Preprints.org

Review

Not peer-reviewed version

Conceptualizing Digital Awareness: Introducing a Definition of Digital Awareness via a Scoping Review of Digital Literacy and Citizenship Literature

Leonie Brummer *

Posted Date: 1 April 2025

doi: 10.20944/preprints202504.0069.v1

Keywords: digital awareness; digital literacy; digital literacies; digital citizenship; lifelong learning

Preprints.org is a free multidisciplinary platform providing preprint service that is dedicated to making early versions of research outputs permanently available and citable. Preprints posted at Preprints.org appear in Web of Science, Crossref, Google Scholar, Scilit, Europe PMC.

Copyright: This open access article is published under a Creative Commons CC BY 4.0 license, which permit the free download, distribution, and reuse, provided that the author and preprint are cited in any reuse.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 1 April 2025 doi:10.20944/preprints202504.0069.v1

Disclaimer/Publisher's Note: The statements, opinions, and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions, or products referred to in the content.

Review

Conceptualizing Digital Awareness: Introducing a Definition of Digital Awareness via a Scoping Review of Digital Literacy and Citizenship Literature

Leonie Brummer

Utrecht University; leoniebrummer@gmail.com

Abstract: Citizens need to be sufficiently digital literate due to the increased mediation and redefinition by digital technologies in individuals' lives. Full participation in the current society means—in particular after the COVID-19 pandemic—that after an individual can be labeled as digital literate or as a digital citizen a concept needs to be proposed that allows further development: digital awareness. This becomes increasingly prevalent in government policies, because of its dynamic or process-oriented nature. However, no clear definition has been derived in scholarship yet which leads to ambiguity in scholarship and policy. Grounded in a systematic review of empirical research in the last five years, this paper conceptualizes digital awareness as an extension of digital literacy and citizenship. We argue that being digital literate or being a digital citizen is, to some extent, a prerequisite for digital awareness—conceptualized as "the degree to which an individual is able to critically recognize and reflect upon the declarative, structural, procedural, and conditional knowledge and understanding which are necessary to identify the necessities, opportunities, risks and consequences of the use of (future) digital technologies in and across one's public, work, and private lives". Conceptualizing digital awareness informs scholarship and policy by contributing to conceptual coherence—as an extension of digital literacy and digital citizenship—and by directing learning objectives related to digital literacy and digital citizenship.

Keywords: digital awareness; digital literacy; digital literacies; digital citizenship; lifelong learning

1. Introduction

Citizens increasingly use digital technologies for a range of purposes related to their public, work and private lives, and consume a broad range of digital information (Jaeger et al., 2012). To be able to participate in the current society, they are required to be sufficiently digital literate (Helsper, 2021). However, not every individual is able to reach this goal due to, for example, a lack of access to social and/or digital (re)sources, a lack of engagement, motivation or difficulties to work with digital technologies (Helsper, 2021). With increased digital mediation as well as the impact and fast-paced developments of digital technologies in daily life, the question arises whether it is sufficient to describe individuals as being digital literate only in terms of acquiring skills or competencies (Littlejohn et al., 2012), or in terms of being socially and/or digitally included in the current society (Helsper, 2021).

Combined with a lifelong learning imperative for full participation in the current society, the question arises whether once an individual has reached the status of being (somewhat) digital literate or being a digital citizen that is the final level for (full and successful) participation in society. A lifelong learning imperative detains such a final status and views digital literacy and citizenship as processes (Martínez-Bravo et al., 2020). This process-oriented view requires continuous personal development and resilience to what the current society requests from individuals. As a result, the concept of digital awareness becomes increasingly prevalent in government policies to stimulate continuous development. Because of its dynamic nature, this concept aligns with the dynamic or process-oriented nature of digital literacy and digital citizenship. However, no clear definition has been derived in scholarship.

© 2025 by the author(s). Distributed under a Creative Commons CC BY license.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 1 April 2025 doi:10.20944/preprints202504.0069.v1

This paper builds such a definition—by means of a scoping review of empirical research from 2015 onward. Whether and to what degree the concept of digital awareness is present in existing literature on digital literacy and citizenship will be analyzed. If applicable, conceptual aspects of digital awareness will be presented. These aspects consist of subjective orientations of (digital) awareness (i.e., positive and/or negative), terms related to awareness (e.g., words critical, future link), and how dynamic the concept of digital literacy and citizenship is (i.e., applicability and transferability. In the following sections, digital literacy and digital citizenship will be discussed, including an elaboration of their conceptualization while acknowledging conceptual shortcomings in the field. This is followed by addressing two clusters of prerequisites for digital literacy and citizenship (i.e., capitals and individual characteristics). Eventually, an evaluation is presented whether and to what extent existing literature allows for a definition of digital awareness and, finally, a definition of digital awareness is proposed--in line with the current lifelong learning society.

2. Digital Literacy and Citizenship

Throughout the years, researchers have designed and adapted existing definitions[1] of digital literacy as an attempt to capture its essence (e.g., Gilster, 1997; Jaeger et al., 2012; Nichols & Stornaiuolo, 2019), to make the definition and framework more inclusive to cover multiple contexts (e.g., UNESCO, 2011, 2018), to tailor a definition to specific educational contexts, such as in primary education (Vélez & Zuazua, 2017), secondary education (Hatlevik & Christophersen, 2013), or higher education (Miller, 2015), or to give direction to future research (e.g., Nichols & Stornaiuolo, 2019). One of the earliest pioneers of digital literacy, referred to digital literacy as a multimedia literacy. Because digital sources provide many forms of information (e.g., written or spoken texts, images, or sounds), Lanham (1995) advocated a new form of literacy to decipher the variety of and between these presentations. A more general definition was provided by Gilster (1997, p. 6), who defined digital literacy as "the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers…". This definition, that does not refer to necessary skills, competencies, or attitudes to make sense of working with digital technologies, moves beyond views of digital literacy merely as a collection and accumulation of technical skills.

Critically analyzing Gilster's (1997) definition, we derive at least four essential aspects. First, digital literacy is *broader* than separate literacies, such as ICT literacy and information literacy, and subsumes aspects from multiple literacies. The inclusion of many literacy dimensions allows the term literacy being replaced by its plural form: literacies. Whereas some researchers might label this change—from digital *literacy* to digital *literacies*[2]—as fashionable (e.g., Buckingham, 2006), the plural form is frequently used in scientific research (see e.g., New London Group 1996; Nichols & Stornaiuolo, 2019; Pahl & Rowsell, 2010; UNESCO, 2018). However, it also raises critical questions when literacies are used as synonyms for competencies or skills (Buckingham, 2008). Second, the *quality* of an individual's digital literacy (or literacies) varies according to life circumstances. Third, the quality will *develop* or *change* according to personal attributes, such as attitudes, beliefs, and knowledge. Fourth, digital literacy is viewed as a *life skill* or process rather than a product. Whereas Gilster (1997) and Martin (2006b) believe digital literacy is learned in more informal ways, Eshet-Alkalai (2004, p. 102) describes it as a "survival skill in the digital era", largely derived from the context of formal education. Ascribing being able to (success)fully participate in the current society and, therefore, being digital literate, as an aspect of formal education necessitates explicitly describing knowledge, skills, competencies, and/or attitudes to make sense of working with digital technologies.

