Literacy of the Future

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Keypoints

- There has been a transition from traditional literacy, focused solely on reading and writing, to an expansion of literacy concepts, characterized by a broader interpretation that includes digital, information, media, and futures literacies. This reflects the need to effectively navigate a complex, interconnected, and digital world.
- Interdisciplinary nature of literacy: literacies intersect with technology, education, and social practices. The future of literacy is not confined to a single domain but spans across various fields, indicating the necessity for a multidimensional approach to literacy education.
- Critical engagement and social participation: Much attention is brought to the importance of critical engagement with information and active participation in social and digital environments. Literacy is portrayed as the acquisition of skills and as an active, critical engagement with content and participation in societal discourses.
- Advancements in technology, especially digital technologies, are shaping the future of literacy. Digital literacy and media literacy are critical for understanding and creating digital content, and coding and programming skills are started to be conceived as essential competencies.
- Futures literacy conforms crucial skills for anticipating, understanding, and engaging with future challenges and opportunities. It deals with the capacity to imagine, design, and actualize potential futures, emphasizing the proactive aspect of literacy in shaping tomorrow.
- There is strong advocacy for integrating various forms of literacies into educational curricula, stressing the need to prepare students for the complexities of the modern and future world. This includes focusing on multiliteracies and holistic perspectives catering to diverse learning needs and contexts.
- There are challenges to achieving universal literacy, including digital divides and educational disparities. However, we need targeted efforts to improve literacy among all population segments and ensure equitable access to literacy resources.
- The ethical and societal implications of literacy, particularly in the digital realm, must be further explored, implemented, and promoted (e.g., information ethics, responsible use of technology, and the importance of literacy in fostering democratic engagement and social change).

- Collaboration among educators, librarians, policymakers, and communities are vital for advancing literacy, as well as a collective approach to address the multifaceted challenges of literacy education and to innovate in literacy training and development for the future.
- The future of literacy education requires continuous adaptation to changing technologies and societal needs. Literacy enhances lifelong learning and, as such, allows individuals to remain informed, engaged, and capable of contributing to society amidst ongoing changes.

Abstract

This entry summarizes the development of the literacy concepts most commonly associated with LIS, namely information literacy, digital literacy, and media literacy, which frame a synthesis of the future perspectives of these and other literacies that have been proposed in the literature[1]. These future perspectives are organized in nine sections: the educational implications of literacy, information literacy, digital literacy, literacy education, multiliteracies and holistic perspectives, media literacy, futures literacy, algorithmic literacy and artificial intelligence implications, and other literacies. The purpose of this entry is to offer a brief overview and commentary on the types of literacies that we need to be aware of and competent in for the near future. As these future trends are derived from the specialized literature, they include some already occurring considerations. However, they might become more salient topics in the upcoming years, and they might entail many different implications for the future of LIS professionals, libraries, and even for education in general.

Keywords: information literacy, digital literacy, media literacy, futures literacy, technological advancements, critical engagement, social participation, educational integration, multiliteracies, programming skills, ethical dimensions, democratic engagement, lifelong learning, collaboration, adaptation.

Introduction

The future of literacy is a dynamic field of discussion that intertwines education, technology, and social practices. The traditional approach to literacy, based on skills like reading and writing, is pivoting toward emergent literacy forms encompassing a more comprehensive range of cognitive and social practices (Street, 2013). A critical dimension of this paradigm shift pertains to the concept of *futures literacies*, which refers to the ability to perceive, actualize, and create possible futures in the present. This approach to literacy emphasizes the potential benefits of moving riveting possibilities and anticipations from the periphery of education to the center as a focal point of pedagogy and practice (Horst & Gladwin, 2022). It suggests dealing with education in a context-sensitive and proactive manner, building on learners' capacities to construct meanings as they navigate future uncertainties (Horst & Gladwin, 2022).

Meanwhile, examining 21st-century literacies acknowledges the growing importance of digital and computational skills. For instance, programming or coding skills are increasingly seen as vital competencies, shaping a complex literacy scenario that will cut across general literacy, computing, and coding in education (Lindberg & Öberg, 2023). The authors also stress the social aspect of literacy, underscoring that it is not merely about individual ability but rather about participating in social activities,

[1] An alphabetical and non-exhaustive list could include: academic literacy, artificial intelligence or algorithmic literacy, civic literacy, context literacy, data literacy, emotional literacy, financial literacy, focus literacy, futures literacies, game literacy, graphic literacy, health literacy, literacy education, legal literacy, media literacy, multiliteracies, new literacies, new media literacies, navigation literacy, numerical literacy, participatory/participation literacy, personal literacy, psycho-literacy, scientific literacy, search engine literacy, skepticism literacy, statistical literacy, transliteracy, and visual literacy or visuacy. Note: not all of these are covered in this entry for space limitations.

reflecting the vibrant interaction between text and context, individual and community. Furthermore, future literacy will consider students' familiarity with multiple literacies, including those associated with the Web (Street, 2013). This recognizes learners' growing interaction with various technology-facilitated literacy practices and multiple modes of communication.

All these insights suggest that the future of literacy goes beyond individual decontextualized cognitive abilities. It entails engagement with societal discourses, technological advancements, and future possibilities, setting the stage for a more integrated, context-oriented, and futures-aware perspective on literacy education. The challenge lies in theorizing and operationalizing these shifts into practical pedagogical strategies to produce individuals who could significantly shape the future narrative.

Literacy, by itself, refers to reading and writing abilities. However, from library and information science (LIS), as well as from other fields such as education, media and communication studies, and even from the natural sciences, the notion of literacy has been combined with other concepts to conform to a wide variety of definitions that serve to refer to the development of competences or a particular proficiency in individuals that are related to the specific subject attached to the word *literacy*. When referring to transcending read-write literacy, Conley & Wise (2011) state that a richer vision of comprehension and literacy is necessary for students to succeed in both education and the workplace, focusing on making them strategic, adaptable comprehenders.

Future perspectives

Regarding literacy in general and its future perspectives on its continuing inclusion in education, we have that it will be viewed as a form of capital, emphasizing the importance of multiple forms of literacy in preparing students for the future, thus indicating a shift toward recognizing the diverse skills and literacies needed for success in a rapidly changing world (Moje & Sutherland, 2003). The future of information literacy involves integrating it more deeply into educational curricula at all levels and adapting to new information technologies and landscapes. Emphasizing the ethical and societal dimensions of information use and fostering information literacy as a foundation for democratic engagement and lifelong learning are critical directions for further development (Kovářová, 2018; Kuttkat et al., 2022).

Educational implications of literacy

Middle school literacy education should focus on using literacy as a tool to navigate and construct a just and democratic world, preparing students for the diverse and complex world they face (Moje & Sutherland, 2003). According to Conley & Wise (2011), we can project that whatever the literacy, the challenges involve preparing students for the future, which can be done through a multifaceted approach to literacy education (i.e. multiliteracies) that integrates school subjects with real-world topics, thus moving beyond isolated subjects and bringing forward the importance of developing strategic comprehension skills to adapt to changing educational and workplace demands, which also require individuals to comprehend complex and multi-tasking environments for succeeding both in their present and future endeavors.

