The Electronic Library*, *35*(2), 283–298. doi:10.1108/EL-08-2015-0160

Krumsvik, R. (2008). Situated learning and digital competence. *Education and Information Technology*, *4*(13), 279–290. doi:10.1007/s10639-008-9069-5

Krumsvik, R. (2009). Situated learning in the network society and digitized school. *European Journal of Teacher Education*, *2*(32), 167–185.

Krumsvik, R. J. (2011). Digital competence in Norwegian teacher education and schools. *Hogre utbildning*, *1*(1), 39–51

*Krumsvik, R. J. (2014). Teacher educators' digital competence. *Scandinavian Journal of Educational Research*, *58*(3), 269–280. doi:10.1080/00313831.2012.726273

*Kühn, C. (2017). Are students ready to (re)-design their personal learning environment? The case of the E-Dynamic. *Space. Journal of New Approaches in*

Educational Research, *6*(1), 11–19. doi:10.7821/naer.2017.1.185

**Lea, M. R., & Jones, S. (2011). Digital literacies in higher education: Exploring textual and technological practice. *Studies in Higher Education*, *36*(4), 377–393. doi:10.1080/03075071003664021

*Lea, M. R. (2013). Reclaiming literacies: Competing textual practices in a digital higher education. *Teaching in Higher Education*, *18*(1), 106–118. doi:10.1080/13562517.2012.756465

Lea, M. R., & Stierer, B. (Eds.) (2000) *Student writing in higher education: New contexts Buckingham*: Society for Research into Higher Education/Open University Press.

*Linares, S. M., & Díaz Romero, C. (2016). Developing multidimensional checklist for evaluating language-learning websites coherent with the communicative approach: A path for the knowing-how-to-do enhancement. *Interdisciplinary Journal of e-Skills and Life Long Learning*, *12*, 57-93.

*Lindroth, T., & Bergquist, M. (2010). Laptopers in an educational practice: Promoting the personal learning situation. *Computers & Education*, *54*(2), 311–320. doi:10.1016/j.compedu.2009.07.014

*Littlejohn, A., Beetham, H., & Mcgill, L. (2012). Learning at the digital frontier: A review of digital literacies in theory and practice. *Journal of Computer Assisted Learning*, *28*(6), 547–556. doi:10.1111/jcal.2012.28.issue-6

**Liyanagunawardena, T. R., Adams, A. A., Rassool, N., & Williams, S. A. (2014). Developing government policies for distance education, *International Review of Education*, *2014*, 60, 821–839. doi:10.1007/s11159-014-9442-0

*Machin-Mastromatteo, J. D. (2012). Participatory action research in the age of social media: Literacies, affinity spaces and learning. *New Library World*, *113*(11), 571–585. doi:10.1108/03074801211282939

**Magrino, W., & Sorrell, P. (2014). Professionalizing the amateur: social media, the "myth of the digital native," and the graduate assistant in the composition classroom. *Journal of Interdisciplinary Studies in Education*, *3*(1), 76–94.

**Mar-Molinero, V., & Lewis, C. (2016). Developing "SotonSmartSkills": A reflection on scaffolded independent learning programmes. *Studies in Self-Access Learning Journal*, *7*(2), 209–219.

Martin, A. (2006). A European framework for digital literacy. *Nordic Journal of Digital Literacy. 1*(02), 151–161.

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. doi:10.11120/ital.2006.05040249

**Masats, D., & Dooly, M. (2011). Rethinking the use of video in teacher education: A holistic approach. teaching and teacher education: *An International Journal of Research and Studies*, *27*(7), 1151–1162.

*Mattila, A. (2015). The future educator skills in the digitization era: Effects of technological development on higher education. In *e-Learning (econf), 2015 Fifth International Conference on* e-learning (pp. 212–215).

**Mckendry, S. (2012). Investigating the possibilities for online delivery of a successful campus-based pre-entry programme. *Widening Participation & Lifelong Learning*, *14*(3), 216–234. doi:10.5456/WPLL.14.3.216

Mengual-Andres, S., Roig-Vila, R., & Blasco Mira, J. (2016) Delphi study for the design and validation of a questionnaire about digital competences in higher education. *International Journal of Educational Technology in Higher Education*, *13*, Article Number: UNSP 12. doi:10.1186/s41239-016-0009-y

**Mirriahi, N., Alonzo, D., McIntyre, S., Kligyte, G., & Fox, B. (2015). Blended learning innovations: Leadership and change in one Australian institution. *International Journal of Education & Development Using Information & Communication Technology*, *11*(1), 4–16.

Mishra, K. E., Wilder, K., & *Mishra, A. K. (2017). Digital literacy in the marketing curriculum: Are female college students prepared for digital jobs? *Industry and Higher Education*, *31*(3), 204–211. doi:10.1177/0950422217697838

*Morellato, M. (2014). Digital competence in tourism education: cooperative-experiential learning. *Journal of Teaching in Travel & Tourism*, *14*(2), 184–209. doi:10.1080/15313220.2014.907959

**Murray, M. C., & Pérez, J. (2015). Informing and performing: A study comparing adaptive learning to traditional learning. *Informing Science*, *18* (1), 111–125. doi:10.11.28945/2165

Moncada Linares, S., & Díaz Romero, C. (2016). *Interdisciplinary Journal of e-skills and Life Long Learning*, *12*, 57-93.

