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Developing a digital platform literacy framework

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Developing a digital platform literacy framework

Abstract

This article introduces the innovative concept of platform literacy, specifically within the context of digital platforms. In today's digital economy, where digital platforms serve as essential tools in people's lives and form the core of the digital ecosystem, the ability to effectively utilize these platforms becomes crucial. This study systematically examines existing literature on digital platforms and digital literacy to establish a conceptual foundation for assessing an individual's platform literacy. Drawing upon insights from the digital literacy framework, we propose a platform literacy framework that can be applied in practical settings. Methodologically, we conducted an extensive review of 735 research papers on digital literacy to gather definitions and frameworks. As a result, we identified seven core constructs and three main proficiencies that constitute the platform literacy framework. Moreover, to adapt the framework to the various digital platform context, we categorized it into fixed attributes and variable attributes. This article contributes to the growing body of knowledge on digital literacy by offering a comprehensive framework for understanding platform literacy within the digital platform landscape.

Keywords: platform literacy, digital literacy, digital platform, digital platform literacy framework

1. Introduction

Digital platform facilitates any form of interaction including communications and transactions, turning to be an essential infrastructure in a digital ecosystem. It is described as the operating system of our lives, emphasizing how deeply it is embedded in our society (Vaidhyathan, 2022). As a result, how to use platform is a vital competence for every entity including government, corporation, and individual. For individual, being illiterate of platform results in the critical isolation. For corporation, it is connected to the loss of competitive power. The capability to utilize platforms highlights the growing value of platform literacy.

However, despite its importance, the concept of platform literacy is absent in academia. Few studies have explored the literacy targeting the platform context. Though there are relevant concepts such as digital literacy, they do not perfectly fit to evolving platform ecosystem. The absence of concrete definition hampers the further development in

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its scientific research (Gong & Ribiere, 2021; Moore et al., 2017). The importance of conceptual clarity as well as the need to explore from different architectural levels has been emphasized by Reuver et al (De Reuver et al., 2018). Without correctly identifying the literacy in platform usage, further scientific operationalization to measure and evaluate the current level of literacy on platform is difficult.

Therefore, the objective of digital platform is to provide a platform literacy framework to help understand the concept and to promote the actual application in the digital platform context. Clarifying the concept and constructs through framework will be the basis for the universal use of platform for consumers and the expanded user base for platform providers. Developing a comprehensive framework requires the understanding of both platform and literacy. At first hand, it explored the core constructs of digital platform and literacies focusing on four main terms. Then, these core constructs/attributes of digital literacies will be adapted into the research to propose the platform literacy framework.

2. Literature review.

2.1 Digital platform

Digital platforms have become deeply ingrained in our society, increasing the need to explore the literacy from platform context. Digital platforms alter how we consume and provide products and services by facilitating transaction among various actors (Hein et al., 2020; Stallkamp & Schotter, 2021). Acting as technical infrastructures, platforms play a central role in the digital economy (Gawer, 2021; Hein et al., 2020; Stallkamp & Schotter, 2021, 2021). Examples of digital platforms include search engines (such as Google and Yahoo), social media platform (like Facebook and Twitter), e-commerce platform (such as Amazon), messenger platform (like Whatsapp), and ride hailing services (such as Uber and Gojek).

Therefore, this section aims to establish a comprehensive conceptual understanding of digital platforms by examining previous definitions and relevant literature. The growing significance of digital platforms in various domains has generated considerable scholarly interest (Gawer, 2021; Ha et al., 2023). Previous definitions, therefore, provide valuable insights on its theoretical and conceptual understanding. For instance, van Dijck et al. (2018) define digital platforms as "a programmable digital architecture designed to organize interactions between users" (van Dijck et al., 2018, p. 1). Furthermore, previous literature on digital platforms offers guidance in identifying the essential attributes. By synthesizing insights from definitions and past research, a theoretical and conceptual understanding of the

core attributes of digital platforms can be achieved. Thus, to grasp the conceptual core of digital platforms, this study conducts a review of previous definitions and relevant articles. It will utilize 119 definitions of digital platforms collected from Ha et al. (2023) as a foundation.

RQ 1. What are the core attributes of current digital platforms?

2.2. Digital literacies

The concept of literacy, originally defined as the ability to read and write, has evolved alongside technological advancement, resulting in a proliferation of related concepts in the literature (Njenga, 2018; Reddy et al., 2022; Rinekso et al., 2021; Yuan et al., 2019). Digital literacy, in particular, has been extensively studied but remains in a state of continuous flux. Despite the abundance of previous literature encompassing both conceptual and empirical research, fundamental challenges remain. The lack of standardized definition of digital literacy poses a primary concern. The current concept of digital literacy has faced criticism for being vague, poorly defined, and prone to misinterpretation (Canchola-González & Glasserman Morales, 2020; Feerrar, 2019; Machin-Mastromatteo, 2012). It has not clearly defined within the current ICT environment (Nichols & Stornaiuolo, 2019). Additionally, a wide variety of synonyms and related concepts exist, including technology literacy, computer literacy, IT literacy, ICT literacy, e-literacy, media literacy, academic literacy, information literacy, health literacy, financial literacy, critical literacy, cultural literacy, communications literacy, and visual literacy. This complexity and ambiguity hinder precise measurement and operationalization, thereby impeding scientific research (Gong & Ribiere, 2021; Moore et al., 2017) and potentially leading to misunderstandings among the practitioners (Feerrar, 2019). Furthermore, digital literacy is characterized by its evolving nature, closely tied to technological advancements. Nichols and Stornaiuolo (2019) stress the importance of considering "the networked Internet of Things, embedded geolocational devices, human-technology interfaces and wearable tech, virtual and augmented reality overlays, new forms of collaborative text production, and personalized data-tracking and analytics" when defining digital literacies (Nichols & Stornaiuolo, 2019, p. 21). Notably, despite platforms being the primary drivers of the contemporary ICT environment, there is currently no specialized literacy targeting the platform ecosystem.

This study focuses specifically on digital literacy, ICT literacy, information literacy, and media literacy within the context of digital platforms. Previous systematic literature

reviews have also incorporated multiple terminologies. Bawden (2001) provided a comprehensive overview of information literacy and digital literacy while Park et al (2021) examining all-digital and related fields (Bawden, 2001; Park et al., 2021). Ferrar (2019) emphasized the connection between digital literacy and information, media, computer or technology literacy (Feerrar, 2019).