[1]The term 'definition' can be nested within a framework; however, the terms definition and framework will be used as interchangeable in the remainder of this current review, despite the differences that exist between the two concepts.

[2]The remainder of this review will use the singular form (digital literacy) rather than the plural form (digital literacies) to have a better match between the current review and the included articles.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 1 April 2025 doi:10.20944/preprints202504.0069.v1

The amount of research conducted on digital literacy and the different disciplinary backgrounds this is rooted in, has resulted in a lack of consensus about digital literacy frameworks, with variations in width, detail, and position of digital literacy to other literacies. For example, Fieldhouse and Nicholas (2008) have listed digital literacy as an information literacy, whereas Buckingham (2008) refers to it as a media literacy and proposes two types of media literacy: web literacy and game literacy. In addition, the conceptualization of digital literacy compared to other literacies differs between definitions and frameworks (e.g., UNESCO's global framework of reference on Media and Information Literacy [MIL] 2011). The lack of consensus in terminology as well as in conceptualization necessitates a reexamination of the existing literature, especially when a newly formed concept is introduced.

Digital literacy and digital citizenship are linked because they can encompass similar activities and acts. However, it is essential to distinguish the concepts to avoid conceptual confusion in both scholarship and policy (Jones & Mitchell 2015). Whereas digital literacy can be ascribed as more specific, e.g., in terms of knowledge, skills, competencies, and attitudes, albeit depending on the definition or framework, digital citizenship can be defined as "the self-creation and self-assertion of citizens as active participants in society through digital acts" (Hintz et al., 2018, p. 21). It appeals to different levels of society (e.g., individual, societal, and global level) and describes "the centrality of digital infrastructure in contemporary social interactions, the implications for people's identities and forms of belonging, and the active self-creation of citizenship in digital environments" (Hintz et al., 2018, p. 20). A frequently used framework of digital citizenship lists three overarching goals (respect, educate, and protect) and nine elements (Ribble, 2007).

Similar to digital literacy, the increased mediation by digital technologies, for example by emailing, blogging, collaborating, coding, and tweeting, allows individuals to perform, enact, and create their role on the different levels of society (Hintz et al., 2018). While performing, enacting, and creating roles in society, digital citizens encounter both positive and negative aspects of and in the use of digital technologies, on account of digital technologies providing both opportunities and challenges.

Our scoping review explores whether and to what degree the concept of digital awareness is present in existing literature on digital literacy and citizenship. It is essential to examine whether aspects for digital awareness are present in existing literature and build upon this body of scholarship to develop a definition of digital awareness. Our research aim can therefore be captured into two main research questions:

RQ1: To what degree does existing research about digital literacy and digital citizenship provide conceptual aspects for digital awareness, consisting of mentioning (digital) awareness with its subjective orientation (i.e., positive or negative), terms related to awareness, and how dynamic (i.e., applicability and transferability to other contexts) the concept is?

RQ2: What conceptualization of digital awareness, based on aspects in existing literature about digital literacy and digital citizenship, can be derived?

3. Materials and Methods

The sample consists of peer-reviewed English scientific articles, published in the last nine years[3] (November 2015 until June 2024) involving human behaviors, attitudes, beliefs and/or performances (including knowledge and application). The research was updated in July 2024 (extending the timeframe until June 2024). Given the rapid development of digital technologies, changes in their use in everyday life and growing policy interest in digital literacy and citizenship, this is a relevant timeframe. To guarantee that research from relevant disciplines was included, articles were obtained from the search databases ERIC, SocINDEX, Communication & Mass Media Complete, and Library, Information Science & Technology Abstracts (LISTA). The search string used was designed to include as many relevant articles as possible: ('digital' OR 'digitalization') AND ('aware*' OR 'resilien*' OR

[3]The research was updated in July 2024, extending the initial five year time span with four more years.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 1 April 2025 doi:10.20944/preprints202504.0069.v1

'liter*' OR 'illiterate' OR 'citizen*'). Referring to part 1 and part 2 respectively of this search string, part 2 had to occur near part 1 (i.e., five words). This search string was used in a preliminary search to examine how many hits each search engine provided. The goal of this preliminary search was twofold: (a) to determine whether relevant literature would be included in the current review, and (b) to select a suitable manageable time frame (five or ten years). It turned out that a time frame of five year resulted in a representative sample of relevant articles albeit the update of our research extended this timeframe with three more years of research.

In order to be included in the current systematic review, articles had to meet one of the following criteria:

1. Studies involving general and special needs education and/or work-related practices;
2. Studies involving social media platform use (e.g., TikTok or Instagram);
3. Quantitative outcomes obtained from human on individual or group level, including validation of specific instruments;
4. Manuscripts explicitly mentioning (a) digital literacy, (b) digital citizenship, or (c) a combination of digital literacy and citizenship.

The following exclusion criteria were used to narrow the scope:

1. Studies primarily focused on user experience or (game) design with a digital device or technology (e.g., to test if a specific mobile application matches its purpose or computational models);
2. Studies primarily focused on awareness measured with or by a digital device, technology, and/or company (e.g., tracking awareness of breast cancer by means of a mobile application, or tracking [health] devices in general) or training (e.g., navigation training);
3. Studies focused on using digital devices for (research of) illegal practices (e.g., stalking and/or sexual assault), offensive language, and/or addiction;
4. Studies reporting on technological forecasting, remote sensing, and/or migration (e.g., of historical, geographical, and/or architectural phenomena; e.g., historical trackways in forests or mobility);
5. Studies reporting on outcomes from medical (physiological) imaging, material or development for engineering or supply chain developments, and/or imaging related to architectural purposes;
6. Studies focused on (analysis of) digital art, music, films/movies, and/or literature (e.g., translations and/or archival research/practices);
7. Studies focused on and/or including celebrities;
8. Reviews (systematic or literature reviews, meta-analyses, frameworks, [re]conceptualizations, protocols);
9. Grey literature (dissertations, theses, books or book chapters, conference papers) or editorials.

In total, the initial search provided 1359 hits and during the first phase all abstracts were scanned for the inclusion of the word 'digital' in combination with terms related to (il)literacy, awareness, resilience, or citizen(ship), by either specifically mentioning the term, with a similar description, or placed within five words after 'digital'. Removing the duplicates from the sample and applying the in- and exclusion criteria to the remaining articles resulted in 65 articles that were included in the coding process. The updated research yielded an additional 452 hits. With a similar procedure, we derived seven articles to be included[4].

After systematically searching scientific literature and updating this accordingly, we wanted to make sure that all included material on the topic of digital awareness was reviewed, especially after the COVID-19 pandemic (Polyakova et al., 2014). The emphasis on the concept of digital awareness appeared more crucial. Therefore, we conducted a secondary literature search—after the updated search—with only the search "digital awareness" alongside the in- and exclusion criteria. This search

[4]The start of this scoping review was before the PRISMA checklist (see Page et al., 2021) was introduced as a quality assurance and baseline procedure. As a result, we applied the PRISMA checklist for updated (systematic) reviews during the update of our research in July 2024.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 1 April 2025 doi:10.20944/preprints202504.0069.v1

covered the complete timespan: 2014 until 2024. This secondary search yielded 39 hits and we derived nine articles, in which three were included.