There should also be a more considerable emphasis on lifelong learning that considers the evolving landscape of technology and media, there will be a greater focus on fostering lifelong learning skills in individuals (Thoman & Jolls, 2004). Thus, media literacy education will be crucial in teaching and reinforcing 21st-century learning skills.

Elmborg (2017) suggests that literacy education should rethink the fundamental premises of pedagogy to address disparities in educational outcomes and cultural differences brought on by rapidly shifting communication media, while also recognizing the impact of new technologies, moving toward a more inclusive and pluralistic understanding of literacy, encompass social and cultural aspects of literacy, as well as negotiations of belonging in communities, and developing an information literacy closely related to writing, with an emphasis on understanding the processes involved in producing quality academic products. Olson et al. (2023) contribute the following recommendations for developing information literacy education:

- Integrating information literacy into specific disciplines and courses, aligning its essential competencies with specialized themes and the information research process.
- Mapping information literacy curriculum to courses with specific learning objectives, assessments, and learning activities.
- Emphasizing research organization, search syntax, information architecture, scholarly communications, and information equity as key concepts and skills in information literacy, all of which have been related to the importance of academic or scientific literacy.
- Collaborating between faculty and librarians to design frameworks for developing information-fluent future professionals, highlighting the importance of partnership in information literacy education.

Marcella & Chowdhury (2020) present very relevant warnings to avoid taking some things for granted regarding literacy training and preventing exclusion. As such, they state that it is crucial to address *simple literacy* as a real issue for many individuals living in poverty, as access to essential reading and writing skills remains a challenge for some. However, they state that there is a need to distinguish between information literacy and the mere location of information through online platforms, highlighting the necessity of teaching individuals how to effectively use information for everyday problem-solving, education, research, and decision-making. They also stress that we must empower individuals to produce and share their own data and information, rebalancing society's representation of itself and addressing the challenge of information being dominated by those who already hold power while also alleviating information poverty and information inequalities.

Kutlu-Abu & Arslan (2023) stress that media and information literacy, digital media literacy, and teacher training for media competence must focus on critical pedagogy in education to enhance critical media literacy skills among students, public participation and engagement, while also promoting participatory citizenship through media policies, the development of critical media literacy, and the incorporation of anticolonial perspectives in media literacy education, including critical race theory and challenges related to settler colonialism.

When addressing information and digital literacy, Hardy & McKenzie (2020) recommend the following lines pertaining to their educational implications:

- Shift toward a digital-first focus in information literacy instruction, moving away from traditional face-to-face methods to online interactive tutorials and videos.
- Integrate information and digital literacy skills into the curriculum to reach students wherever they are, whether on campus, online, or in a distance learning environment.
- Providing support at the right time and place, particularly when students find information for their tasks.

- Developing digital learning objects together with academic staff to deliver literacy resources that cater to students' needs at various points in their education.
- Improve library-academia collaboration to enhance students' skills.
- Recognize and act upon the importance of situating information and digital literacy content in the learning management systems to provide students with authentic and engaging learning environments.

Information literacy

The evolution of information literacy reflects a journey from a skill-focused perspective to a more nuanced understanding that incorporates a range of cognitive, affective, and social dimensions. This evolution can be tracked through various significant publications and emerging conceptual frameworks. Initially, information literacy helped us transcend the classical bibliographic instruction, and it was primarily viewed in terms of the skills required to locate, evaluate, and use information effectively. The Association of College and Research Libraries played a pivotal role in formalizing this concept with its definition and standards, emphasizing personal orientation and the practical skills needed for academic success and lifelong learning.

Over the years, various models and standards have been developed to enhance information literacy abilities and adapt the concept to education, leading to incremental awareness about the importance of information literacy. Information literacy involves personal abilities such as critical thinking, problem-solving, and analysis. It also engages with various disciplines and topics, contributing to personal development, self-confidence, lifelong learning, and social change.

However, the rapid advancements in information and communication technologies (ICTs) and the increasing complexity of the information ecosystem necessitated a reevaluation of the information literacy concept, something that produced an overabundance of concepts, although they arguably share a common essence: improve people's experiences, practices, and work with information. The shift moved toward recognizing information literacy as a set of skills and critical literacy that involves understanding information creation, dissemination, and use within a broader societal context. This recognition was partly driven by the need to navigate the vast and often uncertain information landscape, highlighting the importance of foundational ideas about the information ecosystem.

The introduction of *threshold concepts* marked a significant evolution in the information literacy discourse. Threshold concepts are transformative, integrative, and potentially troublesome ideas that, once understood, lead to a deeper and more substantive engagement with information. This approach emphasizes the importance of understanding how to find and use information and the underlying principles that govern the creation and dissemination of knowledge. It reflects a move toward a more holistic understanding of information literacy, focusing on developing a critical stance toward information and its role in society.

Moreover, the conceptualization of information literacy has expanded beyond the individual to consider social and collaborative aspects of information use. This is evident in the emphasis on *information ecosystems* and the recognition of the communal construction of knowledge. The idea of information literacy as involving ethical participation in communities of learning and scholarship further illustrates this shift toward a more integrated and socially embedded understanding of it. This evolution of the information literacy concept underscores the dynamic nature of information itself and the need for

information literacy education to adapt continually to the changing information landscape. It reflects a deeper understanding of the complexities of information use in contemporary society and the need for a more comprehensive and nuanced approach to information literacy education.

Information literacy can become the backbone for the development of generic competencies, through the recognition of the importance and integration between generic competencies and information literacy competencies, particularly to prepare individuals for new professional environments, but this requires a more holistic approach to education and preparation for the workforce, emphasizing: 1) the importance of transferable skills and information literacy in today's job market; 2) integrating information literacy into curriculum development and workplace environments; 3) improving communication between the educational and work sectors to ensure graduates are adequately prepared with the necessary skills; and 4) the recognition of the importance of information literacy and generic competencies in shaping the skill sets of future employees and improving their prospects in the job market (Zorica et al., 2014). Also speaking about information literacy in the workplace, Šobota (2023), influenced by sociocultural research, works with the concept of *critical workplace information literacy* as a framework for empowering workers and also for enacting a shift toward a socioculturally-anchored understanding of information literacy by encompassing critical awareness and social context, focusing on interactions between people and information practices, developing a critical literacy perspective in participatory environments, emphasizing empowerment and critical engagement, as well as the exploration of information literacy as a sociotechnical practice, highlighting its dynamic nature.

Walton (2017) projects four significant future trends related to information literacy instruction and how it may increase its focus on empowering individuals and deepening its questioning potential:

- Shift toward cognitive questioning and emphasizing the importance of fostering a cognitive questioning state in learners to enhance information discernment. This encourages critical thinking and information evaluation.
- Exploration of epistemic beliefs and motivated reasoning: this will be driven by the relations between epistemic beliefs, emotions, and learning from texts. Future trends may involve further research and understanding of how these factors impact information discernment.
- Emphasis on empowerment and critical engagement: traditional information literacy approaches are limited in the sense that they might reproduce existing power relations and academic discourses, future training will focus on empowering individuals to question received meanings and engage critically with information sources.
- Use of discourse analysis: for understanding the interplay of power and knowledge in shaping information literacy and for exploring the influence of social contexts on information discernment.

