A cartography of digital literacy: conceptual categories and main issues in the theorization and study of digital literacies

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Abstract

This paper presents a cartography of the digital literacy academic field. Such cartography is comprised of two sections: a categorization of the field through literature review and analysis, and an exploration of its main issues through thematic and network analysis. On the one hand, five conceptual categories of digital literacies are found: functional, sociocultural, critical, transformative, and sociomaterial. On the other, main issues are described with 21 recurring themes of digital literacy and a few networks depicting its most salient matters of concern, concluding with an interpretation of these in the composition of 8 encompassing issue spaces: digital literacies conceptions and practices, digital literacy in education, access and digital divide, digital texts and literacy, websites and social networks, digital technologies at the workplace and healthcare, digital technologies users and uses, and information issues. Finally, a few paragraphs are dedicated to the limitations of categorizing and issue mapping.

Keywords

digital literacy; cartography; categorization; issue mapping; network analysis

I. Introduction

Both conceptually and practically, *digital literacy* (DL) is notable for its multiplicity as it refers to diverse meanings and practices in research, policy, and education (Nichols & Stornaiuolo, 2019). The expression "digital literacy" is uttered in a variety of projects generally associated with "access, evaluation, curation, and production of information in digital environments", ranging "from studies of screen-based reading comprehension [through] accounts of youth media practices [to] applications of critical theory" (Nichols & Stornaiuolo, 2019, p. 14). As a dynamic and continuously evolving concept (Lund et al., 2019), and one that can be approached from various theoretical perspectives (Lee et al., 2019), there is no totalizing academic consensus on what DL implies. The concept can manifest ambiguities (Spires, 2019) when attempting a single definition. To this, it must be added that DL belongs to a family of conceptual constructs that are themselves disparate; names that these notions adopt are characterized by the combination of a domain prefix, such as 'media', 'information', or 'digital', with an indicative of 'competence', 'skill', or 'literacy' (Lund et al., 2019).

Considering the multiple levels on which DL operates, it is convenient to start by citing its broadest meanings. Pangrazio (2016) notes that digital literacies are often positioned as semiotic activities mediated electronically, plus the investigation of specific digital practices or skills. Similarly, Yue et al. (2019) identify DL with the ability to negotiate and navigate digital platforms, and the knowledge about digitally mediated activities. Even broader descriptions are those that Darvin (2017) and Hagerman (2019) pose: for them, digital literacies are communicative practices of relationship, being, and thought associated with *digital technologies* (DT), which make, negotiate, and transform multimodal meanings in specific social contexts. Lastly, Traxler provides a provisional definition that encompasses specific elements of intent: DL corresponds to the "skills, abilities and attitudes that enable people and communities to survive, flourish and grow in an environment that is increasingly digital" (2018, p. 1) making decisions about matters of "digital safety, digital rights, digital property, digital identity and digital privacy" (2018, p. 4).

The various concepts that have emerged are coexisting and plural (Lankshear & Knobel, 2008), situated in context (Traxler, 2018), and contingently assembled (Nichols & Stornaiuolo, 2019). In fact, DL is multidimensional in that it shows overlapping and conflicting definitions (Njenga, 2018) that suggest internal tensions in the field, manifested as divergent trajectories (Gourlay & Oliver, 2013). This is in part due to a multidisciplinary interest, with contributions stemming from media education, psychology, pedagogy, social and cultural studies, linguistics, information sciences, and so on (Koltay, 2011). Furthermore, the concepts content and form are intertwined with technical and institutional conditions so, "what precisely amounts to digital skills, literacy, or competences is in continuous flux in line with changing technological frames and the shifting demands of teachers, students, educational institutions, and society at large" (Pötzsch, 2016, p. 119). This is not unique to DL since the nature of other literacies change or fork as well, for they are also deictic (Leu et al., 2017); however, in digital domains this characteristic seems to be exacerbated in response to rapid technological and sociocultural changes (Yuan et al., 2019).

Precisely in the light of its multiplicity and dynamism, various attempts have been made to systematically document DL's conceptual uses (e.g., Spante et al., 2018). Others have categorized the field branches through periodization (e.g., Rantala & Suoranta, 2008), type of perspective or definition (e.g., Martin, 2015), or literacy goals (e.g., Søby, 2008). Nonetheless, available categorizations, whether made with explicit differentiation of period—such as 'functional' or 'sociocultural' trends—or implicit divergence from other literacy goals—as in 'transformative' perspectives—, have not been unified onto a single classification of digital literacies. Also, a complementary map of the main issues being discussed in scholarly texts directly dealing with all categories of DL has not been depicted. In this paper, both matters are tackled by categorizing digital literacies *and* attempting to map their main issues within academic literature: that is, a

cartography of the theorization and study of digital literacies.

II. Methodology

a. Categorization

The formation of categories has been carried out through *coding* techniques with *grounded theory* applied to the text of a *conventional literature review* on "digital literacy". Specifically, open and selective types of coding (Corbin & Strauss, 1990) were used to elucidate how fine categorization should be, what definitions would fall into each category, and what labels would be more representative. It is important to state that all resulting categories were given names that have been coined before in literature—see figure 1—and, even when one of them has not been recognized in categorization efforts—i.e., sociomaterial DL—, it surely exists as a self-designated DL subfield with the label borrowed in here. In that sense, the categorization in this paper is an *integration* of categories already stated by other authors, and a *merging* of subcategories[1], more than a classification made from scratch.

b. Issues: themes, networks, and spaces

To identify the main issues in the field, a *social cartography* through *issue mapping* (Rogers et al., 2015) has been conducted out of a group of academic texts whose main topic is "digital literacy". This map is comprised of three elements: a thematic description of the field, a depiction of its networked issues, and a composition of issue spaces. Texts that served as input data were extracted from Elsevier's *Scopus*, Clarivate Analytics' *Web of Science* (WoS), and the Institute of Education Sciences' *Education Resources Information Center* (ERIC). These databases were chosen because of their importance indexing academic publications; in particular, Scopus and WoS offer a wide collection of bibliographic citations and strong search engine capabilities, while ERIC is a well-known digital library that catalogs educational research—a very relevant area in the discussion of DL. These were queried for the terms ["digital literacy" OR "digital literacies"][2] when they appear in the title, keywords, and/or abstract of the publications. Only publications that appear in scientific journals, humanities journals, conference proceedings, and academic books were admitted[3].

Searches were directed only to texts written in English since 1997; there are two reasons for this specific date. Firstly, searches carried out without limits to date of publication did not yield any results before 1997 in the case of Scopus and ERIC, and only one[4] for WoS. Secondly, histories of DL (e.g., Bawden, 2008; Koltay, 2011; Spante et al., 2018) posit that academic discussion on this topic in its current understanding began[5] with Gilster's book "Digital Literacy" (1997). Now then, all

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[1] For instance, 'instrumental', 'autonomous', and 'competence based' all fall under one 'functional' category.

[2] The query *is* everything contained within brackets, including quotation marks and the Boolean connector.

[3] Academic articles, book chapters, conference papers, systematic reviews, research reports, etc.

[4] The only result that contains the term "digital literacy" before 1997 is a brief article by Lanham (1995). In it, he would explicitly refer to "digital literacy" as the skill to make sense of multimedia information and hyperlinks (Bawden, 2008).

[5] Although genealogies on the field show that many of its principles come from other 'literacies of the digital' that precede DL (Martin, 2008), mainly computer, information and media literacies (Nichols & Stornaiuolo, 2019).

records[6] gotten from the three databases were arranged and refined in such a way that only unique registers with correct information are left as input, resulting in 2961 records. On the other hand, all open access documents encountered were downloaded and converted to software readable format, resulting in 844 unique full texts. Since there were two possible datasets—2961 records or 844 full texts—both were analyzed separately[7]. Analyses on the 2961 records will hereafter be called *Experiment 1* ("Ex1"), while those pertaining to the 844 texts are referred as *Experiment 2* ("Ex2")[8].