**Neira-Piñeiro, R., Villalustre, L., & Del-Moral, E. M. (2013). Didactic experiences with blogs in training teachers: Writing in digital media to develop professional competences. *International Journal of Technologies in Learning*, *19*(2), 51–64. doi:10.18848/2327-0144/CGP/v19i02/59007

*Novakovich, J. (2016). Fostering critical thinking and reflection through blog-mediated peer feedback. *Journal of Computer Assisted Learning*, *32*(1), 16–30. doi:10.1111/jcal.12114

OECD (2005) Definition and Selection of Key Competencies. Executive Summary (online resource) OECD Publishing.

Official Journal of the European Union. (2006). Recommendation of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning.

**Osborne, R., Dunne, E., & Farrand, P. (2013). Integrating technologies into "authentic" assessment design: An affordances approach, *Research in Learning Technology*, *21*, 21986. doi:10.3402/rlt.v21i0.21986

*Parvathamma, N., & Pattar, D. (2013). Digital literacy among student community in management institutes in Davanagere District, Karnataka State, India. *Annals of Library and Information Studies*, *60*(3), 159–166.

*Pates, D., & Sumner, N. (2016). E-learning spaces and the digital university. *The International Journal of Information and Learning Technology*, *33*(3), 159–171. doi:10.1108/IJILT-10-2015-0028

Peisachovich, E., Murtha, S., Phillips, A., & Messinger, G. (2016). Flipping the classroom: A pedagogical approach to applying clinical judgment by engaging, interacting, and collaborating with nursing students. *International Journal of Higher Education*, *5*(4), 114-121.

*Pérez-Mateo, M., Romero, M., & Romeu, T. (2014). Collaborative construction of a project as a methodology for acquiring digital competences. *Comunicar*, *21*(42), 15–23. doi:10.3916/C42-2014-01

*Phuapan, P., Viriyavejakul, C., & Pimdee, P. (2016). An analysis of digital literacy skills among Thai University seniors. *International Journal of Emerging Technologies in Learning*, *11*(3). doi:10.3991/ijet.v11i03.5301

*Pinto, M. (2012). Information literacy perceptions and behaviour among history students. *ASLIB Proceedings*, *64*(3), 304–327. doi:10.1108/00012531211244644

Pool, C. R. (1997). A new digital literacy: A conversation with Paul Gilster. *Educational Leadership*, *55*(3), 6–11.

**Powel, M. (2002). Designing library space to facilitate learning: A review of the UK higher education sector. *LIBRI*, *52*(2), 110–120.

**Power, J., & Kannara, V. (2016). Best-practice model for technology enhanced learning in the creative arts. *Research in Learning Technology*, *24*(1), 30231. doi:10.3402/rlt.v24.30231

**Prendes, M. P., Castañeda, L., & Gutiérrez, I. (2010). ICT competences of future teachers. *Comunicar*, *17*(35), 175–181. doi:10.3916/C35-2010-03-11

*Radovanović, D., Hogan, B., & Lalić, D. (2015). Overcoming digital divides in higher education: Digital literacy beyond Facebook. *New Media and Society*, *17*(10), 1733–1749. doi:10.1177/1461444815588323

**Ribeiro, S., Cunha, S., & Da Silva, M. M. (2015). Language tools: Communicating in today's world of business. *Teaching English with Technology*, *15* (2), 67–80.

*Roche, T. B. (2017). Assessing the role of digital literacy in English for academic purposes university pathway programs. *Journal of Academic Language and Learning*, *11*(1), A71–A87.

*Roushan, G., Holley, D., & Biggins, D. (2016) The kaleidoscope of voices: An action research approach to informing institutional e-learning policy. *Electronic Journal of E-Learning*, *14*(5), 293–300.

**Savin-Baden, M., Gourlay, L., Tombs, C., Steils, N., Tombs, G., & Mawer, M. (2010). Situating pedagogies, positions and practices in immersive virtual worlds. *Educational Research*, *52*(2), 123–133. doi:10.1080/00131881.2010.482732

Savolainen, R. (2016). Information seeking and searching strategies as plans and patterns of action: A conceptual analysis. *Journal of Documentation*, *72*(6), 1154-1180.

**Schmidt Hanbidge, A., Sanderson, N., & Tin, T. (2016). Information Literacy on the Go! Adding Mobile to an Age Old Challenge. International Association for Development of the Information Society, (IADIS), 12th International Conference Mobile Learning, Vilamoura, Algarve, Portugal, Apr 9-11, 103-106.

**Scott, J. L., Moxham, B. J., & Rutherford, S. M. (2014). Building an open academic environment - a new approach to empowering students in their learning of anatomy through 'shadow modules'. *Journal of Anatomy*, *224*(3), 286–295. doi:10.1111/joa.2014.224.issue-3

*Scuotto, V., & Morellato, M. (2013). Entrepreneurial knowledge and digital competence: Keys for a success of student entrepreneurship. *Journal of the Knowledge Economy*, *4*(3), 293–303. doi:10.1007/s13132-013-0155-6

**Sinka, R. (2006). Primary school teachers in the information society. *Journal of Universal Computer Science*. *12*(9), 1358–1372.