The Assessment of Multiple Systematic Reviews (AMSTAR; Shea et al., 2007) was used to ensure the methodological quality of the current systematic review. This tool provides an overall judgment whether required elements of a (systematic) review were included and emphasizes which methodological decisions could have been implemented better. The AMSTAR was administered throughout the process to provide input for the discussion of main findings and the study's limitations. In addition, in the update of this research, we applied the PRISMA checklist for updated (systematic) reviews alongside the flowchart for updated reviews, including our additional search (i.e., search term 'digital awareness'; see Appendix B for the flowchart).

4. Coding of Variables

The coding scheme was developed beforehand to determine variables that matched the research questions. These variables covered two main categories. First, methodological and study characteristics (e.g., age, research setting, and sample), related to the research design of the included studies. Second, potential aspects of (digital) awareness, e.g., explicitly mentioning (digital) awareness, creation, critical, future link, potential, and comparison. These aspects should explicitly mention the terms 'awareness' and/or 'digital awareness', terms often related to awareness such as 'critical' and a future link, and whether the concept of digital literacy and citizenship is described as a dynamic rather than static concept. In addition, inductive open coding was used to further refine the categories of aspects of digital awareness.

The articles were coded dichotomously (i.e., yes or no) according to whether the term 'digital literacy' (or 'digital literacies') and/or 'digital citizenship' was mentioned. This creates three main bodies of scholarship: one focused on digital literacy, one focused on digital citizenship, and one with a combination of the two aforementioned concepts (themes A, B, and C respectively). This distinction was considered relevant in the current review because digital awareness subsumes a different position in articles focused on digital literacy than in articles focused on digital citizenship. A fourth theme (theme D) was created with the search term 'digital awareness'.

In addition, results will be presented on both article-, study-, and case-level. Methodological and study characteristics will be displayed on article-level, whereas the variables of the three themes will be presented on case-level. Each article can report on multiple studies or experiments with more than one digital literacy or citizenship measure necessitates presenting the results on case-level. The 113 included articles report on 117 studies and 128 cases (the list of included articles is presented in Appendix A).

5. Results

5.1. Methodological and Study Characteristics

The sample contained studies from a broad range of different countries, reflecting the international nature of digital literacy and citizenship, and the scope of research. For 32 out of 113 articles the country or origin of the participants was explicitly mentioned in the article (28.3%). The remaining 81 articles did not display this country- or origin-specificity (71.7%). For the majority of the articles it remained unclear in which language the measures were implemented (see Table 1). The remaining languages comprised Bengali, French, Japanese, Kachin, Korean, Portuguese, Slovenian, and Taiwanese, each pertaining to 0.9% of the total number of articles. One article (0.9%) used both Chinese and English materials.

The setting in which the studies were conducted was in 71 out of 113 articles situated in public lives (62.8%), fourteen articles reported on studies situated in work lives (12.4%), and private lives were covered in eight articles (7.1%). Seventeen articles reported on studies adopting a combination of settings (15.4%). For example, Wang & Xing (2018) included both teens and parents as participants. Sánchez-Valle and colleagues (2017) examined the family environment and digital literacy and the

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 1 April 2025 doi:10.20944/preprints202504.0069.v1

education of critical citizens—therefore, covering public, and private lives. Three articles were listed as *other* (2.7%; e.g., "older adults" without further specification [Schreurs & Quan Haasse, 2017]).

When it comes to the target group of the studies, we see a clear focus on students and education (see Table 1)**.** The articles reported on a target group labelled as *other* (7.7%; e.g., Altinay et al., 2016).. For example, Altinay and colleagues (2016) studied disabled citizens to explore the role of social media tools in creating accessible tourism.

In terms of educational level, most articles could be assigned to belonging to higher education (see Table 1). In fifteen articles the participants could be assigned to a combination of educational levels (13.3%). More specifically, in the studies conducted by Eckert (2018) participants were aged 11 to 15 years and 11 and 14 years for the pilot and the main study respectively. Both studies included participants with ages stemming from middle and high school. The label *other* was assigned to an article with education from the private sector (Malec, 2024).

Finally, an age-range was mentioned in 35 articles (31.0%). More specifically, Altinay and colleagues (2016) mention five sequential age-ranges and cover an overarching age range of 18 until 64 years old. In 54 articles the age of the participants was unclear (47.8%). Eight articles displayed the age of the participant by, for example, mentioning the grade level, or with general categories. Fourteen articles mentioned the average age of the participants (12.4%). The average age of the participants in the current sample—based on four articles—was 30.38 years (*SD* = 12.60; min. 12.60; max. 49.00).

Table 1. Frequencies and Percentages of Language, Education, and Educational Level.

Characteristic	Frequency	Percentage (%)
Language		
English	34	30.1%
Turkish	6	5.3%
Spanish	2	1.8%
Unclear	61	53.9%
Education		
General education	67	59.3%
General work	10	8.8%
Special needs education	1	0.9%
Other	10	8.8%
Combination	25	22.1%
Educational level		
Higher education	46	40.7%
High school	3	2.7%
Middle school	3	2.7%
Primary school	6	5.3%
Combination	15	13.3%
Other	2	1.8%
Universal/ all ages	33	29.2%
Unclear	5	4.4%

5.2. Indications for Digital Awareness

Ninety-five out of 113 articles—reporting on 98 studies and 105 cases—mentioned the term "digital literacy" in the article (61.6%), and 19 of out 113 articles—reporting on 27 studies and 31 cases—mentioned the term "digital citizenship" (26.0%), and thirteen out of 113 articles—reporting on twelve studies and twelve cases—mentioned both "digital literacy" and "digital citizenship" (12.3%). While all 65 articles presented *indications* for digital awareness, only one explicitly mentioned the concept while none of the studies presented a definition. Kim and Choi (2018) listed digital awareness as part of the ethics for digital environments in the SAFE framework for digital citizenship scale of youth; however, the article which focused on both digital literacy and citizenship does not elaborate on this awareness. The remaining three articles included in the updated search (see Chen

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 1 April 2025 doi:10.20944/preprints202504.0069.v1

et al., 2018; Mack et al., 2012; Serdarušić et al., 2024) will be discussed after digital literacy, digital citizenship, and both digital literacy and citizenship.

5.3. Digital Literacy

Although the concept of *digital* awareness was not mentioned specifically, 51 out of 88 cases mentioned 'awareness' as such (58.0%). In twelve cases (13.5%) this awareness was related to something positive, such as gaining knowledge or increasing specific experiences or "…by interacting with their colleagues who are competent in this" (Hamutoglu et al., 2020, p. 137). Nine cases mentioned negative aspects (10.2%), related to cyberbullying (Altun, 2019) and privacy-related matters (Feola, 2016) amongst others. Both positive and negative aspects of awareness have been mentioned in 31 cases (35.2%). For example, Clark and Simpson (2020) referred to the "increased awareness of the rapidly approaching need for employment" (p. 144), highlighting both job opportunities and hinting towards potential knowledge and/or understanding gaps to filling in these jobs. Table 2 displays how many cases mentioned the following related aspects of awareness (listed from most to least): critical, creation, , potential and future link, , and comparison. In addition, the majority of the cases described in the articles (n_{cases} = 26; 29.5%) allowed the concept of digital literacy as something continuously open for improvement and change, meaning that the concept can be considered dynamic. Power and colleagues (2020), for example, report on the dynamic nature of digital literacy by explicitly mentioned that digital literacy is constantly evolving—emphasizing the dynamic nature of the concept. Two cases were labelled as being static (2.3%), meaning that the article did not explicitly mention whether digital literacy is continuously open for improvement and/or change. For the remaining 60 cases the dynamicity of the concept was unclear (68.2%), as a result of the concept of digital literacy remaining undefined and/or unconceptualized.