In the ICT and media sectors, the core literacies discussed are digital, ICT, information, and media literacy. Bawden (2001) suggested that the six most common terms synonymous with information literacy are computer literacy, library literacy, media literacy, network literacy, and digital literacy (Bawden, 2001). Similarly, Park et al. (2021) selected digital literacy, ICT literacy, information literacy, and media literacy as the subjects of their scientometric study, while Nichols and Stornaiuolo examined the genealogy of digital literacies through information literacy, media literacy, computer literacy, and digital literacy (Nichols & Stornaiuolo, 2019; Park et al., 2021).

These four literacies are particularly relevant in the digital platform environment. According to Ha et al (2021), out of the 146 papers that define the platform, 23 types of platforms have been categorized into eight: digital platform, online/internet platform, multi-sided platform, business platform, e-commerce platform, open platform, platform economy & ecosystem, and platformization (Ha et al., 2023). All these eight types of platforms can be encompassed by digital, media, ICT, and information literacy. However, computer literacy has been excluded from the scope of this study as it has been extensively examined during the late 20th century when computers played a primary role in the digital network (Nichols & Stornaiuolo, 2019).

In this study, the plural form, “digital literacies,” is utilized to encompass the four terms. The use of the plural form in previous literature reflects the concept’s multiplicity and diversity (Alexander et al., 2017; Nichols & Stornaiuolo, 2019; Spante et al., 2018). For instance, Nichols and Stornaiuolo (2019) argue that the plural form signifies the second wave of digital literacy, incorporating a wider range of digital activities (Nichols & Stornaiuolo, 2019). Additionally, the plural form has been used as an umbrella term to cover diverse literacies (Ferrari, 2012). For example, Yuan et al (2019) discuss how the plural form of digital literacy “encompasses overlapping elements of ICT literacy, information literacy, media literacy and visual literacy” (Yuan et al., 2019, p. 130). Machin-Mastromatteo (2012) uses the plural form to group the ‘information literacy,’ ‘digital literacy,’ and ‘new literacy’ (Machin-Mastromatteo, 2012). Although digital competence has been used interchangeably with digital literacy, this study adopts digital literacies as the primary term.

Therefore, this study adopts a multifaceted approach to ensure the robustness and applicability of the platform literacy framework by building upon existing theoretical foundations. It incorporates not only a conceptual understanding from previously discussed definitions but also frameworks to select operational constructs. Drawing insights from definitions and frameworks of digital, media, ICT, and information literacy, this study will propose a comprehensive digital literacy framework that incorporates the identified core attributes. This approach ensures a concrete conceptual understanding and provides a solid foundation for the platform literacy framework.

RQ2. What are the core attributes of current digital literacies' concepts (digital literacy, media literacy, ICT literacy, and information literacy)?

2.3 Platform literacy

This study argues that digital platforms are the primary driver in the current ICT environment and highlights the need for platform-specific literacy. While digital platforms can be defined as "open, participative intermediaries for interactions and exchanges that create value for all participants" (Ha et al., 2023, p.15), digital literacy refers to the utilization and application of the Internet, social networks, web 2.0, and the management of digital risks (Gutiérrez-Ángel et al., 2022, p. 6). By establishing robust connections between these identified conceptual and operational constructs from previous research, this study proposes a concrete framework for platform literacy.

To develop an operational framework for platform literacy, this research adapts and integrates relevant elements identified in previous research. Building upon a comprehensive digital literacy framework as a foundation in RQ 2, specific dimensions will be tailored to the digital platform context. This approach ensures that the framework encompasses a practical understanding of platform literacy while drawing upon the wealth of knowledge and insights from related literacies.

However, encompassing the entire digital platform within a single framework poses challenges. As emphasized by De Reuver et al. (2018), digital platforms are characterized by their distributed nature and interconnectedness with institutions and relevant ecosystems (De Reuver et al., 2018, p. 124). Furthermore, many definitions of digital literacy remain at the conceptual level without practical operationalization. Hence, this study proposes a specialized framework for the digital platform as a potential example of how this framework could be adapted. Consequently, this research contributes to the advancement of platform literacy by

providing a comprehensive and adaptable framework that addresses the complexities of digital platforms in contemporary contexts.

RQ3. What is platform literacy?

2.4 Previous systematic literature review (SLR) on digital literacies

Several attempts have been made to organize the concept of digital literacy and related terms (Park et al., 2021; Peng & Yu, 2022; Wang et al., 2019a). These literature reviews primarily focus on the period from 2020 to 2022, indicating recent efforts to organize these concepts. Specifically, researchers have provided overviews of digital literacy in academia, with a focus on the educational sector (Audrin & Audrin, 2022; Peng & Yu, 2022). Gutiérrez-Ángel et al. conducted a systematic review of digital literacy in higher education (Gutiérrez-Ángel et al., 2022) while Pangrazio et al. identified definitions of digital literacy from three different contexts: Australia, Sweden, and Argentina, exploring how it is conceptualized and addressed as an educational initiative (Pangrazio et al., 2020). Spante et al (2018) conducted a systematic review of digital competence and digital literacy from 1997 to 2017 (Spante et al., 2018). From the perspective of digital fluency, Canchola-Gonzalez and Glasserman Morales conducted a systematic review of literature from 2010 to 2020 in the Spanish-speaking context (Canchola-González & Glasserman Morales, 2020). Media literacy has also been systematically organized in the literature on media literacy education, with studies dating back to 2000 (Wang et al., 2019b). Rasi et al (2021) focused on media literacy among the elderly in their systematic literature review (Rasi et al., 2021). Furthermore, social media literacy has been organized in a systematic review conducted by Polanco-Levicán and Salvo-Garrido (Polanco-Levicán & Salvo-Garrido, 2022).

In terms of data collection methods, a few studies have adopted the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) (Gutiérrez-Ángel et al., 2022; Peng & Yu, 2022). Park et al (2021) employed the scientometrics, a quantitative research method used to measure the influence of research, to examine digital, ICT, information, and media literacy (Park et al., 2021). Farias-Gaytan et al (2022) proposed the use of systematic literature mapping, a method for identifying, evaluating, and interpreting available literature on a particular research topic (Farias-Gaytan et al., 2022).