Regarding the thematic description of the field, *topic modeling* (Blei, 2012) was applied: an algorithmic technique that automatically analyses the relationship between words from a group of texts in order to identify the topics of the set (Figuerola et al., 2017). To this end, the executable version of the software tool *Mallet* (McCallum, 2002) was used. This version runs on a topic modeling algorithm called *Latent Dirichlet Allocation* (Blei et al., 2003), which makes it possible to associate words in various documents with a given number of topics, identify those topics, and determine the quantified presence of each (Figuerola et al., 2017).

Concerning the depiction of issue networks and composition of issue spaces, several concepts and methods of *issue mapping* were considered to 'make the status of issues visible' (Rogers et al., 2015). To query the databases and, in part, to interpret the results, one important tenet of issue mapping was 'search as research'; that is, the repurposing of search engines—academic databases, in this case—as resonance analysis devices that provide hierarchies of sources and words (Rogers et al., 2015). Results of this resonance—words that make up a topic, in this case—should be recognized as *matters of concern* (Latour, 2004, 2005) in constant formation and reformulation, rather than completely stabilized facts whose discussion is forever closed. This principle applies especially to contested or controversial entities in a network (Venturini, 2010a, 2010b), as is the case with DL[9] and its related issues. Big sets of associated objects—topics, in this case—can be treated and demarcated as *issue spaces* (Rogers et al., 2015) of the controversy.

Issues can be represented with a network graph that allows tracing associations between entities and emphasize such aspects as the strength and specificity of the association, as well as centrality and periphery (Rogers et al., 2015). All network visualizations were traced with the software *Gephi* (Bastian et al., 2009), applying Yifan Hu's (2005) force algorithm. Node centrality parameters were calculated with the Brandes (2001) algorithm by means of the aforementioned software. In addition to the quantitative phase of network analysis, the qualitative narrative is based on network perspectives and recurrent network readings (Venturini et al., 2017). *Panoramic*

[6] Records consist of publication title, authors, year, abstract, and source.

[7] Datasets should not be combined: first, because one contains the references of the other; second, because the textual length of each record is notably shorter than that of each complete document, which would result in a disproportionate presence of some topics over others; and third, because they are data of different nature in terms of structure, i.e., title-abstract vs. full text.

[8] In experiments the first topic modeling is carried out for a high number of topics (50) with a generic exclusion list of stop words. Subsequently, outputs requested to Mallet are reduced with each new iteration of the experiment, while the list of stop words increases in each instance. This is done by inspecting the groups obtained in the preceding iteration looking for a satisfactory differentiation between topics. Ex1 took 5 iterations to obtain satisfactory results, while Ex2 demanded 11 iterations. By the 5th iteration of Ex1, the number of requested groups had been decreased from 50 to 24, and all the words that introduced noise had been added as stop words as they lacked semantic relevance to this particular case.

[9] In Venturini's vocabulary, it can be said that DL is a controversy in the academic world. For Venturini (2010a, 2010b) and Rogers et al. (2015), controversies do not necessarily carry the connotation of traditional confrontation—although they can lead to it—; rather, "controversy" is understood in the broadest sense of the expression: social, political, scientific and technological discrepancies between entities in 'collective life' (Latour, 2005). Given the myriad definitions associated with DL, its dynamism, and the lack of consensus across disciplines and researchers, it can be confidently stated that DL is indeed a controversial issue for scholars.

storytelling and *advantaged positions* have been particularly useful in describing issue distribution by observing clusters, mediation, and structural holes in the network (Bounegru et al., 2017).

III. Results

a. Digital literacy conceptual categories

Available categorizations

Categorization of literacies in general, and of digital literacies in particular, can be done in various ways depending on governing criteria: through historical periods of the academic field, or by its conceptual approaches, methods, objectives, etcetera. In many scholarly contributions to *digital literacy* (DL) a categorical postulate can be found, either with an explicit taxonomy or implicitly contrasting two or more trends. All categorizations found in specialized literature are summarized in Figure 1. The columns "Categorization" and "Category description" paraphrase the cited source with underlined nouns kept as in the original. Meanwhile, the columns "Type", "Form", and "Notes" have been added for structure and clarification.

Type	Authors	Categorization	Category description	Form	Notes
According to the time period	Rantala & Suoranta (2008)	Perspectives movement	1. Functional, mechanical, autonomous vision	Binary	Influenced by Brian Street
			2. Sociocultural, practices, ideological vision		
	Hinrichsen & Coombs (2014)	Focus change	1. Focus on the machine itself and operational skills	Binary	-
			2. Focus on the digital with the idea of situated practices and openness to critical literacies		
	Bhatt et al. (2015)	Paradigmatic change	1. Autonomous-singular model as uniform and universal set of technical skills	Binary	Influenced by Street's models
			2. Plurality that highlights social practices, ideologies and contexts		
	Lund et al. (2019)	Orientation development	1. Technological orientation and skills	Binary	-
			2. Orientation to literacy, competence, attitudes, knowledge and transformation		
	Nichols & Stornaiuolo (2019)	Movement in academy	1. First wave: normative acquisition of skills	Binary	"First wave" is implied
			2. Second wave: descriptive approaches to activity		
	Martin (2015)	Focus evolution	1. Focus on skills (cognitive)	Ternary	-
			2. Focus on applications (procedural)		
			3. Focus on criticism and reflection (meta-skills)		
	Chaka (2019)	Ages evolution	1. Pre-digital: separate single-function devices, discrete literacies of reading-writing	Ternary	Based on Tom Goodwin's ages
			2. Digital media: the digital immersed in daily life, corresponding with skills discourse		
			3. Post-digital: digital technologies fundamental to daily life, blurring online and offline		
According to the perspective	Bawden (2008)	Consideration of two perspectives	1. Technical skills	Binary	Observed by Eshet-Alkalai
			2. Cognitive and socio-emotional aspects of work		
	Oliveira & Knobel (2017)	Concept focus	1. Skills and competencies that qualify as literate	Binary	-
			2. Digital literacies as sociocultural practices		
	Martin (2015)	Vision of relationship group/individual and the digital	1. Functional	Ternary	Based on Claire Bélisle's description
			2. Sociocultural, linked to social context		
			3. Intellectual empowerment, transformative		
	Spante et al. (2018)	Emergence of different perspectives	1. Know-how skills-oriented operational approach	Ternary	Found in their field review
			2. Plural form, non-generic multiple concept		
			3. Critical perspective as reflexive approach		
	Godhe (2019)	Vision from three perspectives	1. Technical skills: e.g., handling digital devices and online communication	Ternary	Observable trends
			2. Social practice: e.g., how online environments affect communication and social norms		
			3. Critical digital literacies: e.g., critical approach to media or digital design		
According to the goal	Lankshear & Knobel (2008)	Delineation between objectives	1. Specific skills-techniques that qualify as literate	Binary	Noted by Paul Gilster
			2. Mastery of ideas and evaluation of information		
	Søby (2008)	Distinction between objectives	1. Using computers, networks, media technologies	Binary	Distinction by Kathleen Tyner
			2. Understanding media representation, meaning making and organization		
	Nichols & Stornaiuolo (2019)	Strategy differentiation	1. Prescriptive	Binary	-
			2. Descriptive		
	McDougall et al. (2018)	Type of DL intervention or initiative	1. Economic/Employable: e.g., increase skills, access services, benefits or labor practices	Ternary	-
			2. Educational/Academic: e.g., competences, pedagogy or digital practice ethnographies		
			3. Civic Engagement/Welfare: e.g., improve democracy or access to public services		
According to the definition	Lankshear & Knobel (2008)	Distinction between definition types	1. Standardized definitions that operationalize skills	Binary	-
			2. Conceptual definitions as general idea or ideal		
	Pangrazio (2016)	Tendency towards definition types	1. Competence and operational mastery	Binary	-
			2. Evaluation and critique		
	Martin (2015)	Conception on three levels	1. Technique: mastery of digital competences	Ternary	-
			2. Reflexive: contextual application of digital tools		
			3. Critical: understand the impact of digital actions		
	Pötzsch (2016)	Distinction between digital competences	1. User skills	Ternary	Distinction by Eevi Beck and Leikny Øgrim
			2. Technological expertise		
			3. Knowledge of technology in culture and society		

Figure. 1. Digital literacies categorizations in literature.