**Smith, B. E., Kiili, C., & Kauppinen, M. (2016). Transmediating argumentation: Students composing across written essays and digital videos in higher education. *Computers & Education*, *102*, 138–151. doi:10.1016/j.compedu.2016.08.003

*Stewart, B. (2013). Massiveness + openness = new literacies of participation? *Journal of Online Learning & Teaching*, *9*(2), 228–238.

*Stordy, P. H. (2015). Taxonomy of literacies. *Journal of Documentation*, *71*(3), 456–476. doi:10.1108/JD-10-2013-0128

Swedish Ministry of Education. (2017). Nationell digitaliseringsstrategi för skolväsendet U2017/04119/S. Retrieved December 7, 2017 from: http://www.regeringen.se/4a9d9a/contentassets/00b3d9118b0144f6bb95302f3e08d11c/nationell-digitaliseringsstrategi-for-skolvasendet.pdf

Syed, R., & Collins-Thompson, K. (2017). Optimizing search results for human learning goal. *Information Retrieval Journal*, *20*, 506–523. doi:10.1007/s10791-017-9303-0

*Tan, E. (2013). Informal learning on YouTube: Exploring digital literacy in independent online learning. *Learning Media and Technology*, *38*(4), 463–477. doi:10.1080/17439884.2013.783594

*Tang, C. M., & Chaw, L. Y. (2016). Digital literacy: A prerequisite for effective learning in a blended learning environment? *Electronic Journal of e-Learning*, *14*(1), 54–65.

*Timmis, S., Broadfoot, P., Sutherland, R., & Oldfield, A. (2016). Rethinking assessment in a digital age: Opportunities, challenges and risks. *British Educational Research Journal*, *42*(3), 454–476. doi:10.1002/berj.3215

Tømte, C., Enochsson, A. B., Buskqvist, U., & Kårstein, A. (2015) Educating online student teachers to master professional digital competence: The TPACK-framework goes online. *Computers and Education*, *84*, 26–35. doi:10.1016/j.compedu.2015.01.005

*Torres-Coronas, T., & Vidal-Blasco, M. A. (2011) Adapting a face-to-face competence framework for digital competence assessment. *International Journal of Information and Communication Technology Education*, *7*(1), 60–69. doi:10.4018/IJICTE

*Torres-Coronas, T., & Vidal-Blasco, M. A. (2015). Students and employers perception about the development of digital skills in higher education. *Revista De Educacion*, *367*, 63–89.

*Traxler, J., & Lally, V. (2016) The crisis and the response: After the dust had settled. *Interactive Learning Environments*, *5*(SI), 1016–1024. doi:10.1080/10494820.2015.1128216

*Tsankov, N., & Damyanov, I. (2017) Education majors' preferences on the functionalities of e-learning platforms in the context of blended learning. *International Journal Of Emerging Technologies In Learning*, *12*(5), 202–209. doi:10.3991/ijet.v12i05.6971

*Tuamsuk, K., & Subramaniam, M. (2017). The current state and influential factors in the development of digital literacy in Thailand's higher education. *Information and Learning Science*, *118*(5/6), 235-251.

UNESCO (2008). ICT competency standards for teachers. Policy Framework (156210). Paris, France: United Nations Educational, Scientific and Cultural Organization.

Ungerer, L. (2016). Digital curation as a core competency in current learning and literacy: A higher education perspective. *International Review of Research in Open and Distributed Learning*, *17*(5), 1-27.

**Vazquez-Cano, E., Martin-Monje, E., & Castrillo de Larreta, M. (2016) Analysis of PLEs' implementation under OER design as a productive teaching-learning strategy in higher education. A case study at Universidad Nacional de Educacion a Distancia. *Digital Education Review*, *29*(SI), 62–85.

© 2018 The Author(s). This open access article is distributed under a Creative Commons Attribution (CC-BY) 4.0 license.

You are free to:
Share — copy and redistribute the material in any medium or format.
Adapt — remix, transform, and build upon the material for any purpose, even commercially.
The licensor cannot revoke these freedoms as long as you follow the license terms.

Under the following terms:
Attribution — You must give appropriate credit, provide a link to the license, and indicate if changes were made.
You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.
No additional restrictions

You may not apply legal terms or technological measures that legally restrict others from doing anything the license permits.

Cogent Education **(ISSN: 2331-186X) is published by Cogent OA, part of Taylor & Francis Group.**

Publishing with Cogent OA ensures:

- Immediate, universal access to your article on publication
- High visibility and discoverability via the Cogent OA website as well as Taylor & Francis Online
- Download and citation statistics for your article
- Rapid online publication
- Input from, and dialog with, expert editors and editorial boards
- Retention of full copyright of your article
- Guaranteed legacy preservation of your article
- Discounts and waivers for authors in developing regions

Submit your manuscript to a Cogent OA journal at www.CogentOA.com