However, systematic literature reviews on digital literacies have certain limitations. Many of these reviews primarily focus on examining research trends, providing quantitative results such as the most cited articles, geographical distribution of authors, and prominent

publishing journals (Farias-Gaytan et al., 2022; Gutiérrez-Ángel et al., 2022; Peng & Yu, 2022). While these quantitative findings offer valuable insights, they do not provide a comprehensive understanding of the proposed concepts and their practical implications. Nichols and Stornaiuolo (2019) utilized tools like GoogleNGRAM and GoogleTrends to analyze usage patterns (Nichols & Stornaiuolo, 2019). Audrin and Audrin (2022) conducted text mining on article titles and abstracts to examine the research trend of digital literacy (Audrin & Audrin, 2022). However, a comprehensive and concrete understanding of the proposed concepts is lacking in these studies, failing to capture evolving digital literacy. Additionally, although some studies have attempted to define digital literacy, they often provide a fragmented overview of past literature without establishing a comprehensive structure (Reddy et al., 2022; Rinekso et al., 2021)

This study seeks to address the aforementioned limitations by systematically organizing digital literacies and developing a comprehensive framework to adapt it into a "platform literacy." The study initiates by identifying diverse concepts and descriptions related to both digital platforms and digital literacy. Through this process, the framework for digital literacies will be enhanced to incorporate features that are specifically relevant to the platform context. By building upon previous digital literacy concepts, this study will propose the concept of platform literacy.

3. Methodology

3.1 Data collection

3.1.1 Article collection

This study conducted a systematic literature review (SLR) to examine previous research on digital literacy, media literacy, and information literacy. The purpose was to obtain a comprehensive understanding on digital literacy. To minimize bias and random error, the study followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) guidelines for article selection and tracking. The flow diagram in Figure 1 illustrates the sequential steps of the search process, including identification, screening, eligibility, and inclusion.

The review process focused on collecting scholarly papers and articles from the international database SCOPUS. Conference papers, book chapters, and notes were excluded to ensure the quality and reliability of the sources. The inclusion criteria were papers published between January 2019 and December 2021 that contained the terms "digital literacy," "media literacy," "information literacy," or "ICT literacy" in their titles. Only

papers written in English were considered. Technical papers were excluded to maintain a focus on the academic trends in the social science field. Given that SCOPUS categorizes research into various social science sub-fields, such as business, law, humanities, psychology, and communications, the collected articles encompassed a wide range of disciplines within the social sciences. A total of 735 research papers, excluding technical papers, were obtained for analysis. Table 1 provides an overview of the number of articles identified for each literacy category and the corresponding years.

Table 1. Distribution of articles by publication year

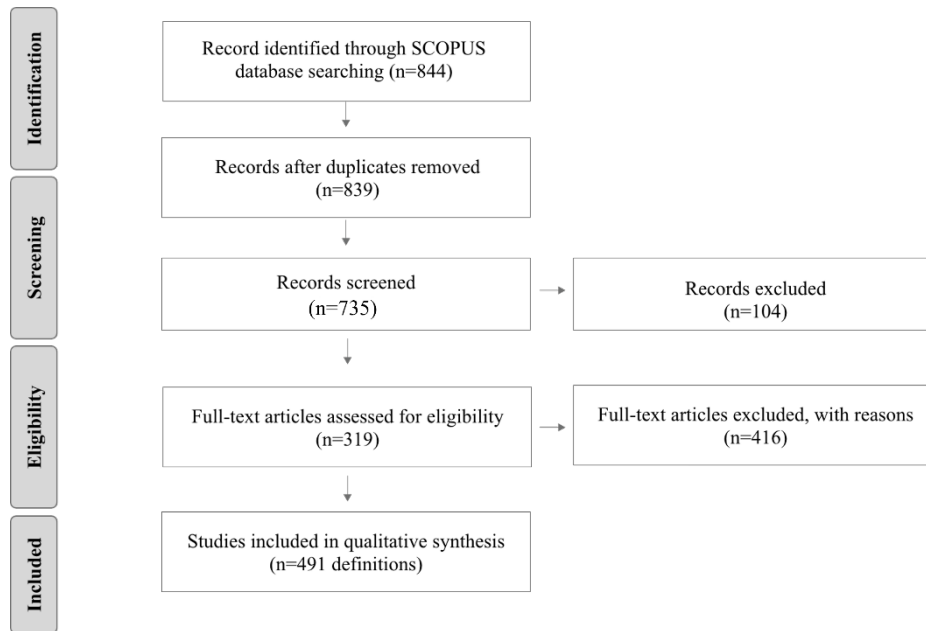
| | 2019 | 2020 | 2021 | Total |
|----------------------|------|------|------|-------|
| Digital Literacy | 56 | 68 | 67 | 191 |
| Media Literacy | 42 | 58 | 57 | 157 |
| ICT Literacy | 4 | 2 | 6 | 12 |
| Information Literacy | 111 | 120 | 144 | 375 |
| Total | 213 | 248 | 274 | 735 |

3.1.2 Definition collection

Two researchers manually collected the definitions from the 735 collected articles. Every definition related to any form of literacy mentioned in the articles was included in the sample. In total, 491 definitions were collected.

Many researchers have expressed concerns about loosely defined concepts, including issues of conflation and conceptual stretching (Gong & Ribiere, 2021), as well as confusion regarding the components and causes of the concept under discussion (Chan et al., 2006). Definitions with abstract meanings and vague emphasis, such as considering digital literacy as a mere survival skill, have been excluded. The inclusion of key constructs is essential for providing a concrete definition. The collection process of both articles and definitions on digital literacies is depicted in Figure 1.

Figure 1. PRISMA process and output



3.1.3 Framework collection

A total of 24 frameworks, which were the most frequently discussed, were selected from the collected articles to identify the core attributes of digital literacies. Among these frameworks, those that did not explicitly mention relevant concepts of digital literacy were excluded. The selected frameworks include those mentioned in previous review papers as well (Alexander et al., 2017; Ferrari, 2013; Hall et al., 2014).

As a result, 24 frameworks for digital literacies were reviewed including ACRL Framework for Information Literacy (Association of College and Research Libraries, 2016), AASL (AASL, 2018), DigComp (Ferrari, 2013), and DigComp 2.1 (Carretero et al., 2017), JISC Digital Capabilities framework (Jisc, 2022), SCONUL (SCONUL, 2011), ETS (O'Connor et al., 2002), OECD (OECD, 2019), and UNESCO (UNESCO, 2018), Media Smarts (Media Smarts, 2022). Additionally, frameworks proposed by individuals such as Belshaw (2015) and Chen et al. (2011) were included. Both versions of the European Commission's framework, were adapted due to their different focuses in terms of terminology and conceptual models. An overview of the collected frameworks can be found in Table 2.