Table 2. Aspects, Frequency, and Examples Theme A: Digital Literacy.

Theme	Aspect	Frequency* (n_{cases})	Percentage	Examples[1]
A	Critical	71	80.7%	"…foster critical thinking…" (Valdés et al., 2018, p. 76) "…a critical vision of the technological environment…" (Valdés et al. 2018, p. 76) "…while demonstrating a critical awareness of the designs, algorithmic processes and datasets that constitute these platforms (Liu et al., 2023, p. 20)
	Creation	70	79.5%	"…to create, share, and understand meaning and knowledge in a digital environment…" (Baterna et al. 2020, 106) "…texts or visuals created with digital tools…" (Ozden, 2018, p. 28) "…the students created narratives on topics such as paleontology, forces, genetics, Pythagoras' theorem and cell structures" (Paige et al., 2016, p. 1) "…including using AI to create vocabulary games for learning new English words, seeking real-time grammar feedback from AI to enhance English grammar proficiency, and engaging in topic-specific conversations…" (Liu et al., 2024, p. 16)
	Potential	58	65.9%	"…the potential to transform teaching and learning" (Powers et al., 2020, p. 62) "…chatbots have demonstrated remark able potential in accomplishing natural-language tasks…" (Liu et al., 2024, p. 2).
	Future link	50	65.9%	"…may influence their future competencies and skills…" (Šorgo et al., 2017, p. 751) "…lifelong learning in the future workplace…" (Šorgo et al., 2017, p. 751) "…in a way that safeguards environmental, social and economic wellbeing, both in the present and for future generations" (Filho et al., 2020, p. 11261)
	Comparison	21	23.9%	"Visual mode results were higher with addition of non-digital elements as compared with pure digital images only" (Starčič et al. 2016, 42) "…influence their future competencies and skills" (Šorgo et al., 2017, p. 751)

Note. *One case could mention one or more aspects. [1]Read the corresponding article for the complete context.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 1 April 2025 doi:10.20944/preprints202504.0069.v1

5.4. Digital Citizenship

Sixteen out of 24 cases mentioned 'awareness' (66.7%). Of these cases, one was predominantly positive and only two focused on predominantly negative consequences (Hollandsworth et al., 2016; Styron et al., 2016). Styron and colleagues (2016) exemplified: "Awareness levels of teacher and principal preparation students to identify acts of cyberbullying, perceived awareness of and preparedness for incidences of cyberbullying…" (Styron et al., 2016, p. 19). Eleven cases reported on both positive and negative aspects of awareness (45.8%). For example, Takavarasha and colleagues (2018, p. 11) explicitly mentioned that students may *lack* digital citizenship qualities (negative aspect) such as "the ability to use technology safely, responsibly, critically, productively, and civically" (positive aspects). In addition, Altinay and colleagues (2016) argued: "Education for the awareness and applications will become strategic actions to remove barriers of disabled" (p. 90). For ten cases the subjective orientation was unclear (41.7%).

Table 3 displays the aspects often related to awareness (listed from most to least). The majority of the cases described in the articles (n_{cases} = 8; 33.3%) allowed the concept of digital literacy to be dynamic, as exemplified by the following texts: "…to enhance the concept of digital citizenship" and "…to increase instilling digital citizenship values…" (Alharbi & Alturki, 2018, p. 81). Two cases can be labelled as partly dynamic (8.4%; Altinay et al., 2016), as indicated by the description that digital citizenship needs to be accomplished by knowledge *sharing*. Twelve cases were labelled as being static (50.0).

Table 3. Aspects, Frequency, and Examples Theme B: Digital Citizenship.

Theme	Aspect	Frequency* (n_{cases})	Percentage	Examples[1]
B	Creation	16	66.7%	"…the current digital technology that is used and what will be applied in future…" (Alqahtani et al., 2017, p. 98) "More students reported that they knew how to create an online survey after the workshop" (Eckert et al., 2018, p. 25)
	Future link	15	62.5%	"…browses questions and solutions created by peers…" (Cheng & Chau, 2016, p. 262) "…to exercise critical thinking toward information…" (Eckert et al., 2018, p. 30)
	Critical	14	41.7%	"…stressed the critical importance of good organisation and instructional design…" (Howard & Scott, 2017, p. 60) "…Such a digital citizen is more likely to possess critical literacy…" (Nordin et al., 2016, p. 72)
	Potential	13	54.2%	"The full potential of LMSs can be realised through the alignment of online activities…" (Cheng & Chau, 2016, p. 258) "…to assess the familiarity, potential harm and frequency of each type of cyberbullying,…" (Styron et al., 2016, p. 22) "…when Internet users became potential contributors of information…" (Takavarasha et al., 2018, p. 2)
	Comparison	10	41.7%	"…compare international with US students' levels of digital citizenship" (Alqahtani et al., 2017, p. 97) "When asked to compare their use of computers and cell phones regarding internet access,…" (Eckert et al., 2018, p. 25)

Note. *One case could mention one or more aspects. [1]Read the corresponding article for the complete context.

5.5. Digital Literacy and Digital Citizenship

All thirteen cases mentioned 'awareness'. Ten out of thirteen cases reported on both positive and negative aspects of awareness (76.9%), as exemplified by the following text from Kim and Choi (2018): "local/global awareness" (157) extended with "…citizenship awareness in the digital age to provide effective education and to facilitate culturally appropriate behavior online" (158). One case (11.1%; Phillips & Lee, 2019) primarily reported on negative consequences: "…safe and responsible online interactions should be discussed with teens…" (2), and "…the lack of awareness about what was being taught…" (10). Two cases were labelled as predominantly positive, stemming from

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 1 April 2025 doi:10.20944/preprints202504.0069.v1

Karunanayaka and Weerakoon (2020): "a learner's awareness of, and access to, digital technologies, creating awareness of and enhancing access to available resources".

Table 4 displays how many cases mention the following aspects (listed from most to least): future link, critical and potential, creation, and comparison. Five out of thirteen cases described in the articles allowed the concept of digital literacy as something open for improvement, meaning that the concept is dynamic (38.5%). As exemplified by Van de Oudeweetering and Voogt (2018), by placing emphasis on fostering competencies. Two cases could be labelled as being static (15.4%; Kim & Choi, 2018; Wang & Xing, 2018). For the remaining six cases it was unclear how dynamic the concept was (46.2%).

Table 4. Aspects, Frequency, and Examples Theme C: Digital Literacy and Digital Citizenship.