Unifying categories

Figure 1 shows that the most frequent categorization type is *periodization*. Depending on time period, three categories can be distinguished which roughly coincide with the movement from a functional, singular, normative, cognitive and skill-focused DL; towards plural, sociocultural, contextual, descriptive, attitudinal and practice-focused digital literacies; and to critical digital

literacies characterized by meta-skills of critique, reflection and judgment. A pattern of periods clearly emerges: (1) functional, (2) sociocultural, and (3) critical DL.

According to *perspective*, four recognized categories emerge. The first has a functional and operational orientation and is focused on cognitive aspects; the second is sociocultural and linked to social practices around digital texts, with special attention to context, plurality and the non-generic nature of the concept; the third combines critique and reflection; and, finally, a DL of empowerment and transformation of individuals and groups. In summary, the perspectives are: (1) functional, (2) sociocultural, (3) critical, and (4) transformative DL.

Depending on their *goals*, four intervention styles can be distinguished: skill prescriptions with the purpose of qualification, competitiveness or employability; academic/ethnographic descriptions of digital practices or addressing skills for educational purposes; objectives for the critical/reflexive treatment of information and understanding of digital technologies (DT); and serving democratic participation and access along civic lines and social welfare. Once again, if we were to group these, we would get: (1) functional, (2) sociocultural, (3) critical, and (4) transformative DL.

According to *definition* type, three categories appear in the literature: definitions that standardize tasks and skills or that postulate operational skills, digital techniques, uses or technological expertise; conceptual and ideal definitions of use, practice and contextual application of DT; and critical/reflexive definitions about knowing and understanding human, social and cultural impacts of digital actions and technologies. These types can be allocated as: (1) functional, (2) sociocultural, and (3) critical DL.

As it can be observed, these categorizations have four groups in common. Nevertheless, in recent years a fifth category has emerged out of the sociomaterial perspective applied to the description and prescription of digital literacies; namely, one that is the result of contributions made by Gourlay & Oliver (2013), Bhatt & Roock (2014), Bhatt et al. (2015), Dezuanni (2015), and Jensen (2019). This branch of DL is relatively new in literature, but the mentioned articles rely on sociomaterial aspects in education that count with numerous publications (Fenwick, 2015) and other applications besides DL. In any case, our integrated categorization of digital literacies is as follows: (1) functional, (2) sociocultural, (3) critical, (4) transformative, and (5) sociomaterial DL.

b. Digital literacy main issues

Themes

Resulting topics from Ex1 and Ex2 have been grouped under themes and coded with a single phrase to designate them—see the "Name" column in figure 2. The coding process is based on the words contained in each topic—see the "EX1 resulting issues" column—carefully contrasted with the text—i.e., title-abstract—of the top participating registers per grouping. In other words, the 10 most prominent EX1 registries for each topic[10] were analyzed to compose, not only the theme's name, but also its description—see the "Thematic description" column.

Due to the nature of Mallet's output files and other considerations mentioned in footnote 7, it is necessary to choose between the results of Ex1 and Ex2 for further analysis. All 24 topics of Ex1—see the "EX1 code" column—can be gathered as 21 themes—see the "№ Theme" column—, while Ex2 only produced 19. Considering that the 21 themes of Ex1 contain all of those from Ex2, plus two, the results of Ex1 have been selected for further analysis—networks in next section. However, issues obtained from Ex2 are taken into account to enrich the description of the corresponding Ex1 theme—see the words in parentheses in the "EX1 resulting issues" column.

[10] A metric extracted from Mallet's output data.

To be sure, *every component word of a topic is considered an "issue"* due to grouping sets ease, and soundness with the tenets of social cartography. Words make up issues and issues are understood as networked matters of concern, then issues make up topics and topics group as themes. Finally, themes come together as issue spaces—see Conclusions. The following figure shows the main issues and themes of DL.