Table 2. Collected digital literacies frameworks.

| Framework | Year | Origin | Domain | Structure | Levels | Descriptions |
|--|------|---------------|----------------------|------------|--------|--|
| ACRL (Association of College and Research Libraries, 2016) | 2016 | United States | information literacy | 6 concepts | None | 1. authority is constructed and contextual 2. information creation as a process 3. information has value 4. research as inquiry |

| | | | | | | |
|--|------|----------------|------------------------|-------------------------------|-------------|--|
| | | | | | | 5. scholarship as conversation 6. searching as strategic exploration |
| AASL Standards Framework for Learners (AASL, 2018) | 2018 | United States | Information literacy | 4 Strands | None | 1. Inquire 2. Include 3. Collaborate 4. Curate 5. Explore 6. Engage |
| DIGCOMP (Ferrari, 2013) | 2013 | Europe | Digital competence | 5 Competence areas | 3 levels | 1. Information 2. Communication 3. Content creation 4. Safety 5. Problem solving |
| DIGCOMP 2.1 (Carretero et al., 2017) | 2017 | Europe | Digital competence | 5 competence areas | 8 levels | 1. Information and data literacy 2. Communication and collaboration 3. Digital content creation 4. Safety 5. Problem solving |
| JISC (Jisc, 2022) | 2022 | United Kingdom | Digital capability | 7 thematic areas | None | 1. Digital proficiency and productivity 2. Digital creation and problem-solving and innovation 3. Digital learning and development 4. Digital identity and wellbeing 5. Information data and media literacies 6. Digital communication, collaboration and participation |
| SCONUL (SCONUL, 2011) | 2011 | United Kingdom | Information literacy | 7 pillars | None | 1. Present 2. Identify 3. Scope 4. Plan 5. Gather 6. Evaluate 7. Manage |
| ETS (O'Connor et al., 2002) | 2002 | United States | ICT literacy | 5 components, 3 proficiencies | 4 quadrants | 1. Access 2. Manage 3. Integrate 4. Evaluate 5. Create 1. ICT proficiency 2. Cognitive proficiency 3. Technical proficiency |
| OECD (OECD, 2019) | 2019 | International | ICT literacy | 3 dimensions | 2x2 levels | 1. Student cognitive performance 2. Student ICT competencies 3. Student well-being |
| UNESCO (UNESCO, 2018) | 2018 | International | digital literacy | 7 competences | none | 1. Devices and software operation 2. Information and data literacy 3. Communication and collaboration 4. Digital content creation 5. Safety 6. Problem-solving 7. Career-related competences |
| Media Smarts (Media Smarts, 2022) | 2022 | Canada | Digital media literacy | 9 essential skills | none | 1. Reading media 2. Media representation 3. Finding and verifying 4. Ethics and empathy 5. Privacy and security 6. Media health 7. Consumer awareness 8. Community engagement 9. Making and remixing |
| Mozilla (Mozilla, 2019) | 2019 | International | Web literacy | 3 Skills | none | 1. Read 2. Write 3. Participate |

| | | | | | | |
|--|------|---------------------------------|-------------------------|-------------------------------|-------------|---|
| ANZIL (Alan, 2004) | 2003 | Australia and New Zealand | Information literacy | 6 Standards | none | 1. Recognize 2. Find 3. Evaluate 4. Manage 5. Application 6. Social issue |
| ANCIL (Coonan & Secker, 2011) | 2011 | United States | Information literacy | 10 strands | none | 1. Transition from school to higher education 2. Becoming an independent learner 3. Developing academic literacies 4. Mapping and evaluating the information landscape 5. Resource discovery in your disciplines 6. Managing information 7. Ethical dimension of information 8. Presenting and communicating knowledge 9. Synthesizing information and creating new knowledge 10. Social dimension of information |
| Utah Core Standards (Utah State Board of Education, 2016) | 2016 | Utah State | Information literacy | 7 Strands | none | 1. Reading to pursue intellectual, personal, and emotional growth for life 2. Defining an information problem and identifying information needed 3. Identifying, evaluating, and selecting sources 4. Locating sources and accessing information 5. Engaging with and extracting information 6. Organizing, synthesizing, and presenting information 7. Evaluating the process and product |
| UNESCO MIL Assessment Framework (UNESCO, 2013) | 2013 | Internatio nal | Digital capabilities | 6 Elements | 3 levels | 1. Access and retrieval 2. Understanding and evaluation 3. Creation and utilization |
| Big 6 Model (Eisenberg & Berkowitz, 1992, p. 6) | 1987 | United States | Information literacy | 6 stages | none | 1. Task Definition 2. Information Seeking Strategies 3. Location and Access 4. Use of Information 5. Synthesis 6. Evaluation |
| Future Lab (Payton & Hague, 2010) | 2010 | United Kingdom | digital literacy | 8 componen ts | none | 1. Functional skills 2. Creativity 3. Critical thinking and evaluation 4. Cultural and social understanding 5. Collaboration 6. Ability to find and select information 7. Effective communication 8. E-safety |
| DigEuLit (Martin & Grudziecki, 2006) | 2015 | Europe | Digital Literacy | 12 processes (3 levels) | 3 levels | 1. statement 2. Identification 3. Evaluation 4. Interpretation 5. Organisation 6. Integration 7. Analysis 8. Synthesis 9. Creation 10. Communication 11. Dissemination 12. Reflection |

| | | | | | | |
|---|------|----------------|-----------------------------------|--------------------------|----------|---|
| British Columbia (British Columbia Ministry of Education, 2019) | 2019 | Canada | Digital literacy | 6 skills | none | 1. Research and information literacy 2. Critical thinking, problem solving, decision making 3. Creativity and innovation 4. Digital citizenship 5. Communication and collaboration 6. Technology operations and concepts |
| IEA (Fraillon et al., 2013) | 2013 | International | computer and information literacy | 2 strands (7 aspects) | 5 levels | 1. Collecting and managing information 2. Producing and exchanging information |
| Belshaw (Belshaw, 2012) | 2012 | United Kingdom | digital literacies | 8 elements | none | 1. Cultural 2. Cognitive 3. Communicative 4. Confident 5. Creative 6. Critical 7. Civic |
| Chen et al (Chen et al., 2011) | 2011 | Singapore | new media literacy | 4 types | none | 1. Functional media 2. Critical media 3. Functional prosumer 4. Critical prosumer |
| Primack (Primack et al., 2006) | 2006 | United States | media literacy | 3 domains and 8 concepts | none | 1. Authors and audiences 2. Messages and meanings 3. Representation and realities |
| Ng (Ng, 2012) | 2012 | Australia | digital literacy | 3 dimensions | none | 1. Cognitive 2. Technical 3. Social emotional |

4. Result

4.1 Core attributes of digital platforms

A total of 119 definitions on digital platforms from Ha et al (2023) has been utilized. This study presents the frequently occurring keywords found in the collected definitions, which serve as indicators of the key concepts associated with digital platforms. Keywords that appeared more than 10 times include "platform," "digital," "between," "user," "value," "interaction," "business," "two-sided," "groups," "online," "service," "social," "information," "technology," "multi," "consumers," "market," "enable," "transactions," "technical," "provide," "facilitate," "content," "technological," "system," "providers," "data," "customers," "producers," "participants," "internet," "actors," "network," "model," "media," "intermediary," "exchange," "distinct," and "create." The categorization of these collected keywords can be found in Table 3.