Todd (2017) highlights that information literacy education should: 1) emphasize conceptual skills and intellectual agility over information technology or location skills; 2) address challenges in theoretical pedagogical frameworks for information literacy instruction to improve them as a significant part of an educational and social agenda; 3) focus on building meta-analyses of empirical claims and propositions about the impact of information literacy development and instruction across different theoretical perspectives; and 4) call for meta-analyses of research studies to establish the outcomes and impacts of information literacy instruction, with a focus on user-centered outcomes.

For their part, Stebbing et al. (2019) recommend focusing on: 1) developing reading skills as a critical factor in enhancing information literacy skills; 2) emphasizing the need for students to be aware of and use a greater selection of appropriate sources for their discipline (this is where librarians must address the gap in students' knowledge of available resources); 3) encouraging students to engage in wider reading to introduce them to a range of viewpoints, facilitate critical analysis, and improve their ability to construct arguments; 4) recognizing the link between reading and writing ability, where students with a limited range of reading skills tend to write in a descriptive manner, while those who read more widely write in a more academic style; and 5) acknowledging the importance of developing evaluation and critiquing skills in future information literacy programs to enhance students' ability to assess the quality of information sources.

Shenton (2023) highlights: 1) the shift from traditional literacies (reading and writing) to a broader set of skills encompassing the effective use of information; 2) the recognition that individuals must acquire skills to cope with rapid changes in society and technology to avoid being disadvantaged; 3) the importance of evaluating information, constructing meaning, and navigating through the vast amount of material available; 4) the concept of *learning how to learn* as a key ability to thrive in the modern world; and 5) the need to question the reliability and accuracy of information sources, highlighting the importance of information source appraisal. However, Rath (2020) suggests shifting from viewing information literacy as a set of discrete skills to conceptualizing it as a social practice, while emphasizing the importance of understanding information literacy as a lifelong process, exploring multiliteracies as what is beyond information literacy; and integrating theories of information landscapes and practice theory to deepen the understanding of information literacy as a social practice.

The importance of information literacy in this age of post-truth, social media and fake news cannot be understated. As such, Rachman (2019) stresses the significance of understanding how to evaluate information critically and identify trustworthy news sources, that students need to be able to counter hoaxes, especially on social media, and that librarians have an essential role in promoting critical thinking skills in their users and in supporting the information society. Moreover, Lebid et al. (2020) recommend the following:

- Increasing emphasis on fact-checking and data verification tools as essential skills for students to combat manipulation, populism, and disinformation in today's world.
- Enhance the culture of media literacy, introducing fact-checking into academic courses, and work with various sources of information.
- Fact-checking started as an investigative journalism tool but now is a media trend with unique features and methodologies. It includes verifying official statements, news reports, and public narratives presented in social media, public discourses, and diverse media materials.
- Critical and meaningful information consumption in the face of growing populism, manipulation, disinformation and fact-checkers are playing a crucial role in uncovering falsehoods.
- Students need to develop skills in handling data verification tools and understanding fact-checking principles for academic and research work.

Hannah (2023) is among the authors who have expanded the concept of information literacy to *critical information literacy*, because of a need for implementing a critical approach to information literacy to respond to the growth of online conspiracy theories, emphasizing the importance of addressing

underlying material conditions that make such theories attractive, by fusing critical information literacy with critical theories of race, gender, sexuality, ideology, political economy, and material conditions in which information is produced. As such, this approach could arguably reach an expanded public impact through the promotion of information literacy beyond the traditional realms of higher education institutions and advocate for developing interventions that address the public consumption of information, as the information crisis is centered on public consumption that cannot be solely addressed within academia. However, this approach acknowledges that current information literacy concepts may be insufficient in addressing Internet conspiracy theories, thus requiring the development of more impactful interventions through an adapted approach to literacy pedagogy.

Adding to the critical literacy perspective, Aguilera & Pandya (2021) draw attention to the need for cultivating new forms of critical literacy in the digital age amidst social, political, cultural, and economic tensions facilitated by technologies. Their proposal also includes: 1) shifting to digital modes of instruction and work, with the likelihood of more time spent in the digital realm in the future (because of social changes and under the suspicion of future pandemics?); 2) embracing a pluralized conception of literacies beyond traditional notions of reading and writing to encompass linguistic diversity and the transformative impact of emergent technologies on literacy practices; 3) addressing issues of equity, power, and ideology that are sometimes overlooked in discussions about technology and literacy, in favor of more holistic and nuanced perspectives; and 4) expanding research agendas toward mobilizing knowledge for contributing to deep social change in educational spaces.

Digital literacy

Literacy has evolved to encompass the ability to use technology, understand information, and express ideas (Daley, 2003). From this notion, digital literacy is the most immediate concept that comes to mind. Digital literacy can be defined as the ability to effectively use ICTs to locate, evaluate, create, and communicate information. It involves possessing a broad range of technological, cognitive, and social competencies, encompassing skills such as operating computers, navigating the Internet, evaluating information reliability, and critically assessing technology. Additionally, digital literacy entails understanding and interpreting various forms of digital texts, including hypertextual and multimedia content, and engaging in different online communication forms. Digital literacy is crucial in the digital information and communication dominance age, enabling individuals to participate effectively in society and thrive in educational and professional settings.

Digital literacy is a multifaceted and dynamic concept that is critical in education, employment, and societal participation. Its development reflects ongoing technological changes and the increasing importance of digital competencies in all areas of life. It is generally defined as using ICTs to find, evaluate, create, and communicate information (Vrana, 2014). According to the cited author, the scope of digital literacy includes a wide range of technological, cognitive, and social competencies, such as operating computers, navigating the Internet, managing large volumes of information, evaluating its reliability, and critically assessing technological tools.

Initially, digital literacy was focused on reading and understanding hypertextual and multimedia texts. Over time, the definition expanded to encompass a more comprehensive array of skills and competencies, including critically evaluating information and using digital technology for communication and creation (Živković et al., 2013). Digital literacy is crucial for academic performance and employability,

enabling individuals to effectively use digital technologies for learning, communication, and problem-solving (Vrana, 2014, 2016).

Educational institutions worldwide recognize the importance of digital literacy and incorporate it into their curricula to prepare students for the demands of the labor market (Vrana, 2014). Despite the widespread acknowledgment of its importance, there are challenges in achieving universal digital literacy, including the digital divide—inequalities in access to and use of digital technologies (Santos et al., 2013; Vrana, 2014).

The digital divide affects individuals' ability to participate fully in a digital society, underscoring the need for targeted efforts to improve digital literacy among all population segments (Santos et al., 2013). As digital technologies continue to evolve, so too will the concept of digital literacy. Future definitions must incorporate new skills and knowledge required to navigate an increasingly complex digital landscape (Vrana, 2016).

Daley (2003) argues that literacy in the twenty-first century involves learning to read and write in the multimedia language of screens and challenges traditional academic attitudes toward media studies, stressing the importance of a broader understanding of literacy that encompasses multimedia language alongside traditional written forms. Similarly, we have that literacy in the new media age involves multimodality, multilingualism, and genres, transforming reading and writing into new modes and affordances (Kress, 2003).