№ Theme	Name	EX1 resulting issues (EX2 additions in parentheses)	EX1 code	Thematic description
1	DL in higher education: students and programs	students, university, student, skills, academic, study, education, year, digital, higher, faculty, undergraduate, college, teaching, learning, universities, literacy, graduate, program, courses (research, open, practice, uk, technology, work, staff, resources, development, design, online, project, professional)	T0	DL in higher education can refer to undergraduate/graduate programs, faculties, specific courses and projects for/from teachers, students or university staff. It includes issues of: information literacy (IL) and digital divide (DD) in higher education; impact and advantages of DT—hardware and software—and the role of DD in student skills for digital communication, literacy, language, critical thinking, digital composition and academic skills; expiriences such as blended learning and digital writing classrooms; approaches to teaching/learning at the individual and institutional level, services and academic resources
2	ICT initiatives, politics/government, development and citizenship	ict, society, policy, public, countries, citizens, citizenship, european, development, government, knowledge, europe, information, sector, projects, global, sustainability, communication, national, initiatives (social, internet, education, educational, training, spain, activities, networks, spanish, people, digital, cyberbullying, learning, competences, analysis, studies)	T1	Information and communication technology (ICT) initiatives for society and their relationship with the development or governance of information, knowledge, education, training and skills, from a political, public, international or regional point of view. It includes topics of: computer science (CS) and informatics in European schools; relationships between media literacy (ML) and participation for social change; civil society promotion of ML and IL; communication models between government authorities and citizens through digital skills and the Internet; ICTs to support social inclusion; economic-technological strategies for the implementation of DT and its relationship with DD; ML, IL and DL public policies and debates; education and DL and its relation to democracy
3	Digital technology uses/users: interactions, applications, implications	mobile, devices, apps, technology, user, users, smart, phone, app, applications, computers, phones, computer, technologies, smartphones, device, tablets, smartphone, computing, usage, interaction, virtual, human, production, analysis, material, theory, traditional, theoretical, perspective, social, specific, environment, vr, actors, presented, culture, making, interactions, point	T2, T21	About uses and users of mobile devices, applications, smartphones, computers, tablets, virtual reality and digital environments. Includes issues of: uses of DT in self-management and monitoring of health or financial capacity; cultural production on the Internet and its relationship with communication; studies of human behavior and task effectiveness with DT; changes and nuances of literacy in the context of DT; evaluation of DL with user-centered design apps; feasibility and implications of digital work environments, e.g., virtual reality, e-sports
4	Literacy: reading and writing strategies, literacy modalities	reading, online, students, information, text, comprehension, print, web, sources, read, readers, texts, strategies, wikipedia, tasks, writing, knowledge, internet, participants, credibility (school, interest, enjoyment, high, university, social, academic, study, media, education, factor, sciences, competence, educational)	T3	Strategies, practices, interest, and skills of students or participants for reading and writing online and web texts—e.g., on Wikipedia—and their relationship to information and source credibility, comprehension, and knowledge. It includes issues of: adolescents and their understanding of multimodal texts; integration of divergent sources of information for DL and argumentation; evaluation of information in social networks and learning in digital environments; online reading process; health information and online sources; behavior, comprehension and meaning related to digital texts
5	DT at the workplace: digitalization, innovation and business	technology, work, innovation, business, industry, workers, future, innovative, process, management, economy, change, time, employability, professional, development, market, organizational, employees, security	T4	DT at work and professions and their relationship with innovation, business, development, management, security, economy, markets, employability and workers. It includes issues of: industry digitization evaluation; staff response to digital systems—e.g., real-time location—; role of DL in work performance and behavior; employability and employer expectations and implications of technological change regarding digital skills and adoption in labor markets; emerging management models with the Internet of Things (IoT) and cyber security; emerging ways of learning and working; ICT implementation in medium and small companies
6	Social media possibilities: participation communicat., production	media, social, online, content, people, youth, culture, sites, networking, network, networks, facebook, participation, communication, users, cultural, critical, twitter, platforms, production (news, internet, public, digital, political, young, society, information)	T5	Participation of young people and other groups in social networks and their cultural practices, communication, use, production, critique, politics, on online sites like Facebook and Twitter. Includes issues of: education—curricular instruction or DL education—with social media; use of social networks by specific groups—e.g., refugees, adults, academics, adolescents—in terms of information, identity, meanings, entertainment, communication, DL, ML, inclusion, online behavior and content production; implications of platform infrastructure—particularly algorithms—on the discursive power of certain groups—e.g., far right
7	Community or group DL: challenges and projects	community, project, school, program, digital, literacy, communities, local, immigrant, states, youth, technology, city, university, center, global, programs, united, centers, adult	T6	DL programs for student, immigrant, youth or adult communities, in local centers, schools, universities or cities. Includes issues of: public and private DL projects aimed at online education, digital museums, libraries, community welfare, etc.; community DL practices—e.g., Latinos—in educational settings, free time, makerspaces, digital archives, extracurricular activities, etc.; critical literacy and participatory DL
8	Education: DL and technology in schools and curriculum	teachers, school, teacher, technology, teaching, students, digital, schools, education, classroom, literacy, service, learning, professional, pre, secondary, curriculum, ict, primary, educational (pupils, knowledge, training, pedagogical)	T7	DL teaching and learning in schools for teachers—professional training—and students, with technological, pedagogical and curricular requirements. It includes issues of: theorizing, models or experiences with DL in primary and secondary schools, and technological integration—ICT, 3D printing, software; instructional practices with DT andcase studies; DL training of school teachers for learning activities, special education, and digital storytelling; challenges in developing countries to implement or improve DL educational initiatives
9	Information services and resources: access, management, libraries	information, library, libraries, librarians, services, research, literacy, academic, resources, il, public, staff, access, university, seeking, users, search, management, role, open (copyright, cultural, innovation, people, heritage, survey, online, institutions, book, older, adults)	T8	Research and practices of information services staff in institutions such as public libraries or universities regarding DL, access and search, users, copyright, culture, management and innovation. It includes issues of: digital humanities (DH) in library instruction programs for DL improvement; information barrier factors for different groups—users, academic staff, librarians—or conditions; information search behavior in libraries with digital resources; online learning systems, public or academic digital libraries and research services
10	Young people use of DT: risks, opportunity, family	children, young, parents, early, online, internet, privacy, adults, risks, family, childhood, home, child, families, years, activities, adolescents, play, opportunities, risk (games, school, digital, game, media, computer, technology, development)	T9	Privacy, family/home and risk/opportunity due to DT use and online activities—Internet, videogames, digital media—of children and adolescents. Includes issues of: promoting safe Internet use—online behavior, psychological predispositions, development, social connections—and online risk reduction from advertising, spam, violence, pornography, hate, etc.; DL programs to promote wellness amongst young people, substance abuse awareness, identity and body education; meaningful participation of children in literacy events
11	Digital literacies: research, practices, education	digital, literacy, literacies, practices, research, critical, education, technologies, practice, ways, studies, contexts, work, social, learning, approaches, media, global, writing, educators (texts, school, classroom, cultural, culture, meaning, space)	T10	Ways of conceiving DL of and from practices and contexts, research and studies, critique and approaches, education and work, technology and media, texts and culture, spaces and meanings. It includes issues of: academic perspectives, theoretical or practical frameworks, definitions, studies, and methodological tools—e.g., transliteracy—on DL; practices of teachers—e.g., pedagogical—, students—e.g., collaborative storytelling—, or other people, in the context of classrooms equipped with DT or digital spaces in general
12	Practices and discourse in online space: identity, demography, power	practices, spaces, online, study, literacy, news, identity, fake, american, identities, transnational, african, youth, narratives, girls, ways, power, discourse, gender, construction	T11	Online literacy studies—practices, power and space construction, discourse, fake news, narrative, and gender—regarding groups and identities—african americans, youth, girls, etc. It includes issues of: digital rhetoric and multimodal narrative associated with marginalized groups—e.g., LGBTQ—, activism and social justice; normalization of categories in digital spaces such as online games or social networks; practices of digital communication and multiculturalism—e.g., of immigrants—; academic responses and critical literacy to power issues; digital skills and tools against fake news; gender and new perspectives of DL
13	Information issues: knowledge, internet searches, big data	information, science, search, google, scientific, articles, review, approach, based, big, knowledge, change, issues, research, climate, web, published, terms, systematic, data (users, privacy, user, technology, surveillance, management, system, security, systems, open, rfid, digital, models, public, future, service, students, wikipedia, literacy, online, internet, sources, source, library, tasks, skills, il, evaluate, student, reading, task)	T12	Academic studies from information sciences and others, user approaches and practices concerning information and Internet search, web platforms and sources, data and big data, privacy and surveillance, management of information systems and knowledge, questions about access—public vs. private, or "open access"—, libraries and services, IL and DL. It includes issues of: knowledge, learning, attitudes, "hyperattention" and behavior in the "information society"; big data applications; search engines as bodies of knowledge; search for specialized information by students; evaluation of online information for school students; development of online learning programs; uses of geographic information in web applications