Table 3. Frequent keywords from collected definitions.

| Category | Frequent keywords | Digital platform traits |
|----------|-------------------|-------------------------|
|----------|-------------------|-------------------------|

| | | |
|--------------|---|---|
| Environment | platform, online, internet | Exist within online context |
| Nature | social, service, system, model | Constructed as a social system |
| Digital | digital, technical, technological, technology | Use of digital technology |
| Role | facilitate, enable, exchange, create, provide interaction, transaction | Role of transaction, interaction, and value creation |
| Exchange | value, information, content, data, media | Exchange of content (information, data, media, value) |
| Actors | groups, actors, participants providers, producers users, consumers, customers | Interaction among different actors |
| Relationship | between, two-sided, multi, intermediary, distinct | Multi-sided nature |
| Industry | business. market | Business domain |

Above categorization encompasses the fundamental concepts associated with digital platforms. To start with, in the context of the digital platform environment, online presence is a prominent characteristic of contemporary digital platforms (Yablonsky, 2020). Platforms do not rely on physical assets but instead leverage pervasive internet connectivity and technological advancements (Yablonsky, 2020). Also, the use of technology is a defining feature of digital platforms, which encompass socio-technical systems consisting of software, hardware, and architecture, distinguishing them from non-digital platforms (De Reuver et al., 2018; European Commission, 2023; Iden et al., 2021; Liu et al., 2023). For example, the emergence of digital platforms is closely tied to the proliferation of digital technologies such as smartphones (Stallkamp & Schotter, 2021). De Reuver et al (2018) also highlighted the importance of digitality in understanding digital platforms (De Reuver et al., 2018). Plus, the literature consistently highlights the role of digital platforms in value creation and reducing transaction costs (Gawer, 2021; Hein et al., 2020). Mediating interactions and facilitating value exchange among various actors are key role of digital platforms (Constantinides et al., 2018; Iden et al., 2021; Stallkamp & Schotter, 2021). Along with this role, previous studies

have identified different types of interactions, including those between users and the collection and utilization of data (European Commission, 2023). Above category highlights the actors within digital platform as well. Within the platform industry, multiple stakeholders, including customers, producers, third-party actors, and complementors, play crucial roles (Constantinides et al., 2018; Iden et al., 2021). Complementors, specifically, create products or services using the services provided by platform providers, assuming the role of producers in the digital platform context (Hein et al., 2020; Stallkamp & Schotter, 2021). It is important to note that the user base extends beyond individuals to include business organizations as well (Gawer, 2021). Yablonsky (2020) categorizes the actors into four groups: platform owners, platform providers, users on the supply side (producers), and users on the demand side. Furthermore, digital platforms are characterized by their multi-sided business models and network effects, whereby an increase in users leads to an increase in platform value (Stallkamp & Schotter, 2021). The multi-sided market is the major trait of digital platforms, and has been explored in-depth in previous literature (Parker & Van Alstyne, 2005; Rochet & Tirole, 2006). Although this categorization may not explicitly mention network effects, they constitute the core of platform business models, explaining the interactions among content providers and end consumers in dynamic platform context (European Commission, 2023; Gawer, 2021; Parker & Van Alstyne, 2005; Stallkamp & Schotter, 2021). Table 3 organizes the common traits of digital platforms derived from the collected definitions and relevant literature. As a result, 8 core concepts of digital platforms have been identified: Environment, Nature, Digital, Role, Exchange, Actors, Relationship, Industry.

4.2 Research trend on digital literacies

The research trends observed in the analysis of 735 articles can be categorized into six main findings. Firstly, there is a steady growth in the publication of digital literacies studies. Despite focusing on a three-year period (2019-2021), the number of publications has increased from 213 to 274, consistent with previous studies that cover longer time spans (Farias-Gaytan et al., 2022; Gutiérrez-Ángel et al., 2022). This upward trend indicates the increasing attention and significance of digital literacies as an academic subject. Table 4 shows the distribution of articles by year and quarter.

Secondly, in terms of journal publications, the current focus of digital literacies research is predominantly on the fields of library and information science (32%) and education (28%). Table 5 provides the distribution of articles by journal category. The

concentration of articles in these two disciplines suggests an imbalance in the perspectives and approaches used to study digital literacy.

Thirdly, in relation to the institutional location of the authors, digital literacies research is most popular in North America (34%) and Asia (32%). Despite the growing interest in digital literacies in the educational sector of Asian countries, the United States remains a key driver in this domain, accounting for 30% of the publications. This finding contradicts previous research on digital literacies in higher education, where Spain, the United States, the United Kingdom, Australia, and Russia were identified as the five main countries contributing to over half of the total publications (Farias-Gaytan et al., 2022). This study reveals the increasing publication power of India and Indonesia in the field of digital literacies, ranking second and third in terms of publication volume, respectively, after the United States. A detailed distribution of digital literacies literature by country can be found in Appendix A.

Fourthly, the target audience of literacy studies predominantly focuses on students, particularly those in higher education. This aligns with the emphasis placed on the education sector in the research articles. Table 4 shows the distribution by literacy subjects.

Lastly, funding for digital literacies research shows diverse trends. While the majority of articles are not publicly or privately funded, China, Spain, and Malaysia exhibit relatively higher funding statuses in digital literacies research. Notably, Australia and Malaysia show a higher proportion of public funding, whereas China and Spain are characterized by government funds. Table 6 illustrates the distribution of public, governmental, and private funds by countries.