Theme	Aspect	Frequency* (n_{cases})	Percentage	Examples[1]
C	Future link	11	84.6%	"…to help them self-regulate learning processes in future learning situations…" (Morreale et al., 2017, p. 14) "…students may adapt their capstone ePortfolio into a professional ePortfolio for future uses" (Morreale et al., 2017, p. 16) "…to use these new skills on digital media projects in the future" (Morreale et al., 2017, p. 17)
	Critical	10	76.9%	"…apply critical thinking skills…" (Morreale et al., 2017, p. 13) "…can critically review content from disparate general education classes…" (Morreale et al., 2017, p. 13) "…critical reflection…" (Morreale et al., 2017, p. 18) "…to observe the entire education system in a critical way…" (Seifert, 2017, p. 27)
	Potential	10	76.9%	"…have the potential for guiding future model development and to further influence positive social change by supporting parents and educators to promote online safety and digital citizenship development" (Wang & Xing, 2018, p. 186) "…to prevent potential dangers faced by youth…" (Kim & Choi, 2018, p. 155) "…amidst increasing concerns about cyberbullying and the potential for hacking…" (Philips & Lee, 2019, p. 2)
	Creation	9	69.2%	"…to create multi-modal representations such as digital art and images, video, audio, and websites…" (Hughes & Read, 2018, p. 2) "…create communities in a different way from the older generation that was born and grown in the industrial world" (Kim & Choi, 2018, p. 167)
	Comparison	5	38.5%	"…described their science teacher using technology a lot compared to only about 8% of students reporting they used it a lot" (Hughes & Read, 2018, p. 15) "…reflective capstone ePortfolio as compared to a professional presentation ePortfolio" (Morreale et al., 2017, p. 16)

Note. *One case could mention one or more aspects. [1]Read the corresponding article for the complete context.

5.6. Digital Awareness

Three articles explicitly mentioned the term "digital awareness" (see Chen et al., 2024; Mack et al., 2017; Serdarušić et al., 2024). Two articles did not provide a definition of the concept (Mack et al., 2017; Serdarušić et al., 2024), whereas Chen and colleagues (2024) conceptualized digital awareness as the importance of different aspects, such as the use of Internet for a range of activities (p. 9). The authors referred to the "penetration of digital awareness". A future link and comparison were

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 1 April 2025 doi:10.20944/preprints202504.0069.v1

mentioned in two cases, whereas critical and potential were mentioned in one case[5]. Chen and colleagues (2024) referred to positive aspects of digital awareness, such as the crucial role of the Internet for different activities alongside the trust that individuals need to put in strangers. In a similar vein, Mack and colleagues (2017) refer to "enhancement purposes", highlighting the positive effect of the use of Internet for a variety of activities. Last, Serdarušić and colleagues (2024) emphasize both the positive and negative aspects of digital awareness by discussing "the perceived risks and barriers associated with the adopting Fintech solutions" (p. 5).

5.7. Comparison Aspects Between Themes

The comparison of aspects listed in Tables 1, 2, and 3 and in-text for themes A, B, C, and D respectively is display in Table 5. Comparing these aspects yield information about potential prioritization or commonality—indicated by how often these are mentioned—of those aspects within that context. In turns, this prioritization or commonality can be used for theoretical and practical implications of digital awareness.

Table 5. Ranked from Most to Least Mentioned Aspects for Themes A, B, C, and D.

Theme			
A	**B**	**C**	**D**
Digital literacy	Digital citizenship	Digital literacy/ citizenship	Digital awareness
Critical	Creation	Future link	Future link/ comparison
Creation	Future link	Critical/ potential	Potential/ critical
Potential	Critical	Creation	
Future link	Potential	Comparison	
Comparison	Comparison		

6. Discussion

The included empirical studies from 2015-2024 shows how issues related to digital literacy and citizenship have become a global phenomenon. Our sample included research stemming from international contexts. Notably, most studies were conducted in a non-Western context and were partly replicating previous research in a different national setting. It shows that no part of the world remains untouched by digitalization, as illustrated by the COVID-19 pandemic. Within this body of research there was strong variation in countries, participants with specific origins, or domain-specific settings. The differences but also strong similarities between research outcomes imply that digital literacy and digital citizenship have situational aspects as well as general, perhaps even transferable, aspects. This points to the necessity of deriving a definition of digital awareness, as an extension of digital literacy and citizenship, that includes domain- and situation-specific as well as generalizable components.

With a large emphasis on participants stemming from general education, it becomes clear that *teaching* digital literacy and citizenship to individuals provides the main context for research (cf. Gillen et al., 2018; Martínez-Bravo et al., 2020; Miller, 2015). Studies combining educational with work contexts fit the dimensionality of digital literacy and citizenship because it is nested in many areas of an individual's life (Jaeger et al., 2012; New London Group, 1996). Remarkably, in particular after the COVID-19 pandemic (Polyakova et al., 2024), studies solely focusing on private life were limited. For future research to further develop and (re)conceptualize the concept of digital awareness, it is crucial to move beyond education and students, and acknowledge the interdisciplinary nature and situation-specific aspects of digital literacy and citizenship (Martínez-Bravo et al., 2020).

RQ1 covers the degree to which existing research provides potential aspects of digital awareness. While none of the cases explicitly mentioned 'digital awareness', the majority of the articles reported on awareness in general with a dominant focus on both positive and negative aspects, such as

[5]Due to the low numbers of articles (cases), no percentages will be reported on.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 1 April 2025 doi:10.20944/preprints202504.0069.v1

consequences and knowledge. Articles about digital literacy often mentioned critical thinking, creation, or the potential for something. A link to future use of and the potential of, for example, ICT or digital technologies was mentioned to a lesser extent. The comparative aspect was focused on, for example, the consequences of using a specific application or digital technology. In the sample, a comparison of some sort was mentioned the least. The dynamicity of digital literacy became apparent in approximately 80% of the cases, whereas almost 20% was labelled as being static. This view corresponds with the necessary changes called upon our society during and after the COVID-19 pandemic (Polyakova et al., 2024).

Similar to work on digital literacy, the majority of articles on digital citizenship reported on awareness with a dominant focus on both positive and negative aspects, such as consequences and/or knowledge. They often referred to creation, followed by a future link.. The terms 'critical' and 'potential' were used to a lesser extent. A comparison of some sort—for example a comparison of the use of digital devices—was mentioned the least. Lastly, the dynamic nature of the concept of digital citizenship was reported on in approximately 70% of the cases, whereas almost 16% was labelled as being static (leaving the dynamicity of the concept unclear in the remaining cases).

All cases discussing both digital literacy and citizenship reported on awareness and included both positive and negative aspects, allowing for a complete rendering of the concept. Digital awareness was mentioned specifically once, in items in the SAFE framework digital citizenship scale of youth related to the ethics of digital environments, such as "Students should be aware of the order of others in the online digital environment and should obey the order" (Kim & Choi, 2018, p. 164). Furthermore, all articles in this theme referred to future roles of digital literacy and/or citizenship and almost all mentioned 'critical' (e.g., critical thinking, critical analysis, or critical evaluation) and/or the word 'potential'. The term 'creation' was used to a lesser extent and a comparison of some sort, for example a comparison of two types of ePortfolio tasks (Morreale et al., 2017) and a comparison of information from different sources (Van de Oudeweetering & Voogt, 2018), was mentioned the least. Lastly, the dynamic nature of the concept of digital citizenship was reported on in approximately 70% of the cases, whereas almost 30% was labelled as being static. With the dynamicity of both digital literacy and citizenship, corresponding with how dynamic digital literacy and digital citizenship as separate concepts are used.