14	DL development: skills, competences, tools, evaluation, training	digital, literacy, skills, information, technology, knowledge, technologies, development, communication, world, society, tools, competencies, ability, education, framework, order, develop, based, critical, educational, research, competence, training, assessment, competences, university, process, higher, evaluation, level, international, analysis, ict, system, authors (media, work, social)	T13, T15	Skills, technologies, tools, competences, education, approaches, research and training for DL and critical DL in various contexts. It includes issues of: experiments with DL models, standards and concepts—instrumental and complex skills—for effective management of digital technologies and environments; student digital skills; evaluation of digital education; DL-focused civic and ethical education
15	Digital access: socio-economic and technological factors	digital, access, internet, divide, rural, social, services, people, inclusion, india, public, economic, low, south, government, income, technologies, women, urban, service (mobile, information, technology, ict, community, countries, policy, development)	T14	Factors and implications of Internet access, services, DT, and information, depending on the inclusion/exclusion of rural communities, women, countries of the Global South, and economic, technological and public policy conditions. It includes issues of: domestic approaches towards reducing DD; factors and barriers inhibiting Internet adoption and public access to computing; projects with emphasis on economic competitiveness; digital access indicators based on infrastructure, services, DL, geography, economy
16	DL research: studies, frameworks, surveys, factors, tests, models, implications	digital, literacy, study, internet, level, survey, information, factors, computer, research, data, skills, significant, analysis, test, findings, age, model, based, variables, participants, interviews, design, qualitative, approach, studies, technology, understanding, context, implications, framework, literature (social, education, items, higher, group, online, process, work, time, questions, project, knowledge, people, content, support, important)	T16, T18	Studies of levels, factors, skills, models, approaches, implications and literature of DL in the technological, social, educational and labor context. It includes issues of: adoption of digital applications—e.g., valuation of medical services—; student DL—e.g., digital storytelling, IL, DD in higher education, etc.—; approaches to online learning with massive open online courses (MOOCs); influence of ethnicity, gender, or migration status on online health-related information search behavior; students attitudes and preferences towards digital learning tools and levels of dependency on tutors; public policies to improve informational and strategic skills on the Internet to reduce inequality
17	Students multimodal practices: digital texts production and analysis	digital, video, multimodal, students, storytelling, creative, visual, writing, videos, project, stories, projects, composing, composition, production, multimedia, media, making, analysis, texts (story, text, literacy, student, humanities, classroom, reading, work, narrative, class)	T17	Composition projects—multimodal, creative, narrative, multimedia—of digital texts—video, audio, text, image—, or text analysis, for students. It includes issues of: composition modes and languages in the classroom for digital projects and development of tacit knowledge, and the study of these activities—adaptive processes of composition, affects, audience, identity, creativity, analysis, proposals—; internalized literacies to make sense of complex narratives; integration of DH into instruction to improve DL and research skills; embodied learning pedagogy; creativity, art and meaning making interactions
18	Online learning: open projects, collaboration, design	learning, online, students, learners, design, technology, education, teaching, based, development, open, support, environments, model, project, educational, knowledge, collaborative, face, environment (student, university, skills, tools, study, academic, mobile, digital, classroom, courses, class, higher)	T19	Technology, tools, development, and types of teaching environments for online learning. It includes issues of: blended learning for students in higher education—cases of online tutorials, redesign of academic programs, and MOOCs—; experiences of students as producers of digital content and academic environments designed with open source; pedagogical strategies for the use of online resources and improvement of scientific skills and DL; motivational factors, completion rates, learner behaviors, effective learning and academic experiences with MOOCs; non-formal education projects through ICT—e.g., "digital literacy 2.0"
19	Healthcare issues: eHealth literacy, older people, barriers	health, older, care, medical, patients, adults, people, healthcare, patient, elderly, barriers, support, ehealth, technology, management, based, groups, participants, face, treatment (apps, data, app, information, mobile, clinical, review, mhealth, services, diabetes, study)	T20	Mobile and clinical applications, data, ICT, mHealth, and services for healthcare of groups, especially older adults and patients. It includes issues of: effects of electronic symptom monitoring and reported outcomes in and by patients; evaluation of competences—eHealth literacy—for 'digital health' services; changes in physical activity of groups—e.g., middle-aged women—due to DT; digital learning packages for mitigating the impact—e.g., of Covid-19—of health work; service demands—e.g., IoT—according to older people, people with disabilities, care providers and health services; ICT-supported health services
20	Computational thinking and games: STEM, curriculum, programming	games, game, thinking, computer, science, students, computational, programming, design, learning, school, skills, computing, gaming, based, curriculum, stem, problem, engineering, educational (education, research, knowledge, process, scientific, model, materials, problems, development)	T22	Implementation of skills—programming, problem solving—through CS, computational thinking (CT), and game design. It includes issues of: programming development metrics and CT with games designed by students of science, technology, engineering and mathematics (STEM); gamified lessons for STEM education; computational literacy, numeracy, and ML; programming and career choice gap between women and men; curriculum and MOOC application of game-based learning to improve skills of young people unfamiliar with CS; fusion of DL and algorithmic skills from CS and CT for general problem solving
21	Language learners: tools, DT, resources	language, english, writing, teaching, learners, efl, foreign, tools, languages, communication, social, linguistic, arts, class, web, instruction, resources, based, vocabulary, computer (students, text, teachers, learning, study, teacher, reading, translation)	T23	Digital resources for language instruction/learning. It includes issues of: use of audio tools for learning mother tongue and foreign language for preschoolers; teaching digital skills in the second language—mainly English—and contemporary communication; multimodal, communication, ethnographic, DL and "multiliteracy" research through applied linguistics on digital platforms—e.g., videochat, social networks, etc.—; attitudes of language teachers towards digital competences

Figure. 2. Main issues and themes in digital literacy texts.

Issue networks

Consequent with social cartography precepts it is important to *visualize the associations* of the issues shown above. There are several visualization strategies for mapping issues, but a network graph fits this case. Figure 3 depicts all issues as nodes and their associations represented as undirected edges. There are 306 nodes—unique issues from Ex1—and 4274 edges—unique associations[11]. The size of each node is proportional to its degree[12], that is, to the number of edges that converge in it. An annotation on the right side of the graph reveals the color palette and

[11] A node has been assigned to each of the 20 words of each of the 24 topics determined in Ex1. Then associations have been traced, i.e., edges that connect all the issues of the same topic with each other. In principle there should have been 480 issue nodes but, due to issues appearing in several topics at once, the result is 306 *unique* nodes attracted by their associations through the force algorithm.

[12] Visually limited in Gephi to a range of degree sizes from 10 to 60 to improve readability of smaller nodes and avoid overlapping of larger ones. Actual sizes would range from 19—those connected only to their own topic—up to 127, the highest degree in the network.

indicates the number of topical nodes expressed as a percentage of 306. Nodes have been colored according to topic codes[13].