Table 4. Distribution of collected articles.

| Category | Sub-category | | | Number | Percentage |
|------------------|--------------|---------|----|--------|------------|
| Publication year | 2019 | 1 | 45 | 213 | 29.0% |
| | | 2 | 66 | | |
| | | 3 | 47 | | |
| | | 4 | 49 | | |
| | | unknown | 6 | | |
| | 2020 | 1 | 55 | 248 | 33.7% |
| | | 2 | 71 | | |
| | | 3 | 57 | | |
| | | 4 | 59 | | |
| | | unknown | 6 | | |
| | 2021 | 1 | 61 | 274 | 37.3% |
| | | 2 | 80 | | |

| | | | |
|--------------------------|---------------------------|---------|--------|
| | | 3 | 68 |
| | | 4 | 57 |
| | | unknown | 8 |
| Subject of platform type | Unspecified | 667 | 90.7% |
| | Educational platform | 10 | 1.4% |
| | Social media platform | 38 | 5.2% |
| | E-commerce platform | 0 | 0.0% |
| | Search engine platform | 4 | 0.5% |
| | Etc | 16 | 2.2% |
| Subject of literacy | Unspecified | 138 | 18.8% |
| | Students (K12) | 123 | 16.7% |
| | Student (College, adults) | 277 | 37.7% |
| | Teacher & professor | 69 | 9.4% |
| | Parents | 2 | 0.3% |
| | Elderly | 7 | 1.0% |
| | People with expertise | 52 | 7.1% |
| | Entrepreneur (business) | 6 | 0.8% |
| | Etc | 61 | 8.3% |
| Open access | Open access | 362 | 49.3% |
| | No open access | 373 | 50.7% |
| Total | | 735 | 100.0% |

Table 5. Distribution of collected articles by journal categories

| # of Article | Number | Percentage |
|----------------------------------|--------|------------|
| Library and Information Sciences | 377 | 31.8% |
| Education | 329 | 27.7% |
| Arts and Humanities | 150 | 12.6% |
| Communication | 125 | 10.5% |
| Psychology | 31 | 2.6% |
| Business & Economics | 31 | 2.6% |
| Political Science | 27 | 2.3% |
| Cultural Studies | 26 | 2.2% |
| Linguistics and Language | 25 | 2.1% |
| Social Sciences (miscellaneous) | 21 | 1.8% |
| Public Administration | 8 | 0.7% |
| General Social Sciences | 7 | 0.6% |
| Gender Studies | 5 | 0.4% |
| Health Professions | 4 | 0.3% |
| Decision Sciences | 4 | 0.3% |
| Multidisciplinary | 4 | 0.3% |
| etc | 13 | 1.1% |
| Total (multi-coded) | 1187 | 100.00% |

Table 6. Distribution of collected articles by funding and countries

| Country | No fund | Public fund | Governmental | |
|---------|---------|-------------|--------------|--------------|
| | | | fund | Private fund |

| | | | | |
|--------------------|------|-----|-----|-----|
| United States | 83% | 8% | 7% | 3% |
| India | 93% | 2% | 3% | 2% |
| Indonesia | 66% | 19% | 15% | 0% |
| United Kingdom | 62% | 19% | 15% | 4% |
| Australia | 56% | 26% | 15% | 3% |
| Nigeria | 91% | 3% | 6% | 0% |
| Canada | 77% | 13% | 10% | 0% |
| Turkey | 88% | 8% | 4% | 0% |
| Spain | 26% | 17% | 57% | 0% |
| China | 26% | 26% | 48% | 0% |
| Pakistan | 100% | 0% | 0% | 0% |
| Russian Federation | 79% | 7% | 14% | 0% |
| Malaysia | 33% | 40% | 27% | 0% |
| Germany | 64% | 0% | 18% | 18% |
| Netherlands | 42% | 25% | 33% | 0% |
| Ukraine | 80% | 0% | 20% | 0% |
| South Africa | 75% | 25% | 0% | 0% |
| Korea, South | 50% | 13% | 38% | 0% |
| Finland | 50% | 13% | 38% | 0% |
| Norway | 63% | 13% | 25% | 0% |
| Sweden | 50% | 25% | 25% | 0% |
| Iran | 100% | 0% | 0% | 0% |
| France | 43% | 14% | 43% | 0% |
| Poland | 57% | 29% | 14% | 0% |
| Israel | 100% | 0% | 0% | 0% |
| Philippines | 33% | 67% | 0% | 0% |
| Ghana | 80% | 0% | 20% | 0% |
| Tanzania | 67% | 17% | 0% | 17% |

4.3 Types of digital literacies

A total of 461 definitions were collected from the previous systematic literature review (SLR), resulting in the identification of 38 distinct literacies. These literacies have been further categorized into 12 groups, including digital literacy, ICT literacy, information literacy, media literacy, computer literacy, critical literacy, visual literacy, health literacy, financial literacy, trans literacy, human behavior literacy, and others. The categorization of each literacy can be found in Table 7.

Table 7. Categorizing the collected literacies.

| Group | Literacy |
|------------------|--|
| Digital literacy | Digital literacy, digital literacy ability |
| ICT literacy | ICT literacy |

| | |
|--------------------------|--|
| Information literacy | Information literacy, media and information literacy, computer and information literacy, virtual information literacy |
| Media literacy | Media literacy, digital media literacy, new media literacy, news literacy, news media literacy, social media literacy |
| Computer literacy | Computer literacy, data literacy, tool literacy |
| Critical literacy | Critical literacy, critical media literacy, critical digital literacy, critical information literacy, critical race digital literacy, artificial critical literacy |
| Visual literacy | Visual literacy, photo-visual literacy |
| Health literacy | Health literacy, health information literacy, reproduction literacy |
| Financial literacy | Financial literacy, financial information literacy |
| Trans-literacy | Trans-literacy, meta-literacy, multi-literacies |
| Human behaviour literacy | Communicative literacy, dispositional literacies, constructive literacies, communal literacies |
| Etc | copyright literacy, new literacy |

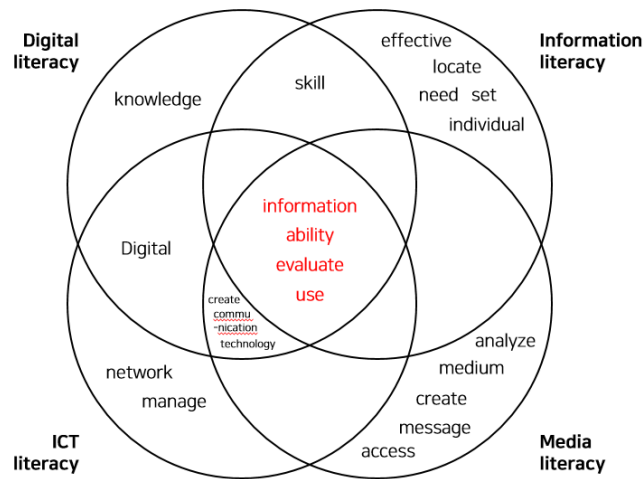
4.4 Definitions of digital literacy

The reports proposing the literacy framework all commence with a foundational task of defining literacy. To establish a clear understanding of digital literacies, it is crucial to define the term precisely. This study has collected a comprehensive corpus of 491 definitions, providing a robust basis for analysis. For this study, word frequency analysis has been employed to preliminarily capture the conceptual understanding of digital literacies. Table 8 shows the key terms associated with information literacy, media literacy, digital literacy, and information literacy.