It is common among authors to suggest that the shifts will occur toward more advanced and specialized literacy skills in response to technological advancements. Specifically, highly specialized sorts of literacy will be enhanced due to informatization, robotization, and changes in social and personal life (Morais & Kolinsky, 2021).

Lindberg & Öberg (2023) go beyond the conception of digital literacy by stressing the current and future challenges and opportunities of generalizing training on programming skills and coding. Their suggestions can be summarized as follows:

- Integrating programming skills as essential competencies for the future, alongside traditional reading and writing skills.
- Transformation of reading and writing skills due to changing views of communication and advancements in digital technologies.
- Emphasis on the need for reading and writing code as a new evolutionary stage of literacy, adding to the developmental stages of *writing technology*.
- *Future scribes* represent a shift toward computer language skills as essential in everyday life, signaling a transition from a printed knowledge society to a post-digital one.
- Programming is a literacy of the future, as it should be acquired as a non-specialized competence in education alongside traditional literacy skills to bridge gaps among different disciplines.
- The blurring of boundaries between educational policy-making and commercial actors in implementing computer science and programming curricula will merge programming with textual comprehension and production.

In turn, Knaus (2020) has a more classical but, at the same time, expansive perspective on digital literacy by referring to technology and data literacy in the following key points about its future:

- Increasing focus on technology literacy alongside media literacy, as digital technology continues to play a crucial role in society, suggesting that individuals need both to navigate the digital age effectively.
- Expansion of media literacy to include digital literacy: with the rise of digital media, there is a need to broaden the definition of media literacy to include digital literacy. This expanded literacy encompasses knowledge about technical hardware, networks, software, and data.
- Shift toward data literacy as a core component of various literacies in the context of media, digital, informational, computational, statistical, and scientific literacy, as understanding data processes and algorithms is essential for individuals to be media literate.
- Empowerment through an augmented understanding of media literacy that incorporates technology and data literacy so that individuals become technically empowered subjects capable of shaping the digital world and empowered to participate in the digital society.

Caton et al. (2022) recommend increasing the focus on digital literacy fluency by developing digital literacy skills to enhance learners' cognitive flexibility and decrease technological cognitive load while helping learners effectively manage and make sense of complex information and emphasizing the importance of having individuals become informed global and digital citizens who can utilize digital technologies and communicate and participate effectively in society. However, their proposal highlights the dynamic relationships among different literacies, including digital literacy, critical thinking, problem-solving, and social intelligence, which also require thinking and researching how to articulate these multiple literacies' interactions and how they influence each other.

Literacy education

Literacy education teaches individuals how to read, write, and communicate effectively using various forms of representation, including print-based texts, oral communication, visual media, and other symbol systems (Moje & Sutherland, 2003). According to the cited authors, literacy education: 1) involves developing skills in comprehension, critical analysis, and expression to navigate and make meaning of written texts within different discourse communities; 2) aims to prepare young people to participate in and contribute to a just and democratic world by providing them with the tools to engage with diverse forms of literacy and to understand the social and cultural implications of different texts and communication practices; and 3) equips students to navigate the changing world's complexities and become active, informed participants in society by teaching multiple forms of representation and fostering critical literacy skills.

Multiliteracies and holistic perspectives

Multiliteracies explore the future of literacy teaching in a global, diverse world, considering technological change, multilingualism, and social futures (Cope & Kalantzis, 1999). Media literacy education is crucial for 21st-century living, working, and citizenship, preparing students for lifelong learning and adapting to a rapidly changing world (Thoman & Jolls, 2004).

Multiple literacies will be incorporated into the school curriculum to prepare students for the future workplace as a movement that integrates technology and diverse forms of literacy into education

(Conley & Wise, 2011). Street (2013) advocates for the following elements to be part of a holistic perspective of literacies: 1) embracing emergent and multiple literacies, such as those associated with contents all over the Web and the Internet; 2) expanding literacy practices to include digital visual literacy; 3) seeing reading and literacy as social activities; 4) recognizing the importance of social practices in writing instruction; 4) shift toward a more social practice perspective in teaching literacy.

Broderick (2023) stresses that the curriculum must be aligned with a holistic vision of scientific literacy, and this vision must be brought into the classroom practice. The author argues that this will be useful at any educational level, as it should result in developing future citizens who are scientifically literate and thus can engage critically with societal issues and make informed decisions, something that we might argue is urgent nowadays. When discussing information literacy training, Akakpo (2024) integrates *classical* information literacy topics, such as the use of keywords in search engines, with topics more typical of media literacy, such as the verification of the authenticity of online content, and with more recent considerations related to AI, such as the composition of prompts in generative AI, and guidelines for the ethical use of generative AI tools for academic work to aid students in developing skills for the future of work.

Media literacy

Under the logic of expanding the concept of literacy, particularly in the digital age, Daley (2003) emphasizes the need for individuals to be literate in both traditional written language as well as the language of multimedia, such as sound and image, to communicate and comprehend in today's society effectively, thus arriving at an early concept of media literacy. The author discusses the disruptive nature of introducing multimedia writing in academic settings and the lack of recognition of the complexity and skills required in constructing media texts, also highlighting the shift toward public distribution and presentation of media forms, emphasizing the changing nature of authorship and the need for a new interdisciplinary space facilitated by multimedia.

According to Thoman & Jolls (2004), media literacy focuses on critical thinking skills and the ability to analyze and interpret mediated messages, which is essential for education in a changing global culture where media and technology converge, in order for individuals to be able to face the challenges of a multimedia world and their need to be fluent in interpreting the news, images, and sounds. Media literacy education bridges the gap between learning and life, aiming to equip individuals with the skills to navigate the constantly changing world.

The convergence of media and technology will continue to transform how individuals learn, emphasizing: 1) the need for media literacy education from kindergarten to graduate school, ensuring the inclusion of media education in national standards; 2) activities involving media message creation will enhance language and arts skills and to develop teamwork, organization, and an appreciation for diverse talents; 3) engagement with media culture in education will be essential for student success (Thoman & Jolls, 2004). However, these authors also project that media literacy should be present beyond school settings, emphasizing the role of various sectors in educating adults and other groups, as it is a literacy that aims to prepare individuals for success in the 21st-century global economy and culture.

There is a trend toward the expansion of media literacy through its integration into the national curriculum, which will become essential to ensure that citizens are: 1) equipped to navigate a media-rich environment; and 2) they can critically interpret multimedia content to make informed decisions and

contributions in a global economy and culture (Thoman & Jolls, 2004). There could also be some merits for including multimedia expression in education and recognizing its significance in academia: multimedia expression may become a requirement for graduation, akin to writing skills, so it may be integrated into educational curricula to ensure that students are proficient in using various forms of media to communicate effectively and this importance and further recognition of the value of multimedia language might also be projected to research, publication, and teaching (Daley, 2003). Technology and new media are and will continue to be intertwined with literacy. Tsortanidou et al. (2019) project that the development of new media literacy skills will be connected with creativity, computational thinking, and collaboration in the following ways:

- Creativity, computational thinking, and collaboration skills will be integrated with new media literacy even in low-technology educational settings.
- The development of 21st-century essential skills will be conducted through imaginative, sociocultural, and multimodal learning experiences.
- The connections among computational thinking, collaboration, creativity, and new media literacy skills will be further explored and harnessed.
- Understanding the implications of computational thinking beyond traditional computer science and mathematics applications.
- Foster creativity through the use of technology.
- Investigating how new media literacy is developed through prototyping and its impact on computational thinking development.
- Exploring the role of learning styles in predicting student engagement and success in computational thinking.