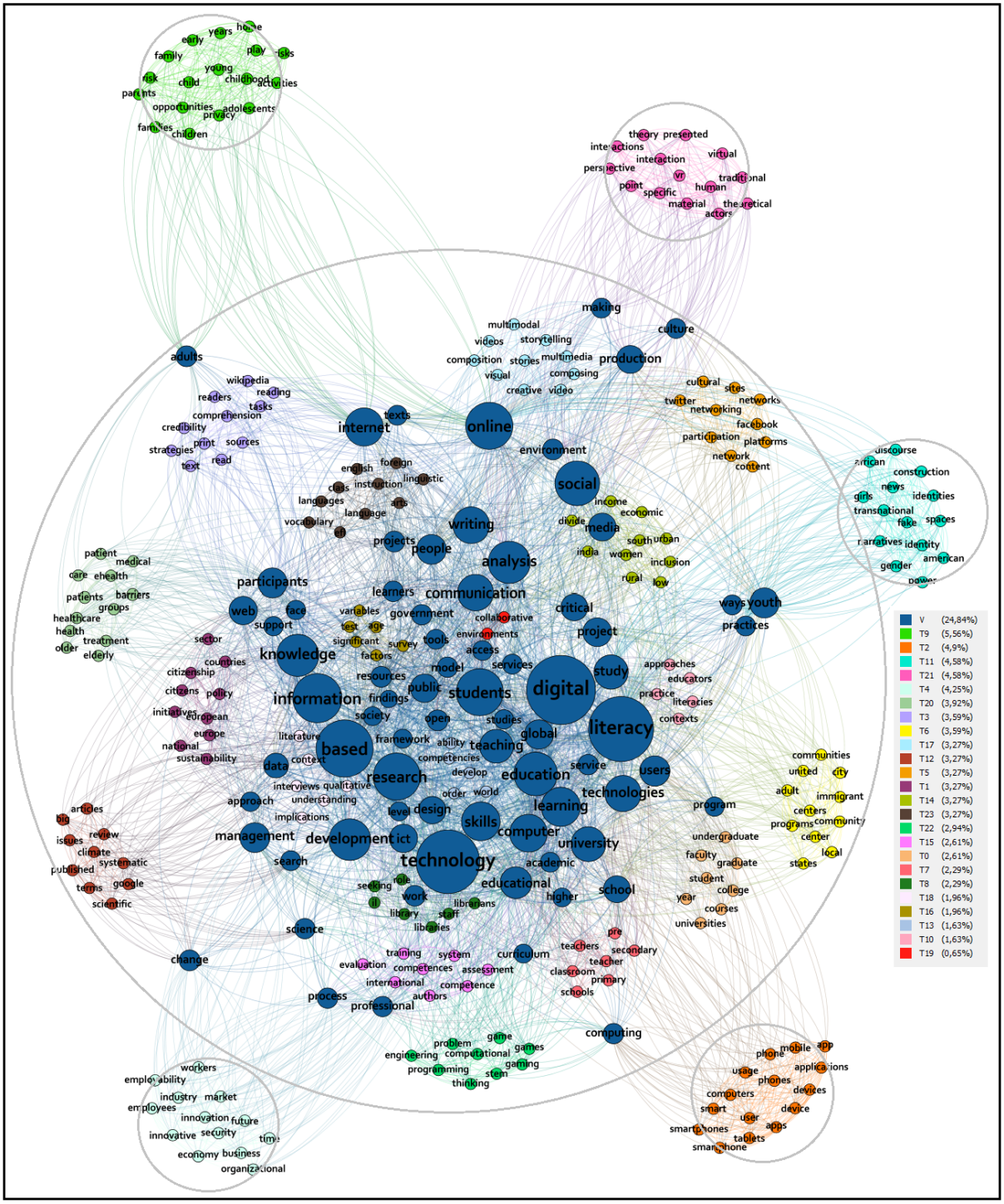

Figure. 3. Digital literacy issue network.

If we adopt a *panoramic view* of figure 3, we can see a central field composed mainly of blue—shared—nodes and relatively clustered communities within. However, regions separated from the

[13] 24 topics as shown in figure 2: T0, T1, T2…T23. Nodes designated with an attribute "V" appear in *various* topics simultaneously.

central field by structural holes are also observed. Due to their lack of mediation, issues from these communities are insular—tight groupings—and marginal—away from the center.

Marginal clusters coincide with those topics composed of unshared issues, i.e., "young people use of DT: risks, opportunity, family" (T9), "digital technology uses/users: interactions, applications, implications" (T2, T21), "practices and discourse in online space: identity, demography, power" (T11), and "DT at the workplace: digitalization, innovation and business" (T4). Conversely, better allocated topics and, thus, with the most issues shared[14], are "online learning: open projects, collaboration, design" (T19), "digital literacies: research, practices, education" (T10), "DL development: skills, competences, training" (T13), and "DL research: studies, frameworks, surveys, factors, tests, models" (T16, T18)[15].

Of course, the two themes that stand out in such structural reading are the extremes of integration and marginality. "Online learning" is notable for sharing almost all its issues with other topics[16]; this indicates that online learning is a central matter of concern for many authors writing about DL, regardless of their focus. On the contrary, "use of DT by young people" appears[17] to be a niche theme and perhaps more self-referential.

Another relevant perspective to interpret the network is the *advantaged position* that some nodes occupy, either due to their degree, or because of their ability to communicate marginal clusters to the center of the network. Figure 4 shows the major nodes, maintaining their spatial arrangement, but filtering out all minor nodes[18]. In this way, figure 4 exclusively shows shared issues; in other words, those common matters that concern different scholars writing about different DL topics.

[14] A lower percentage of a topic's unshared issues in the annotation, means that it shares more with other topics, pulling it to the center.

[15] These results echo the component themes of issue spaces in figure 6: best connected themes—11 (T10), 14 (T13), 16 (T16, T18)—all belong to the 1st issue space, with the exception of theme 18 (T19) that belongs to the 2nd space; conversely, themes with worst connected issues belong to issue spaces 7, 6 and 5. Thus, the structural reading roughly coincides with the issue space hierarchy.

[16] Clearly reflected in figure 3 where the two unique free-floating issues of T19 are still at the *center* in red.

[17] The farthest cluster in figure 3 at the upper left corner, in green.

[18] Degree 19 nodes are hidden. Only those with attribute "V" are visible: degree 20 or higher. This causes all marginal clusters to disappear, leaving only the core network.

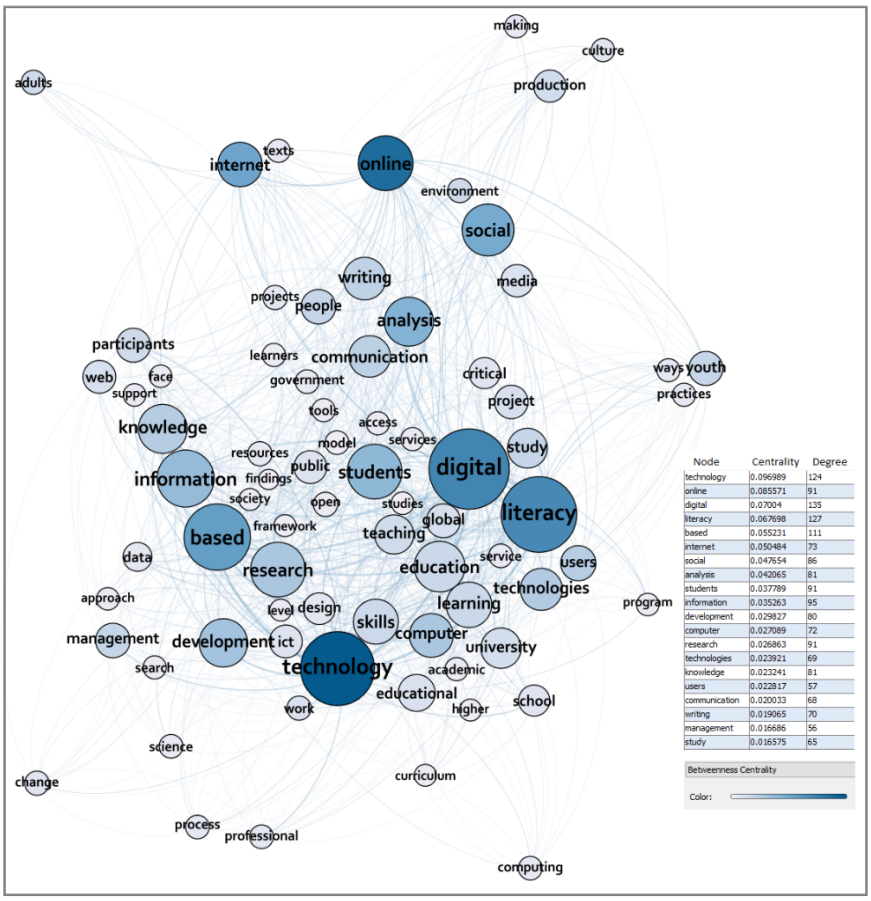

Figure. 4. Zoomed-in issue network.

Nodes with the most connections tend to associate with almost all issues that share more than one topic, which places them in an advantaged position. Although they also display *exclusive* connections with certain topics that others don't, for instance: "digital" is associated with all issues of "DL development" and "digital access"; while "literacy" is tightly connected to "information services and resources" and "practices and discourse in online spaces"; and "technology" is firmly related to "digital technology uses/users", "DT at the workplace" and "healthcare issues".

A glance at the network reveals that high-degree nodes like "technology" and "literacy" serve a fundamental mediating function. This is obvious since the network itself is *about* these issues. Nonetheless, other issues of lower degree, and less obvious, mediate disparate network regions just as well. A numerical expression for this capacity is *centrality*. Centrality is colored in figure 4 as a blue gradient. Certain issues, while not being the most prominent, do play a vital role for marginal clusters, and so, we have that: the topic "young people use of DT" is communicated to the central structure through the issues "adults", "internet" and "online"; "digital technology uses/ users" is connected through "making", "production", "culture", "analysis" and "computing"; "practices and discourse in online space" is mediated by "youth", "ways" and "practices"; and "DT at the workplace" passes through "change", "process" and "professional".