With ample mentioning of digital literacy and citizenship as dynamic concepts. This implies that there is opportunity for including digital awareness in definitions and frameworks related to these concepts. Several potential aspects of digital awareness, serving as input for its definition, were present in the sample, such as mentioning both positive and negative aspects (e.g., consequences or knowledge) of engaging in digital technologies, involving critical thinking and/or a critical evaluation, and comparing consequences and knowledge (amongst other aspects). The concept of digital awareness appends digital literacy and/or digital citizenship due to their dynamic nature, the increased mediation of digital technologies in the current society, and a lifelong learning imperative (Jaeger et al., 2012). In addition, the difference in prioritization of the aspects creation, critical, future link, potential, and comparison—displayed in random order here—might imply that contexts (i.e., the themes) will emphasize or highlight different aspects. As a result, to allow for this prioritization be implemented, both theoretically and practically, the definition of digital awareness should capture these differing prioritizations.RQ2 focuses on establishing a conceptualization of digital awareness. No definition was provided in two out of three cases that mentioned digital awareness. The remaining case referred to the crucial role of the use of Internet. With the variety of digital platforms and tools used in today's society, this definition remains rather simplistic—in particular with the increased mediation of these platforms and tools (Hintz et al., 2018). The association of 'awareness' with terms such as critical, potential, and comparison implies that it is a higher order skill (Conklin, 2012). This means that, prior to being aware, an individual must have mastered functional skills such as identifying, accessing and evaluating digital resources, constructing new knowledge, creating media expressions, and privately and publicly communicating with others (Martin, 2006b). In other words, being digital literate or being a digital citizen is—to some extent—a prerequisite for digital

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 1 April 2025 doi:10.20944/preprints202504.0069.v1

awareness. Furthermore, awareness being conceptualized as dynamic in our sample indicates that digital awareness should be conceptualized as a *process* rather than a product. This fits a lifelong learning imperative (Martínez-Bravo et al., 2020): digital awareness develops continuously throughout an individual's life and should be applicable in a variety of contexts.

The majority of the research included both positive and negative aspects of awareness. A faulty assumption is that awareness is associated with or directed towards negative aspects, such as harmful consequences (e.g., mentioned with digital safety; Ribble, 2007), yet research including illegal practices was excluded (see e.g., Button et al., 2021). The potential of potential of digital technology is often not acknowledged. A concept becomes better established when both the positive *and* negative aspects are addressed. The potential of digital technologies in terms of creation, comparison, future links, and critical aspects requires more emphasis in future research. Whereas the negative aspects of digital technologies are crucial to protect a digital citizen in the current society, the positive aspects further develop the individual and create possibilities in terms of gaining knowledge, skills, and competencies.

Despite the absence of the term 'digital awareness' in our sample, it has been proposed previously by Wang[6] in 2012 (in: Verma et al., 2016) to generally convey the "ability to work with digital devices and environments for research, communication, entertainment, etc." (p. 261). In the methodology of the article, the authors specify digital awareness as being "about different types of electronic gadgets (digital gadgets) being used by the students, their favorite gadget for communication, entertainment, Internet, and SM access" (p. 262). Two arguments are proposed for why a (re)conceptualization is necessary. First, the definition is imprecise and does not provide sufficient detail to be used in a meaningful way. More specifically, the question arises how 'ability' or 'is used' are operationalized. This raises the question if an individual is digital aware when they are able to use a mobile phone for a range of purposes. Raising this question evokes a plethora of follow-up questions, such as questions about the frequency of use and purpose. Furthermore, this leads to a second argument: the term can hardly be distinguished from several definitions of digital literacy (or from being digital literate). For example, the definition of Martin (2006b, p. 155) focuses on the "ability of individuals to appropriately use digital tools and facilities", and Gilster (1997, p. 6) mentions "the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers". In contrary to Martin's definition (2006b), who includes an individual's awareness of appropriately using digital technologies as well as "facilities to identify, access, manage, integrate, evaluate, analyze and synthesize digital resources, construct new knowledge, create media expressions, and communicate with others" (p. 155). This definition shows the dynamicity of digital awareness as a concept, but also shows the complexity (i.e., broadness and depth) of the concept, as indicated by the series of verbs. As a result, our definition of digital awareness should display dynamicity and capture the complexity of the topic at hand.

Towards a Definition of Digital Awareness

The lack of consensus in defining and conceptualizing digital literacy (e.g., the MIL framework from UNESCO, 2011, 2018) and, to a lesser extent digital citizenship, resulted in a broad range of interdisciplinary studies and approaches. Despite that this variety resembles a realistic representation of the quantitative interdisciplinary research conducted in this area between 2015 and 2024 (see Martínez-Bravo et al., 2020), the lack of consensus about clear definitions of digital literacy and citizenship obstructs research, policy and interventions. Future research should focus on developing a more unified definition and framework instead of adding new ones to the existing repository of research to avoid conceptual confusion and ambiguity. The absence of a complete (i.e., dynamic and complex) definition of digital awareness in our sample displays the necessity for more conceptual coherence, starting with indications for digital awareness we found in our sample. These

[6]Article was excluded in the current review due to exceeding the timeframe regardless of meeting the inclusion criteria.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 1 April 2025 doi:10.20944/preprints202504.0069.v1

indications—labeled as containing a future link, involving the creation of a process/product, exercising critical thinking, displaying the potential for an individual and/or society, and comparing two or more aspects, allowed us to define digital awareness as: the degree to which an individual is able to critically recognize and reflect upon the declarative, structural, procedural, and conditional knowledge and understanding which are necessary to identify the necessities, opportunities, risks and consequences of the use of (future) digital technologies in and across one's public, work, and private lives.

Digital awareness is—similar to digital literacy being perceived as being broader than separate literacies—more than a collection of awareness about aspects of digital technologies. It bridges economic, cultural, personal, political, and social aspects of behaviors, activities, attitudes, values, and beliefs involved in digital technologies. In addition, whether or not someone is digital aware is binary; however, once they are, the *quality* of the awareness is relevant. The latter can differ between (groups of) individuals.

For an individual to become digital aware the individual needs to have sufficient knowledge (i.e., the functional skills must be covered). The functional skills can be conceptualized in different types of knowledge and understanding (Rogers, 2003; Martin 2006b). Tapping into different types of knowledge, declarative knowledge is viewed as static (Hooper & Hokanson, 2000) and refers to specific knowledge about a topic and answers a what-question. For example, laptops have an 'on' button and need to be recharged when the battery is empty. Transferring this declarative knowledge to new digital technologies, an individual might look for a button to turn the device on despite not knowing how to operate it. Structural knowledge refers to an understanding of how bits of declarative knowledge fit together in a meaningful way (Egbert, 2017) and can be viewed as a collection of what-questions. For example, an individual has a new technological device, and after charging it, they turn the device on (declarative knowledge). When the device is turned on, they expect instructions to create a personal account, another bit of declaratively knowledge. Procedural knowledge is dynamic and refers to knowledge and understanding of *how* to implement strategies based on an individual's skills and abilities. For example, for an individual to use a laptop it needs to be charged first by plugging in the charger. Conditional knowledge refers to knowledge and understanding about *when* to implement strategies based on an individual's skills and abilities (Egbert, 2017; Hooper & Hokanson, 2000). It provides an answer to a when-question, but also contributes to a why-question. In the simplified example used previously, an individual needs to be aware that the laptop needs to be charged when it does not turn on anymore or when the percentage exceeds a certain threshold (i.e., answering the why-question).