Table 8. Categorizing the collected literacies.

| Literacy | Frequency |
|----------------------|---|
| Information Literacy | Information, use, need, ability, evaluate, skill, effective, locate, set, individual |
| Media Literacy | Medium, Ability, Evaluate, Access, Message, Analyze, Use, Communication, Create, Information |
| Digital Literacy | Digital, Use, Information, Ability, Technology, Skill, Communication, Evaluate, Knowledge, Create |
| ICT Literacy | Information, Use, Ability, Manage, Evaluate, Communication, Technology, Network, Digital, Create |

Figure 2. Benn diagram on digital, information, ICT, media literacy.



The overview of the key terms extracted from the definitions is depicted in Figure 2 using the Venn-diagram. The analysis of various literacies reveals consistent emergence of key terms such as "information," "ability," "evaluate," and "use," suggesting a shared core definition centered around "the ability to effectively use and evaluate information." However, each literacy also possesses distinctive characteristics, as indicated by the remaining keywords. Media literacy, for instance, places a distinct emphasis on understanding and critically analyzing messages and mediums. On the other hand, digital literacy and ICT literacy exhibit a greater prevalence of terms associated with digital technology, highlighting the importance of technological proficiency.

The remaining keywords imply the distinctive characteristics inherent to each literacy. For example, media literacy places a distinct emphasis on understanding and critically analyzing messages and mediums. In contrast, digital literacy and ICT literacy demonstrate a greater prevalence of terms associated with digital technology, underscoring the significance of technological proficiency when compared to information and media literacy.

Previous literature has also examined the interrelationship between digital literacy and other literacy movements (Cuervo Sánchez et al., 2021; Ferrar, 2019). For instance, Ferrar (2019) identified the emphasis on media consumption and creation in media literacy, while computer literacy and ICT literacy emphasize the ability to select and utilize digital tools. Cuervo Sanchez (2021) characterized media literacy as the skill of understanding and evaluating media messages while information literacy primarily involves accessing and analyzing information. Digital literacy, on the other hand, pertains to proficiency in using

software and hardware. By synthesizing insights from previous definitions of digital literacies, this study captures the essential conceptual attributes of digital literacies.

4.5 Comprehensive framework for digital literacies

This study offers a comprehensive framework for digital literacies that extends beyond mere definitions by incorporating key constructs from previous frameworks. While definitions provide conceptual clarity, frameworks are essential for establishing an operational flow of the concept.

Previous studies have focused on categorizing the elements, dimensions, and constructs of digital literacies (Alexander et al., 2017; Cuervo Sánchez et al., 2021; Farr & Murray, 2016; Feerrar, 2019; Nichols & Stornaiuolo, 2019; Peng & Yu, 2022; Valchev, 2018). For example, Dudeney and Hockly distinguished digital literacy into four dimensions: language, information, connections, and (re)design (Farr & Murray, 2016). Nichols and Stornaiuolo (2019) examined how the components of each literacy have been interwoven under Glister's digital literacy definition (Nichols & Stornaiuolo, 2019). Alexander (2017) synthesized these frameworks and identified six common concepts: communication, critical thinking, technical skills, content creation, civics and citizenship, and copyright law (Alexander et al., 2017). Numerous models and frameworks exhibit different emphases. Some frameworks focus on local contexts, while others strive for universal applicability. Certain frameworks prioritize civic engagement, while others highlight technical and personal aspects (Alexander et al., 2017). Though multiple literature proposes multiple models and frameworks, it is mostly limited to the single concept of literacy with the limited contextual domain. Even ACRL, which is the dominant digital literacy framework nowadays does not incorporate digital literacies in general but is limited to information literacy. Therefore, this study attempts to propose the core attributes of current digital literacies in a holistic perspective.

After carefully examining the collected frameworks, the researcher categorized the dimensions and strands. The most frequently mentioned elements from previous frameworks were synthesized in this study. Initially, a total of 141 skills were identified. Subsequently, these identified skills were consolidated and organized into distinct categories, resulting in 77 core attributes of digital literacies (Eakin et al., 2017; Holosko, 2009; Yusuf et al., 1999). These attributes are further grouped into 10 sub-dimensions. Apart from the conceptual attributes found in section 4.4, these 77 attributes in 10 sub-dimensions encompass practical constructs that can be applied in real-world contexts.

The proposed comprehensive framework for digital literacies primarily comprises two main components: flow and proficiency. Under the flow component, seven essential steps have been identified: identify, access, apply, create, participate, evaluate, and manage. To effectively carry out each step, individual proficiency in terms of attitude, technical skills, and understanding of the social context serves as a foundational requirement. Table 9 provides an organized overview of the core attributes of the digital literacies framework.