IV. Conclusions

a. Summarized findings

Digital literacy categories

In an attempt to compose a unified categorization of *digital literacy* (DL) we can integrate all recognized distinctive categories, regardless of their type. That is, instead of specifying if it is being categorized by period, perspective, goal or definition, we can simply propose a classification more comprehensive than those binary or ternary forms shown in figure 1. It should be noted that this strategy blurs the lines between ontology and epistemology of DL models, initiatives, methods, and practices. The categorization presented below is not intended to rigidly trace those lines; rather, it operates as a rough ordering of the DL academic field and as an approximate classification of its contributions—for instance, evoking theoretical affinity with a body of literature designated with the same label as a contribution.

The conceptual categories of the theorization, study, and practice of digital literacy are shown in figure 5.

Category	Brief description	An example in literature to illustrate the category	Remarks
Functional Digital Literacy	Functional DL focuses on operational and instrumental literacy, with a cognitivist and universalist vision. It is mostly normative as it prescribes technical skills, digital competences, or even expertise with certain technologies, in order to qualify as digitally literate. Prescriptions can be given in the form of models or standards. Policy documents tend to favor it, for purposes of economic growth or competitiveness	Hargittai (2009) suggests that DL is made up of skills that are measurable through the person's understanding and familiarity with terms related to ICT concepts, computer use and internet browsing such as "PDF", "advanced search", "spyware", "tagging", "RSS", "wiki", "cache", etc.	Some digital literacies that do not share the autonomous and mechanistic perspective, may still be functional in their goal or method; for example, when they advocate the acquisition of critical, evaluative or creative skills
Sociocultural Digital Literacy	Sociocultural DL focuses on social practices around digital texts with special attention to the context in which they occur at a cultural, attitudinal and socio-emotional level. It is mostly descriptive, applying research methods such as ethnography, but it can also address digital skills or pedagogy. Instead of standardizing DL, it generally seeks to conceptualize it and apply it in a pluralistic way and tending towards the collective. It does not pretend to be generic nor universal in its descriptions and applications	Lankshear and Knobel (2008) define DL as the myriad of social practices and meanings of digital texts. For them, DL is plural at the conceptual (as in 'digital literacies') and practical level (multiple practices and enacted meanings). If some kind of expertise were to be invoked, manifested by skills or literary competence, communication, expression, etc., it would only be so in a given sociocultural context	Sociocultural DL proposals tend to position themselves in response, critique, development, or as a improvement of purely functional digital literacies
Critical Digital Literacy	Critical DL is characterized by orientations and meta-skills of critique, reflection, evaluation, judgement, identification, understanding or knowledge about digital media and technologies, the information and representations they communicate, human, social and cultural impacts they entail, and their economic, political or technological organization. Broadly speaking, critical DL has two branches: critical analysis of digital texts and critical/reflexive production of digital texts	Lohnes Watulak and Kinzer (2013) posit that critical DL adds an 'intentional critical component' to digital practice. Their model has 4 elements: understanding the sociohistorical context of DT production, organization, and use; analysing and thinking critically about DT; reflecting on one's own practices; and maintaining skills with purpose and ethics	Critical DL is transversal because it can be associated with instrumental aspects (as in the production of digital texts), with sociocultural or sociomaterial perspectives, and with transformative projects. What characterizes critical DL is a critical/reflexive disposition
Transformative Digital Literacy	Transformative DL concepts and projects focus on empowerment, connection, creativity and, ultimately, transformation of individuals and groups: users, citizens, and students. These are initiatives that aim to promote social welfare and improve access to DT; attention towards barriers of participation is central for this category. It shows explicit ethical, political or ideological orientations, such as safeguarding or fostering participatory democracy, civic engagement, or mobility	Garcia et al. (2015) propose a DL for educational contexts that empowers young people as 'agents of transformation' to understand and act upon unjust socioeconomic conditions. The connection they draw between transformative actions and the digital lies in that virtual spaces discourse cannot be separated from the commitment to civic agency and political change	Transformative DL may be considered a subset of sociocultural DL, or originated from the latter, but it is considered separately because there are many contributions specifically dedicated to these initiatives with distinctive goals and political orientations
Sociomaterial Digital Literacy	Sociomaterial DL addresses the materiality and social relations that emerge in the situated entanglement of humans with digital texts and their enabling technologies. It can be conceived to describe DL events or to prescribe sociomaterial configurations in the assembly of digital texts. The sociomaterial perspective is symmetrical with the social and material: it equally emphasizes the ecology of social practices, more-than-human associations, and institutional conditions, on the one hand, and the materiality of digital mediation, on the other	Dezuanni (2015) proposes a curriculular design model for media education and digital literacy consisting of 'sociomaterial practices' and 'knowledge assemblages'. The author identifies four effects of socio-material 'negotiations': digital materials, media production, media concepts, and media analysis. These network effects are, in turn, the 'building blocks' of digital media literacies in schools	Despite not being found in categorization literature—perhaps due to its novelty—, sociomaterial DL is included for the distinctive theories that support it and the methods that it proposes. It develops sociocultural DL by considering the social, but synthesizes it with the material

Figure. 5. Conceptual categories of digital literacies.

Digital literacy issue spaces

Based on figures 2 through 4, the similarity among themes, and topic modelling data outputs[19], it is possible to trace large issue spaces about digital literacy. Issue spaces are ordered from most to least prominent, with the first slot representing the most common issues and themes, and the

[19] According to output values of: total presence, number of instances as main topic, and highest presence in last year of resonance.

eighth slot representing the least common; accordingly with the cartography metaphor, the first issue space would be the largest territory of this DL map and the eighth one would be the smallest.

Figure 6 shows composed issue spaces in the network of academic texts on digital literacy.