The level of declarative, structural, procedural, and conditional knowledge and understanding an individual has, can differ per digital technology. It can be directed towards unique characteristics of hardware, software, and/ or connection components, but also refers to their interactions within and between them and other relevant factors. Moreover, digital awareness relies heavily on an individual's intra- and interpersonal characteristics (Karunanayaka & Weerakoon, 2020; Seemann, 2003). As a result, similar to digital literacies, the quality of digital awareness might vary according to life circumstances and experiences but also across different field of expertise.

The concept of digital awareness still needs further development. Our proposed conceptualization can offer a starting point for this. Future research could focus on including the concept of digital awareness in the theoretical framework of (empirical) studies and further developing indicators, such as individual characteristics and contextual aspects (i.e., situation-specific aspects). This also means that (empirical) studies need to include both theoretical and practical implications, in particular about the concept of digital awareness to make sure research develops. The conceptualization of digital awareness is not set in stone with this review, as our rapidly changing digital world requires flexibility of actors and aspects involved. Conceptually, this would mean that our conceptualization provides a foundation for a need for consensus whilst respecting the changing nature of digital infrastructure and what is needed to navigate in that world. A limitation of our review is that it only included quantitative research. Other types of research, such

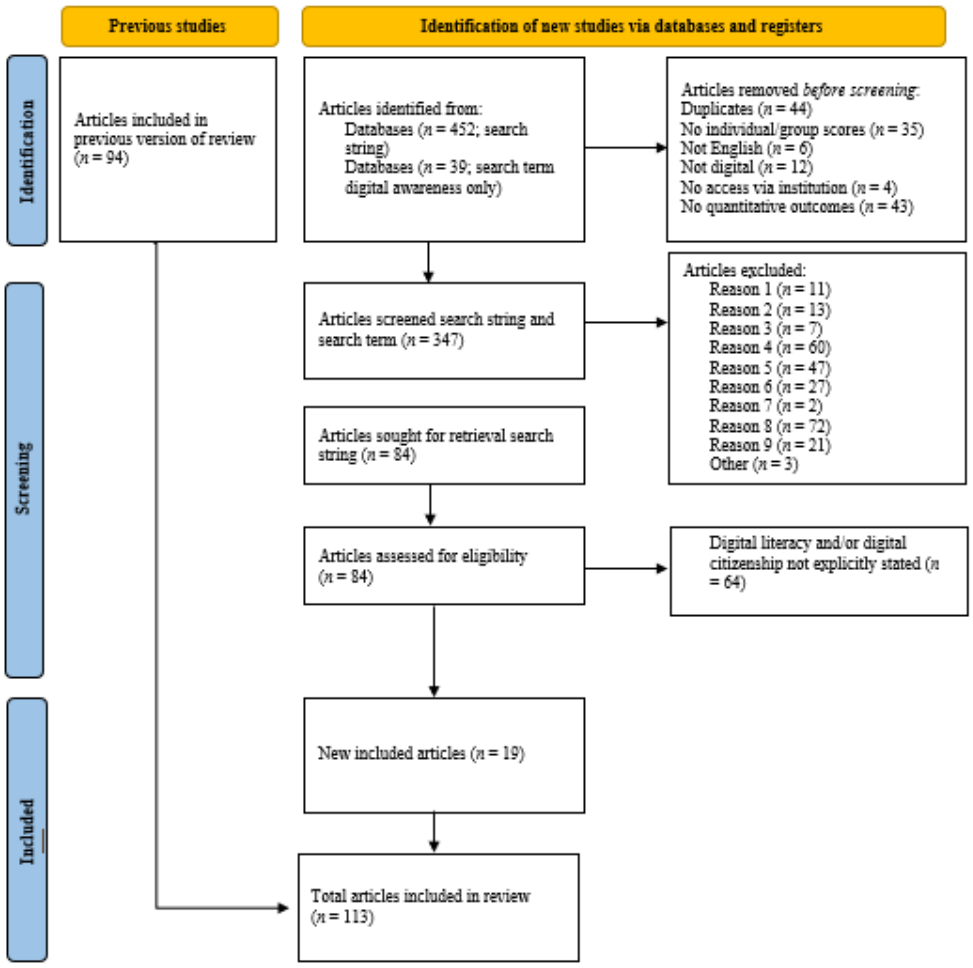
Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 1 April 2025 doi:10.20944/preprints202504.0069.v1

as qualitative research, grey literature, and reviews, may also contain useful aspects of digital awareness to further refine the conceptualization.

Furthermore, future research can develop an instrument to measure digital awareness in both younger and older adults that covers a variety of contexts to acknowledge its interdisciplinary nature, as illustrated by our three themes. The challenges lie in developing the concept of digital awareness in such a way that it is generalizable across different settings, yet with sufficient detail to be useful in research and practice. Furthermore, digital awareness *seems* mostly present in older individuals, or at least in individuals that have mastered functional digital skills, which leads to the question if research on the topic of digital awareness in early educational levels, such as primary and secondary education, is fruitful. These age-related aspects of digital awareness that are crucial for policy and interventions should be a focus point in future studies.

Appendix A

PRISMA 2020 Flow Diagram for Updated Reviews



From: Page M. J., McKenzie J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzladd, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., McGuinnes, L. A., Stewart, L. A., Thomas, J., Tricco, A. C., Welch, V. A., Whiting, P., & Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. British Medical Journal, 372(71). https://doi.org/10.1136/bmj.n7

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 1 April 2025 doi:10.20944/preprints202504.0069.v1

References

Bennett, W. L. (2003). Communicating Global Activism: Strengths and Vulnerabilities of Networked Politics. *Information, Communication & Society, 6*(2), 143–168.

Bourdieu, P. (1986). Forms of social capital. In John C. Richardson (Ed.), *Handbook of theory and research for sociology of education* (241–258). NY: Greenwood Press.

Buckingham, D. (2006). Defining digital literacy: What do young people need to know about digital media? *Digital Kompetanse, 4*(1), 263–276.

Conklin, W. (2012). Higher-order thinking skills to develop 21st century learners. Huntington Beach: Shell Education.

Egbert, J. (2017). Supporting student content learning. In J. Egbert (Ed.), *Methods of Education Technology: Principles, Practice, and Tools* (28–49). Pressbooks.

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

Fieldhouse, M., & Nicholas, D. (2008). Digital literacy as information savvy: The road to information literacy. In C. Lankshear and M. Knobel (Eds.), *Digital literacies: Concepts, policies and practices* (47–72). NY: Peter Lang Publishing.