Other authors discuss new media literacy as one focusing on how individuals engage with media (Scholari, 2019). Specifically, one of the stronger approaches to media literacy relates to this era of post-truth and fake news. For instance, Manabat (2021) stresses that media literacy: 1) highlights the importance of being critical and analytical about information encountered online, especially with the prevalence of fake news and misinformation affecting decision-making; 2) prepares individuals to search, critically evaluate, use, and contribute information and media content, while counteracting hate speech and cyberbullying, understand ethical issues, and promote equality and freedom of expression; and 3) equips students with critical thinking skills to evaluate information online and use it responsibly.

For their part, Kanozia et al. (2022) also stress that media literacy skills are crucial to combat misinformation and fake news. However, it must also incorporate technological literacy to adapt to the changing media landscape and focus on governmental regulations to address the spread of misinformation. Referring to the development of future media literacy trainers, Haidur et al. (2022) recommend: 1) emphasizing the development of media literacy's applied social and communicative aspects, integrating theoretical and practical aspects; 2) preparing students for utilizing media literacy in their future work and everyday life; 3) identifying ways to improve media literacy training through unique learning environments, project activities, and student interactions; 4) incorporating the accessibility and use of media, understanding and criticism, and communication and creative production, while also promoting responsibility and ethics; 5) adapting to the continuous flow of information from various sources to interpret different forms and codes of information effectively.

Bulger et al. (2023) suggest some interesting interactions with students when teaching media literacy, including the following:

- Treating students as experts of their own experiences in media literacy education, recognizing the unique perspectives and insights students bring when engaging with media.
- Promote an increased responsibility for platform accountability in media literacy, highlighting the need for platforms like Google and YouTube to take more active roles in promoting media literacy and addressing misinformation and disinformation.
- Incorporate visual literacy into media education, including discussions on deliberate choices of GIFs and emojis as part of the evolving nature of media formats and the need for educators to adapt their approaches to encompass new forms of visual communication.
- Focus on active listening and critical thinking skills in response to challenges such as polarization, misinformation, and the spread of falsehoods by equipping individuals with the tools to navigate complex media landscapes and engage thoughtfully with information.

Futures literacy

Our thinking of the future, its anticipation, prediction, and forecasting, is influenced by our literacy capacity, with digital literacy and artificial intelligence (AI) potentially impacting our future predictions (Morais & Kolinsky, 2021). The cited authors argue that futures literacy emerges from the intricate relationship between literacy and future-oriented concepts such as anticipation, prediction, and forecasting. Working under this framework implies exploring the cognitive processes involved in thinking about the future and how literacy influences these processes and researchers highlight the transformative power of writing and literacy on cognitive abilities and human societies, which has occurred throughout history and has enabled the development of reasoning and logical thinking.

According to Mangnus et al. (2021), futures literacy requires: 1) reflexivity regarding diverse attitudes toward the future; 2) considering both the underlying power structures and the implications of these approaches for future-oriented action; 3) being aware of different attitudes toward the future; 4) being reflexive about one's attitudes; 5) understanding different epistemological and ontological points of departure in future's work and measuring outcomes to ensure anticipatory practices are fit-for-purpose; and 6) considering the potential contributions of these and other attitudes.

Futures literacy can help balance 'push' education with 'pull' learning, enabling individuals and institutions to embrace complexity and pursue resilience strategies. Moreover, through practical strategies for becoming futures literate, individuals can learn to live with complexity and leverage anticipation to make informed decisions and initiate learning processes. Additionally, there are some limitations of the traditional approaches that are focused on causality and scale, underlining the importance of specificity, novelty, and spontaneity in engaging with the future, but in any case, futures literacy has a transformative potential for redefining humanity's relationship to reality and fostering continuous learning and innovation (Miller, 2015).

A constructivist view of the future focuses on co-creating new futures through collective experimentation, engagement, and imagination. This suggests a move toward more participatory and inclusive approaches in shaping future outcomes (Mangnus et al., 2021). Futures literacy may develop to navigate complexity, change, and uncertainty in the future, focusing on building anticipatory skills and knowledge-creation processes to adapt to evolving circumstances (Miller, 2015).

Horst & Gladwin (2022) highlight the potential integration of futures literacies across disciplines (e.g., math, science, history, and art to explore possibilities and envision future scenarios), while also: 1) reexamining subjectivity; 2) exploring the idea of a more-than-human configuration of the human subject in literacy research; 3) critically evaluate the technologies we incorporate into our lives, the stories we consume, and the images we hold of the future, to anticipate positive and negative impacts and actively shape the future; and 4) aim the development of futures literacies at democratizing futures, challenging normative (or hegemonic) narratives, and increasing people's agency and empowerment in envisioning and shaping the future.

Algorithmic literacy and artificial intelligence implications

Tiernan et al. (2023) project the options for the future of information and media literacy considering the implications of AI by stating that: 1) digital literacy frameworks should be adapted to be more agile and responsive to technological and philosophical developments related to information and media, as these frameworks have been slow to respond to the potential implications of AI, lacking consistency in addressing its impact on information and media literacy; 2) we should incorporate more voices and representation into such frameworks; and 3) there needs to be a move toward a learner and teacher-sourced approach to digital competencies, encouraging collaboration between educators, students, and the use of AI in education.

The implications of AI for literacy are significant, as AI is transforming how individuals access, search for, evaluate, and create information and media content. According to Tiernan et al. (2023), AI's impact on literacy includes changing the nature of information itself, due to AI-generated content, and presenting challenges such as explainability within AI systems. According to the authors cited, the issue of explainability in AI systems, where decisions are based on complex algorithms rather than straightforward rules, can impact users' ability to understand and evaluate information.

AI can indeed affect information processes because it has the potential to challenge traditional literacy skills, as it introduces new complexities in how information is accessed, evaluated, and understood. Additionally, AI-generated content can lead to misinformation and bias, requiring individuals to know how AI can skew information and misrepresent reality. It then is essential for literacy skills to evolve in response to the challenges posed by AI to promote information and media literacy.

Spurava & Kotilainen (2023) explore the role of digital literacy in advancing professional growth within an algorithmically governed landscape. They highlight several key points: 1) the increasing demand for individuals to critically engage with advanced technologies like AI, as underscored by the DigiComp framework from the European Commission; 2) the necessity for employees to remain agile and continually update their digital competencies amidst rapid technological and social changes; 3) the importance of critically assessing information for effective decision-making, which requires a deep understanding of the mechanics and business strategies behind algorithm-based digital platforms; and 4) the imperative to integrate digital and media literacy with platform studies, aiming to enhance workers' critical consciousness in an environment increasingly shaped by algorithmic operations.