Issue space	Approximate space domain	Component themes	Brief space description
1. Digital literacies: conceptions and practices	Research	11) Digital lite... 14) DL develo... 16) DL researc...	This issue space is that of digital literacy (DL) as the very object of study. Publications that take DL as main theme do so from various approaches and scales: theoretical or conceptual discussions, DL as phenomenon, descriptions of DL practices, new proposals or critiques, methodological tools, etc. Research may address digital technology (DT) skills and adoption, DL factors, models and implications; all contextualized at a technological, educational, labor, cultural or political level. A recurring point is competence to navigate effectively digital environments; these imperatives are usually expressed through conceptions, training or evaluation standards, although some contemplate ethical issues
2. Digital literacy in education	Education	1) DL in higher... 8) Education: ... 18) Online lea... 20) Computat... 21) Language ...	The application and study context in which DL appears most frequently is education, mainly primary, secondary and higher formal education, although cases of online learning or training are also covered. This space addresses teaching and learning of and through DL, and what it entails for students, teachers, and requirements. Cases of DL in higher education cover: digital and academic skills, blended learning, digital composition, critical thinking, information literacy (IL), computer science (CS), computational thinking (CT), game design and programming. With online learning typical themes are: collaborative environments, courses, language instruction, and MOOC-type projects
3. Access and digital divide: ICT, policy and factors	Society, politics, economy	2) ICT initiativ... 7) Community... 15) Digital acc...	This space corresponds with political, social and economic issues of access—or barriers—to DT by groups, and with the DL of these groups. Factors of digital access to Internet, services, ICT, information, etc., and the digital divide (DD), are explored based on the inclusion or exclusion of communities to certain technological, socioeconomic and infrastructural conditions, media literacy (ML) and IL. These explorations are studies of access and policies, rurality and urbanism, participation according to gender or migratory status, economy and resources, national ICT strategies, etc. DL is addressed through initiatives for specific communities in centers, schools, libraries, museums, etc.
4. Digital texts and literacy	Literacy	4) Literacy: re... 17) Students ...	Literacy related to digital texts is addressed; this includes student text composition techniques and projects—multimodal, multimedia, digital storytelling, text analysis—and online text reading/writing practices that ultimately relate to information, source credibility, comprehension, and knowledge. Emphasis is placed on advantages, such as the development of embodied knowledge, creativity, meaning making, and increased DL. Also covers the different strategies for comprehension, integration of divergent information sources and forms of collaboration, evaluation, and behavior
5. Websites and social networks	Culture and discourse	6) Social medi... 12) Practices a...	In this space, practices and discourses on online websites are questioned. It deals with literacy associated to power, online space, digital narrative and rhetoric, discourse, and the relationship with groups and identity—women, LGBTQ, african americans, immigrants, refugees, adults, academics, etc.—, activism and social justice, normative categories—e.g., of gender—, communication, critical literacy and digital skills. There is particular interest in young people's participation in social media and civic, political or social consequences. The interest in social media ranges from possible participatory uses, through the study of online behavior, to negative effects of, e.g., algorithms
6. Digital technologies at workplace and healthcare	Labor and health sectors	5) DT at the w... 19) Healthcare...	Implementations and implications of DT for work/profession—referring to innovation, business, economy, management, market, safety and workers—and for the health sector—referring to ICT services, mHealth, apps, patient data. Salient issues regarding work are: digitization of the industry, evaluation and requirements, personnel responses to digital systems, employability in the face of new technologies, management models and security prompted by the Internet of Things (IoT). In the health sector: effects of monitoring symptoms or physical activity, patients, evaluation of competences—eHealth literacy—, healthcare providers technological requirements, and so on
7. Digital technologies users and uses	Practices and behavior	3) Digital tech... 10) Young peo...	The impact of DT on users, mainly, but not limited to, young people. Users of mobile devices and apps are investigated, including issues of self-management and monitoring, human behavior and task resolution, changes in literacy, user-centered design, feasibility of digital work environments. Also, DT use in online activities and risk/opportunities, e.g., about cultural production on the Internet and the effects on communication and learning, young people's privacy and the role of the family, online behavior and psychology, social connections, and risk awareness through DL
8. Information issues: resources and knowledge	Information and data	9) Information... 13) Informatio...	This space deals with information and IL in/for digital media. Thus, it contains studies on the approaches to Internet searches, web platforms as sources of information, questions about access to information and data, and the privacy and surveillance of users. Issues in this space revolve around "information society"—behavior, learning, attention, knowledge, evaluation, attitudes—, applications with big data and geographic data, search engine ethics, among others. Another branch of the study of information in the digital context is information system management, resources, and services in institutions such as public libraries or universities, with considerations for IL and DL

Figure. 6. Issue spaces of digital literacy.

b. Study limitations

Caveats of categorization

DL categories are just an approximation of conceptual branches found in literature. There is permeability between categories, and so, they are better understood in levels of affinity rather than discrete incommensurable compartments. According to period, there are three phases of DL development; however, simultaneous contributions for the three of them continue to be published. A new phase doesn't start where its predecessor historically ends, but they occur more or less in parallel. This is not to say that there are no discernible trends in a particular school of thought, but, despite what periodization might suggest, there is no total replacement or perfectly linear evolution. For instance, a critical disposition toward computer practices in relationship to political-economic hierarchies developed in the 1980s is being explored again after 30 years in *new* critical DL models (Nichols & Stornaiuolo, 2019).

These same precautions apply to categorizations made by DL's perspective, goals or definition. Consider the following cases: the sociocultural *perspective* does not deny the individual cognitive component of functional literacy, it simply takes a position in which collective social practices are the main focus; on the other hand, different DL types can share one or more *goals*, as in the common objective of pedagogical progress that several initiatives manifest; finally, different *definitions* accept to a greater or lesser extent the assumptions of another category, as is the case with sociomaterial DL models that take the notion of "multimodality"—a sociocultural innovation—as one of its own pillars (Bhatt & Roock, 2014).

Clarification on issue mapping

In similar fashion, themes and issue spaces are not incommensurable; rather, they are permeable and approximate, especially considering that many issues occupy more than one space. Some issues in the DL academic network are being discussed in two or more spaces by multiple actors. One could say that their very ontology and future is at stake, as much as that of DL. Hence, issues such as education, work, access, ICT, privacy, etc., are also reconfigured in the crucible of the digital literacy controversy.

Results in this paper must be understood as *one* map of matters that concern scholars dealing with DL, rather than *the* definitive list of all issues ever related to DL. This is the case from data collection to analysis, if we consider that, for example, database queries were limited to titles and abstracts and it could be that documents containing the term in a different section were omitted. But even more crucial, many scholarly perspectives on DL will invariably be left out regardless of search parameters since "search engines are not the web; the web is not the Internet; the Internet is not the digital; the digital it is not the world" (Venturini, 2010a, p. 803). Also, researcher bias—affinity preconceptions about DL—is undeniable when describing themes and grouping issue spaces. Likewise, topic modelling and automatic analysis have their own partiality from the algorithms used.

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Cartografia de l'alfabetització digital: categories conceptuals i principals assumptes en la teorització i l'estudi dels alfabetismes digitals

Resum

Aquest article presenta una cartografia del camp acadèmic de l'alfabetització digital. Aquesta cartografia es compon de dues seccions: una categorització del camp a través de la revisió i l'anàlisi de literatura, i una exploració dels seus assumptes principals a través de l'anàlisi temàtica i de xarxes. D'una banda, hi ha cinc categories conceptuals dels alfabetismes digitals: funcional, sociocultural, crítica, transformativa i sociomaterial. D'altra banda, es descriuen els assumptes principals amb 21 temes recurrents de l'alfabetització digital i xarxes que descriuen els interessos més destacats en aquesta matèria, concloent-ne una interpretació en la composició de 8 espais d'assumptes que abasten: concepcions i pràctiques de l'alfabetització digital, alfabetització digital en educació, accés i bretxa digital, textos digitals i alfabetisme, llocs web i xarxes socials, tecnologies digitals al lloc de treball i al sector de la salut, usuaris i usos de les tecnologies digitals i assumptes relacionats a la informació. Finalment, es dediquen alguns paràgrafs a les limitacions de la categorització i el mapeig d'assumptes.

Paraules clau

alfabetització digital; cartografia; categorització; mapeig d'assumptes; anàlisi de xarxes

Cartografía de la alfabetización digital: categorías conceptuales y principales asuntos en la teorización y estudio de los alfabetismos digitales

Resumen

Este artículo presenta una cartografía del campo académico de la alfabetización digital. Dicha cartografía se compone de dos secciones: una categorización del campo a través de la revisión y análisis de literatura, y una exploración de sus asuntos principales a través del análisis temático y de redes. Por un lado, se encuentran cinco categorías conceptuales de los alfabetismos digitales: funcional, sociocultural, crítica, transformativa y sociomaterial. Por otro lado, se describen los asuntos principales con 21 temas recurrentes de la alfabetización digital y redes que describen los intereses más destacados en esta materia, concluyendo con una interpretación de estos en la composición de 8 espacios de asuntos que abarcan: concepciones y prácticas de la alfabetización digital, alfabetización digital en educación, acceso y brecha digital, textos digitales y alfabetismo, sitios web y redes sociales, tecnologías digitales en el lugar de trabajo y en el sector de la salud, usuarios y usos de las tecnologías digitales y asuntos relacionados a la información. Finalmente, se dedican algunos párrafos a las limitaciones de la categorización y mapeo de asuntos.

Palabras clave

alfabetización digital; cartografía; categorización; mapeo de asuntos; análisis de redes

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