Garista, P., & Pocetta, G. (2014). Digital Resilience: meanings, epistemologies and methodologies for lifelong learning. Accessed November 12, 2021 from https://www.researchgate.net/profile/Patrizia_Garista2/publication/269628593_Digital_Resilience_meanings_epistemologies_and_methodologies_for_lifelong_learning/links/549002d00cf225bf66a80a3e/Digital-Resilience-meanings-epistemologies-and-methodologies-for-lifelong-learning.pdf

Gernsbacher, M. A. (2018). Writing empirical articles: Transparency, reproducibility, clarity, and memorability. *Advances in Methods and Practice in Psychological Science, 1*(3), 403–414. https://doi:10.1177/2515245918754485

Gillen, J., Marsh, J., Bus, J., Castro, T., Dardanou, M., Duncan, P., Enriquez-Gibson, J., Flewitt, R., Gray, C., Holloway, D., Jernes, M., Kontovourki, S., Kucirkova, N., Kumpulainen, K., March-Boehnck, G., Mascheroni, G., Nagy, K., O'Conoor, J., O'Neill, B., Palaiologou, I., Poveda, D., Salomaa, S., Severina, E., & Tafa, E. (2018). Digital Literacy and young children: Towards better understandings of the benefits and challenges of digital technologies in homes and early years settings. Accessed November 12, 2021 from https://e-space.mmu.ac.uk/624237/1/Gillen_Arnott_PB_2018_Digital_Literacy_and_Young_Children_Towards_Better_Understandings_of_the_Benefits.pdf

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

Hatlevik, O. E., & Christophersen, K.-A. (2013). Digital competence at the beginning of upper secondary school: Identifying factors explaining digital inclusion. *Computers & Education, 63*, 240–247. https://doi:10.1016/j.compedu.2012.11.015

Helsper, E. J. (2021). The digital disconnect: The causes and consequences of digital inequalities. London: Sage Publications.

Hintz, A., Dencik, L., & Wahl-Jorgensen, K. (2019). Citizenship in a digital age. In A. Hintz, L. Dencik, K. Wahl-Jorgensen (Eds.), *Digital citizenship in a datafied society* (20–42). Cambridge: Polity Press.

Hooper, S., & Hokanson, B. (2000). The changing face of knowledge. *Social Education, 64*(1), 28–31.

Jaeger, P. T., Bertot, J. C., Thompson, K. M., Katz, S. M., & DeCoster, E. J. (2012). The intersection of public policy and public access: Digital divides, digital literacy, digital inclusion, and public libraries. *Public Library Quarterly, 31*(1), 1–20. https://doi:10.1080/01616846.2012.654728

Jones, L. M., & Mitchell, K. J. (2015). Defining and measuring youth digital citizenship. *New Media & Society*, 18(9), 1–17. https://doi:10.1177/1461444815577797

Karunanayaka, S. P., & Weerakoon, W. M. S. (2020). Fostering digital education among teachers and learners in Sri Lankan schools. *Journal of Learning Development, 7*(1), 61–77.

Lanham, R. A. (1995). Digital literacy. *Scientific American, 273*(3), 160–161.

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*, 547–556. https://doi:10.1111/j.1365-2729.2011.00474.x

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 1 April 2025 doi:10.20944/preprints202504.0069.v1

Livingstone, S. (2004). What is media literacy? *Intermedia, 32*(3), 18–20.

Martin, A. (2006a). Literacies for the digital age. In A. Martin & D. Madigan (Eds.), *Digital literacies for learning* (3–25). London: Facet Publishing.

Martin, A. (2006b). A European framework for digital literacy. *Nordic Journal of Digital Literacy, 2*, 151–161.

Martínez-Bravo, M.-C., Sádaba-Chalezquer, C., & Serrano-Puche, J. (2020). Fifty years of digital literacy studies: A meta-research for interdisciplinary and conceptual convergence. *Profesional de la información, 29*(4), 1–15. https://doi:10.3145/epi.2020.jul.28

Miller, A. (2015). On paper, in person, and online: A multiliteracies framework for university teaching. *Journal of Academic Language & Learning, 9*(2), 19–31.

New London Group. (1996). A pedagogy of multiliteracies: Designing social futures. *Harvard Educational Review, 66*(1), 60–93. https://doi:10.17763/haer.66.1.17370n67v22j160u

Nichols, T. P., & Stornaiuolo, A. (2019). Assembling "Digital Literacies": Contingent pasts, possible futures. *Media and Communication, 7*(2), 14–24. https://doi:10.17645/mac.v7i2.1946

Pahl, K. H., & Rowsell, J. (2010). Artifactual critical literacy: A new perspective for literacy education. *Berkeley Review of Education, 2*(2), 129–151.

Polyakova, V., Streltsova, S., Iudin, I., & Kuzina, L. (2024). Irreversible effects? How the digitalization of daily practices has changed after the COVID-19 pandemic. *Technology in Society, 76*, 102447.

Ribble, M. (2007). The nine elements of digital citizenship. In M. Ribble (Ed.), *Digital citizenship in schools* (23–56). Oregon: International Society for Technology in Education.

Saulsman, L. M., & Page, A. C. (2004). The five-factor model and personality disorder empirical literature: A meta-analytic review. *Clinical Psychology Review, 23*(8), 1055–1085.

Schunk, D. H., & Pajares, F. (2009). Self-efficacy theory. In K. R. Wentzel & Miele, D. B. (Eds.), *Handbook of motivation at school* (35–53). NY: Routledge.

Seemann, K. (2003). Basic principles in holistic technology education. *Journal of Technology Education, 14*(2), 28–39.

Shea, B. J., Grimshaw, J. M., Wells, G. A., Boers, M., Andersson, N., Hamel, C., Porter, A. C., Tugwell, P., Moher, D., & Bouter, L. M. (2007). Development of AMSTAR: A measurement tool to assess the methodological quality of systematic reviews. *BMC Medical Research Methodology, 7*, 10–17. https://doi:10.1186/1471-2288-7-10

UNESCO (2008). ICT competency standards for teachers. Obtained from https://unesdoc.unesco.org/ark:/48223/pf0000156207

UNESCO (2011). Media and information literacy: Curriculum for teachers. Obtained from https://unesdoc.unesco.org/ark:/48223/pf0000192971?posInSet=8&queryId=28c42b34-5f6e-4a02-9258-8e2fb2d5f4f1

UNESCO (2018). A global framework of reference on digital literacy skills for indicator 4.4.2. Obtained from https://unesdoc.unesco.org/ark:/48223/pf0000265403?posInSet=1&queryId=0e0a5c7b-496d-443d-bbd2-039bed2a5179

Van Duyn, M. A. S., Kristal, A. R., Dodd, K., Campbell, M. K., Subar, A. F., Stables, G., Nebeling, L., & Glanz, K. (2001). Association of awareness, intrapersonal and interpersonal factors, and stage of dietary change with fruit and vegetable consumption: A national survey. *American Journal of Health Promotion, 16*(2), 69–78.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 1 April 2025 doi:10.20944/preprints202504.0069.v1

Vélez, A. P., & Zuazua, I. I. (2017). Digital literacy and cyberconvivencia in primary education. *Procedia - Social and Behavioural Sciences, 237*(2), 110–117. https://doi:10.1016/j.sbspro.2017.02.050

Verma, A., Jha, M., & Mitra, M. (2016). Digital awareness and Internet usage by school students. *Journal of Psychosocial Research*, *11*(2), 259–270.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.