Moylan & Code (2023) argue that algorithm literacy must be integrated into teacher education programs to prepare educators for navigating algorithm-driven educational environments and recognizing the role of algorithms in various digital systems that teachers work with. Such integration will also require: 1) emphasizing critical evaluation and coping behaviors; 2) having an awareness of algorithmic bias, as

well as the discrimination and inequities that algorithms might reproduce; and 3) expanding the conceptualizations of algorithm literacy. Ng et al. (2021) add some considerations of inclusion and social participation to AI literacy by claiming that it should focus on:

- Teaching the underlying AI concepts for students' future career development and the ethical concerns of AI applications for them to become responsible citizens.
- Broadening participation in AI education to address the under-representation of minority groups.
- Designing inclusive learning activities and fostering AI literacy in K-12 education.
- Prioritizing fairness, accountability, transparency, and ethical issues in teaching AI literacy.
- Implementing AI literacy teaching with human-centered considerations to build a future inclusive society.

Other literacies

According to Setiawan et al. (2020), financial literacy can be defined as the knowledge and understanding of various financial concepts and terms and the ability to manage personal finances effectively, make informed financial decisions, and navigate financial systems and products. It includes having the skills to budget, save, invest, and manage debt responsibly. Financial literacy also encompasses the awareness of financial risks, the importance of financial planning, and the ability to accurately assess one's financial situation. It has been found that digital financial literacy can positively affect current saving and spending behavior, leading to better future savings, and spending foresight (Setiawan et al., 2020). So, its potential and importance are clear.

Morais & Kolinsky (2021) discuss the impact of written language literacy on cognitive capacities and call for the renewal of science's connection with society, culture, and politics. Ultimately, the authors argue that literacy is crucial in shaping human cognition and capabilities, influencing how we perceive and interact with the world around us.

Sekhar & Raina (2021) look toward a more sustainable future through the concept of sustainability literacy. As they see it, its importance lies in shaping future managers and leaders toward environmental sustainability. However, this requires global initiatives to inform and educate students across various disciplines about sustainable development so that individuals possess knowledge, skills, and values to live and work sustainably and create a more sustainable future. Scholari (2019) underscores the rising significance of multiple literacy forms for the future:

- Transmedia Literacy: because it emphasizes the active involvement of individuals in a media-saturated world where creating content, participating, and forming social groups are common. It aims to cultivate critical *prosumers* (producers and consumers) adept at navigating and contributing to interactive and transmedia environments.
- Multimodal Literacy: crucial for engaging with and creating multimedia and digital content, this literacy type spans oral, gestural, and written communication, as well as the design and production of multimedia materials.
- Metaliteracy: focused on the realms of social media, online communities, and open educational resources, metaliteracy champions the innovative creation and communal sharing of information, leveraging the power of social networks.

- Transliteracy: it advocates for a versatile command over multimedia skills, integrating reading, writing, and numerical analysis through diverse tools and across various platforms.

Regarding academic literacy, Ramos Meza (2021) states that it will seek to explore new approaches to integrating information and academic literacy into curriculum design, evaluating inclusive practice interventions to address student diversity in academic literacy, emphasizing sociocritical literacy development and the impact of the third space in academic contexts of different educational settings.

Raffaghelli & Stewart (2020) discuss data literacy in education, by emphasizing: 1) the need for a complex and critical approach to data literacy in higher education, moving away from technical and instrumental models toward a more holistic understanding of data literacy; 2) integrating critical, ethical, and personal approaches to datafication in education, as educators' data literacy currently focus on management and technical abilities, with a lack of emphasis on critical, ethical, and personal aspects of datafication in education; and 3) exploring the interwoven socio-technical nature of data literacy, by recognizing the socio-technical nature of developing educators' data literacy, moving toward a complex understanding that considers professional cultures, institutional cultures, and individual learning needs.

Health literacy has been increasingly emphasized at both individual and systemic levels to overcome barriers and ensure the development of a more informed and responsive population regarding health issues and information. Okan et al. (2023) highlight that health literacy must empower citizens to engage in collective actions against health misinformation and disinformation, while pointing out the importance of health literacy as a fundamental part of health crisis responses, with a focus on distributing relevant, timely, and valid life-saving information to citizens, and stating that it must be integrated into policymaking. Moreover, McCaffery et al. (2023) suggest the following for health literacy:

- Integrating health literacy principles in public health communication, including writing texts at appropriate reading levels, reducing jargon, using images, and limiting information overload.
- Ensuring the availability of high-quality translated materials in multiple languages, using multimedia formats, and focusing on navigation and information architecture to enhance access and understanding among diverse populations.
- Addressing socio-economic patterns in lower health literacy by targeting interventions toward individuals with social and economic disadvantages such as lower education, income, and language fluency.
- Building health literacy responsiveness at the micro, meso, and macro levels by investing in health-literate workforces, organizations, technologies and innovations, among other targets.

Nita et al. (2023) discuss the concept of quantum literacy, which is proposed as a means to improve knowledge and understanding in the field of quantum computation to bridge gaps in education and problem-solving by making complex quantum concepts more accessible to a broader audience. They highlight the following issues related to quantum literacy:

- Transdisciplinary learning: quantum literacy is positioned in social realist debates in the epistemology of knowledge, emphasizing the importance of interdisciplinary collaboration in addressing complex global sustainability issues.

- Educational critique and access to powerful knowledge: dealing with the challenges of widening access to specialized knowledge and the importance of quantum literacy in providing access to powerful knowledge that can benefit societal well-being.
- Pedagogical innovations: visualization tools such as puzzle visualization learning tools, are methods that can enhance pedagogy and facilitate a deeper understanding of quantum mechanics for non-specialists.

Morris & Yeoman (2023) advocate for integrating news literacy education in the curriculum, as there is a growing recognition of its importance. They suggest: 1) introducing it at the school level as a citizen skill and making it available to all students before they reach higher education courses; 2) diversifying news literacy education initiatives to provide such education in various formats and reaching a wider audience of students; 3) evolve news literacy definitions, shifting toward empowering citizens to question journalistic norms and understand different perspectives.

Montero (2020) reviews the importance of teaching and developing transcultural literacies through the emphasis on soft skills, such as communication, leadership, collaboration, empathy, problem-solving, critical thinking, and creativity in response to the fourth industrial revolution and for developing a global awareness and social consciousness, highlighting themes like linguistic diversity, self-awareness, resilience, and learner empowerment. This proposal is based on integrating transcultural learning to address social, psychological, and physical barriers rooted in ignorance, fear, and hate. It would also involve focusing on students' voices, meaningful relationships, reflexivity within mainstream classrooms, and a focus on decolonizing education for inclusivity by integrating Indigenous and minority literature, engaging in dialogic teaching, and redefining traditional notions of literacy.

Conclusion

This exploration into the future of literacy reveals an urgent need to adapt and evolve our understanding and practices of literacy education. As we stand at the crossroads of technological innovation, digital proliferation, increasingly complex social interactions, and the age of AI and algorithms, the conventional paradigms of literacy, grounded in reading and writing, extend into multifaceted domains encompassing digital, media, information, among other literacies. A common trend was also found in the interest of providing training for the acquisition of skills while emphasizing critical engagement, social participation, and the ability to navigate and contribute to a rapidly changing world.

The future of literacy education hinges on an integrative approach encompassing these diverse literacies, ensuring individuals are equipped with the tools for personal and academic success and the competencies necessary for becoming active and informed citizens. It calls for educational strategies that are adaptive, inclusive, and forward-looking, recognizing the importance of literacy in shaping thoughtful, resilient, and innovative individuals capable of addressing contemporary challenges.

This revision also highlighted the imperative for ongoing collaboration between educators, librarians, policymakers, and communities to foster environments that support continuous learning and the development of critical literacies. As we look toward the future, it becomes clear that literacy, in its broadest sense, is a foundational pillar for a more informed, equitable, and sustainable world. By fostering a culture of critical engagement, creativity, and adaptability, we prepare individuals to face and shape the future. The path forward is one of collective effort, dialogue, and innovation, ensuring literacy remains a vibrant, transformative force in an ever-changing global landscape.

References

Aguilera, E., & Pandya, J. Z. (2021). Critical literacies in a digital age: Current and future issues. *Pedagogies*, *16*(2), 103–110. https://doi.org/10.1080/1554480X.2021.1914059

Akakpo, M. G. (2024). Skilled for the future: Information literacy for AI use by university students in Africa and the role of librarians. *Internet Reference Services Quarterly*, *28*(1), 19–26. https://doi.org/10.1080/10875301.2023.2280566

Broderick, N. (2023). Exploring different visions of scientific literacy in Irish primary science education: Core issues and future directions. *Irish Educational Studies*. https://doi.org/10.1080/03323315.2023.2230191

Bulger, M., Baleria, G., Hobbs, R., & Moffitt, K. R. (2023). The promise of media literacy education when "everything is at stake" and "everything is expected." *Journal of Media Literacy Education*, *15*(1), 99–108. https://doi.org/10.23860/JMLE-2023-15-1-8

Caton, A., Bradshaw-Ward, D., Kinshuk, & Savenye, W. (2022). Future directions for digital literacy fluency using cognitive flexibility research: A review of selected digital literacy paradigms and theoretical frameworks. *Journal of Learning for Development*, *9*(3), 381–393. https://doi.org/10.56059/jl4d.v9i3.818

Conley, M. W., & Wise, A. (2011). Comprehension for what? Preparing students for their meaningful future. *Theory into Practice, 50*(2), 93-99. https://doi.org/10.1080/00405841.2011.558411

Cope, B., &, Kalantzis, M. (1999). *Multiliteracies: Literacy learning and the design of social futures*. Routledge. https://doi.org/10.4324/9780203979402

Daley, E. (March/April 2003). Expanding the concept of literacy. *Educause Review*. https://er.educause.edu/articles/2003/3/expanding-the-concept-of-literacy

Elmborg, J. (2017). Lessons from forty years as a literacy educator: An information literacy narrative. *Journal of Information Literacy*, *11*(1), 54–67. https://doi.org/10.11645/11.1.2190

Haidur, N., Kornieiev, V., Pohrebniak, I., Yatsenko, A., Horska, K., & Kryvka, E. (2022). Applied social and communication aspects of the media literacy development in future specialists. *Journal of Curriculum and Teaching*, *11*(1), 174–184. https://doi.org/10.5430/jct.v11n1p174

Hannah, M. N. (2023). Information literacy in the age of internet conspiracism. *Journal of Information Literacy*, *17*(1), 204–220. https://doi.org/10.11645/17.1.3277

Hardy, A., & McKenzie, C. (2020). Meeting students where they are: Just in time embedded delivery of information and digital literacy skills. *International Information and Library Review*, *52*(1), 64–72. https://doi.org/10.1080/10572317.2019.1710672

Horst, R., & Gladwin, D. (2022). Multiple futures literacies: An interdisciplinary review. *Journal of Curriculum and Pedagogy, 21*(1), 42–64. https://doi.org/10.1080/15505170.2022.2094510

Kanozia, R., Dheera, C. S., & Arya, R. (2022). Critical media and information literacy to combat misinformation: Research gaps and future directions. *Journal of Content, Community and Communication*, *16*(8), 181–201. https://doi.org/10.31620/JCCC.12.22/15

Knaus, T. (2020). Technology criticism and data literacy: The case for an augmented understanding of media literacy. *Journal of Media Literacy Education*, *12*(3), 6–16. https://doi.org/10.23860/JMLE-2020-12-3-2

Kovářová, P. (2018). Information Literacy of Masaryk University students and evaluation of campus-wide course. *Communications in Computer and Information Science, 989*, 399-408. https://doi.org/10.1007/978-3-030-13472-3_38

Kress, G. (2003). *Literacy in the new media age*. Routledge.

Kutlu-Abu, N., & Arslan, R. (2023). Evolving trend of media literacy research: A bibliometric analysis. *Journal of Media Literacy Education*, *15*(1), 85–98. https://doi.org/10.23860/JMLE-2023-15-1-7

Kuttkat, F., Mandl, T., & Dreisiebner, S. (2022). Student perception of online information literacy training through a massive open online course. *Communications in Computer and Information Science, 1533*, 427-438. https://doi.org/10.1007/978-3-030-99885-1_36

Lebid, A. E., Degtyarev, S. I., & Polyakova, L. G. (2020). A study into the skills of using data verification tools as a media information literacy instrument for university students. *International Journal of Media and Information Literacy*, *5*(2), 184–190. https://doi.org/10.13187/IJMIL.2020.2.184

Lindberg Y and Öberg L-M (2023) The future scribe: Learning to write the world. *Frontiers in Education, 8*, 993268. https://doi.org/10.3389/feduc.2023.993268

Manabat, A. R. (2021). Bringing MIL into the margins: Introducing media and information literacy at the outskirts. *International Journal of Media and Information Literacy*, *6*(1), 156–165. https://doi.org/10.13187/IJMIL.2021.1.156

Mangnus, A. C., Oomen, J., Vervoort, J. M., & Hajer, M. A. (2021). Futures literacy and the diversity of the future. *Futures, 132*, 102793. https://doi.org/10.1016/J.FUTURES.2021.102793

Marcella, R., & Chowdhury, G. (2020). Eradicating information poverty: An agenda for research. *Journal of Librarianship and Information Science*, *52*(2), 366–381. https://doi.org/10.1177/0961000618804589

McCaffery, K. J., Ayre, J., Dodd, R., Pickles, K., Copp, T., Muscat, D. M., Nickel, B., Cvejic, E., Zhang, M., Mac, O., Isautier, J., Cornell, S., Wolf, M. S., & Bonner, C. (2023). Disparities in public understanding, attitudes, and intentions during the COVID-19 pandemic: The role of health literacy. *Information Services and Use*, *43*(2), 101–113. https://doi.org/10.3233/ISU-230185

Miller, R. (2015). Learning, the future, and complexity: An essay on the emergence of futures literacy. *European Journal of Education, 50*, 513-523. https://doi.org/10.1111/EJED.12157

Moje, E. B., & Sutherland, L. A. M. (2003). The future of middle school literacy education. *English Education in Middle Grades, 35*(2), 149-164. https://www.jstor.org/stable/40173139

Montero, M. K. (2020). Preparing the future: A review of transcultural literacies: Re-visioning relationships in teaching and learning. *Journal of Adolescent and Adult Literacy*, *63*(6), 724–727. https://doi.org/10.1002/jaal.1053

Morais, J., & Kolinsky, R. (2021). Seeing thought in the future: Literate forecasting and forecasting literacy. *Journal of Cultural Cognitive Science, 5*, 229-265. https://doi.org/10.1007/s41809-021-00085-6

Morris, K., & Yeoman, F. (2023). Teaching future journalists the news: The role of journalism educators in the news literacy movement. *Journalism Practice*, *17*(7), 1573–1590. https://doi.org/10.1080/17512786.2021.1992599

Moylan, R., & Code, J. (2023). Algorithmic futures: An analysis of teacher professional digital competence frameworks through an algorithm literacy lens. *Teachers and Teaching: Theory and Practice*. https://doi.org/10.1080/13540602.2023.2263732

Ng, D. T. K., Leung, J. K. L., Chu, K. W. S., & Qiao, M. S. (2021). AI Literacy: Definition, Teaching, Evaluation and Ethical Issues. *Proceedings of the Association for Information Science and Technology*, *58*(1), 504–509. https://doi.org/10.1002/pra2.487

Nita, L., Mazzoli Smith, L., Chancellor, N., & Cramman, H. (2023). The challenge and opportunities of quantum literacy for future education and transdisciplinary problem-solving. *Research in Science and Technological Education*, *41*(2), 564–580. https://doi.org/10.1080/02635143.2021.1920905

Okan, O., Messer, M., Levin-Zamir, D., Dadaczynski, K., Paakkari, L., Schaeffer, D., & Sorensen, K. (2023). Health literacy action framework for health emergencies and infodemics. *Information Services and Use*, *43*(2), 115–130. https://doi.org/10.3233/ISU-230193

Olson, D., Bates, S. L., Yarbrough, S., Westall, S., Carroll Denis, M. K., & Barnett, M. (2023). Information literacy curriculum mapping in the health sciences: A scoping review. *Journal of Information Literacy*, *17*(1), 65–88. https://doi.org/10.11645/17.1.3319

Rachman, M. A. (2019). Assessing library science programme students' method in countering hoax on social media. *Library Philosophy and Practice*, *2019*. https://digitalcommons.unl.edu/libphilprac/2888/

Raffaghelli, J. E., & Stewart, B. (2020). Centering complexity in 'educators' data literacy' to support future practices in faculty development: A systematic review of the literature. *Teaching in Higher Education*, *25*(4), 435–455. https://doi.org/10.1080/13562517.2019.1696301

Ramos Meza, C. S. (2021). Análisis bibliométrico de la alfabetización académica: una revisión del estado del arte, del pasado al futuro. *Revista de Educación, 394*, 67-99. https://doi.org/10.4438/1988-592X-RE-2021-394-501

Rath, L. (2020). Transforming understanding of information literacy: Sustainable futures through information landscapes. *Proceedings of the Association for Information Science and Technology*, *57*(1), e420. https://doi.org/10.1002/pra2.420

Santos, R., Azevedo, J., & Pedro, L. (2013). Digital divide in higher education students' digital literacy. *Communications in Computer and Information Science, 397*, 178–183. https://doi.org/10.1007/978-3-319-03919-0_22

Scolari, C. A. (2019). Beyond the myth of the "digital native": Adolescents, collaborative cultures and transmedia skills. *Nordic Journal of Digital Literacy*, *14*, 164–174. https://doi.org/10.18261/ISSN.1891-943X-2019-03-04-06

Sekhar, C., & Raina, R. (2021). Towards more sustainable future: Assessment of sustainability literacy among the future managers in India. *Environment, Development and Sustainability*, *23*(11), 15830–15856. https://doi.org/10.1007/s10668-021-01316-0

Setiawan, M., Effendi, N., Santoso, T., Dewi, V. I., & Sapulette, M. S. (2022) Digital financial literacy, current behavior of saving and spending and its future foresight, *Economics of Innovation and New Technology, 31*(4), 320-338. https://doi.org/10.1080/10438599.2020.1799142

Shenton, A. (2023). Information literacy: Did Alvin Toffler beat Paul Zurkowski to it? *Journal of Information Literacy*, *17*(2), 150–156. https://doi.org/10.11645/17.2.10

Šobota, D. (2023). Critical workplace information literacy: Laying the groundwork for a new construct. *Journal of Information Literacy*, *17*(1), 138–161. https://doi.org/10.11645/17.1.3353

Spurava, G., & Kotilainen, S. (2023). Digital literacy as a pathway to professional development in the algorithm-driven world. *Nordic Journal of Digital Literacy*, *18*(1), 48–59. https://doi.org/10.18261/NJDL.18.1.5

Stebbing, D., Shelley, J., Warnes, M., & McMaster, C. (2019). What academics really think about information literacy. *Journal of Information Literacy*, *13*(1), 21–44. https://doi.org/10.11645/13.1.2338

Street, B. (2013). Literacy in theory and practice: Challenges and debates over 50 years. *Theory Into Practice, 52*(sup1), 52–62. https://doi.org/10.1080/00405841.2013.795442

Thoman, E., & Jolls, T. (2004). Media literacy: A national priority for a changing world. *American Behavioral Scientist, 48*(1), 18-29. https://doi.org/10.1177/0002764204267246

Tiernan, P., Costello, E., Donlon, E., Parysz, M., & Scriney, M. (2023). Information and media literacy in the age of AI: Options for the future. *Education Sciences*, *13*(9), 906. https://doi.org/10.3390/educsci13090906

Todd, R. J. (2017). Information literacy: Agendas for a sustainable future. *Journal of Information Literacy*, *11*(1), 120–136. https://doi.org/10.11645/11.1.2233

Tsortanidou, X., Daradoumis, T., & Barberá, E. (2019). Connecting moments of creativity, computational thinking, collaboration and new media literacy skills. *Information and Learning Science*, *120*(11–12), 704–722. https://doi.org/10.1108/ILS-05-2019-0042

Vrana, R. (2014). Digital literacy as a prerequisite for achieving good academic performance. *Communications in Computer and Information Science, 492*, 160–169. https://doi.org/10.1007/978-3-319-14136-7_17

Vrana, R. (2016). Digital literacy as a boost factor in employability of students. *Communications in Computer and Information Science, 676*, 169-178. https://doi.org/10.1007/978-3-319-52162-6_17

Walton, G. (2017). Information literacy is a subversive activity: Developing a research-based theory of information discernment. *Journal of Information Literacy*, *11*(1), 137–155. https://doi.org/10.11645/11.1.2188

Živković, D., Horvat, A., & Čučić, V. (2013). Digital rights for digitally literate citizens. *Communications in Computer and Information Science, 397*, 170-177. https://doi.org/10.1007/978-3-319-03919-0_21

Zorica, M. B., Spiranec, S., & Biskupic, I. O. (2014). What is the employers stand on information literacy – researching employers on expected generic outcomes of their future employees. *Communications*

in Computer and Information Science, *492*, 673–682. https://doi.org/10.1007/978-3-319-14136-7_70

See also

20032. Literacies

30039. Information literacy for lifelong learning

30044. History of Information Literacy

30045. Information literacy, libraries, librarianship and information services

40035. Library Collaboration and Academia

60031. Information Literacy

60033. Digital literacy