Table 9. Core attributes of digital literacies

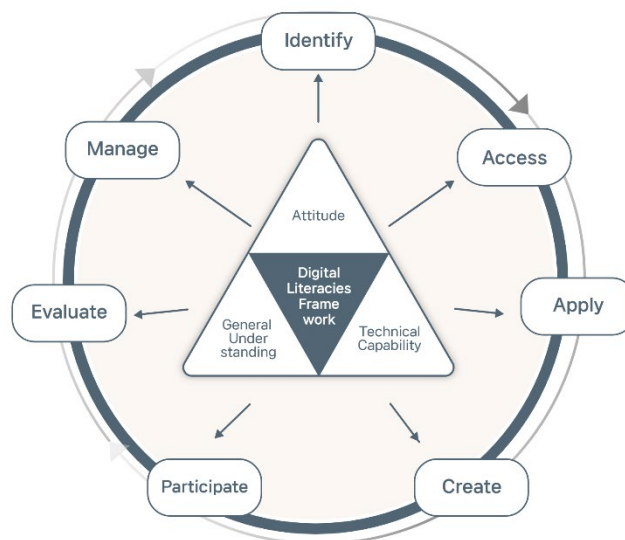
| Dimension | | Descriptions | |
|------------------|-----------------------|---|----------------------------------|
| Flow | Identify | Inquire / Question Recognize the need Trend / Keep up to date Identify the range of knowledge Identify the implications | |
| | Access | Browsing / Searching / Locating Skimming / Scanning Selecting / Gaining information Collecting information | |
| | Apply | Drawing conclusion Interpretation Analysis Presentation Problem solving | |
| | Create | Transformation Remix Synthesis Integration Publication | |
| | Participate | Communication Collaboration Interaction Sharing knowledge Social engagement Developing personal network | |
| | Evaluate | Evaluate sources Evaluate platforms Evaluate efficiency and effectiveness Evaluate quality, accuracy, relevance, bias | |
| | Manage | Cite sources Obtain feedback Manage information Categorize (classify/organize) Record / archive / store Reuse Reflection Back-up | |
| Proficiency | Understanding context | Acknowledge media environment | role of ICT role of authority |

| | | |
|----------------------------|--|---|
| | | characteristics of media characteristics of device characteristic of audience characteristics of information author's intention platforms' credibility |
| | Acknowledge social environment | cultural ethical economical legal environmental socially marginalized group |
| | Acknowledge digital safety | Device Data Health |
| Having adequate attitude | Pursue personal growth | Aware of opportunities Aware of limitations Identify own competence level Learning / Developing competency |
| | Display positive attitude | Open-minded Proactive Responsible Seeking help |
| | Demonstrate cognitive proficiency | Presenting citizenship Developing digital identity Creativity Critical thinking Effectiveness Efficiency Mental flexibility Curiosity Empathy, equity |
| Possessing technical skill | use of different research method use of device use of software use of operating systems online transaction computational thinking | |

Several literature sources have proposed frameworks that focus on the flow of information acquisition. These include frameworks such as AASL, SCONUL, DIGCOMP, ANZIL, and DigEuLit. For instance, Mozilla's framework categorizes web literacy into navigation, creation, and participation (McVerry et al., 2015). Additionally, previous literature has not been limited to unidimensional frameworks but has actively sought to distinguish dimensions and levels. Examples include OECD's PISA ICT Framework and ETS, which position usage and proficiency at different levels. OECD's framework categorizes access and use, student outcomes, cognitive performance, well-being, and ICT

attitudes and competencies. It also incorporates contextual factors, policies, and practices, recognizing literacy within a broad ecosystem. SCONUL (2011) distinguishes ability, described as skills and competencies, from attitudes and behaviors. This framework positions proficiency as a foundation and user flow as the pinnacle of literacy progress. Considering that proficiency, such as general understanding of media environments and social context, technical skills, and attitudinal constructs, applies to the entire process rather than a single flow, it serves as the foundation of the overall literacy framework. As a result, the final framework for digital literacies can be found in Figure 3.

Figure 3. Comprehensive framework for digital literacies (digital literacy, media literacy, information literacy, ICT literacy)



4.6 Platform literacy

The comprehensive framework for digital literacies presented above serves as a solid foundation for the development of platform literacy. To apply this framework in the platform context, it is necessary to differentiate between elements that remain constant regardless of the context and those that are adaptable depending on the specific platform. Figure 4 highlights the core variables that remain unchanged, while Figure 5 focuses on the adaptable variables. Attitudinal attributes and social understanding are the examples of fixed attributes within this framework, as they remain essential regardless of contextual changes. Conversely, variable attributes include understanding of the platform environment, platform safety, technical capability, and the platform-specific user flow.

Figure 4. Fixed attribute in platform literacy framework

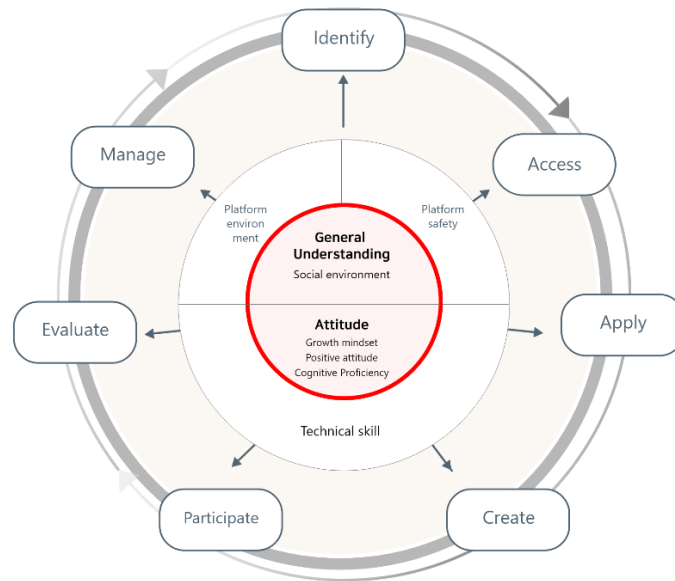
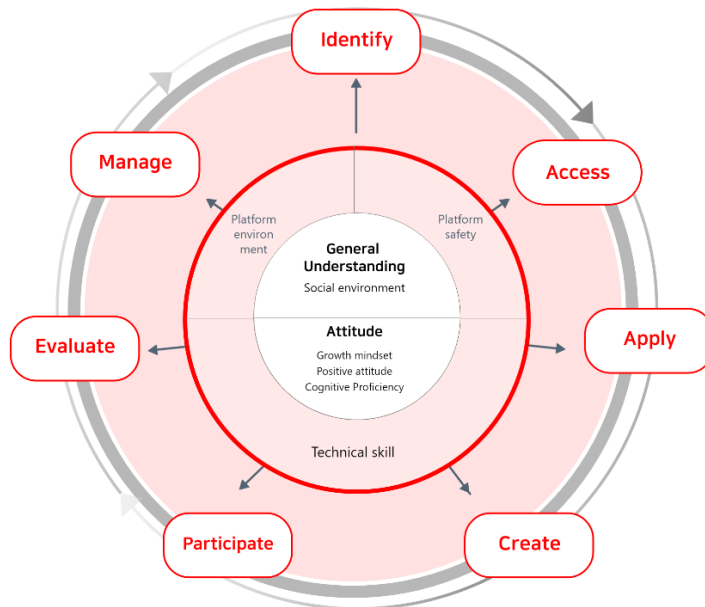


Figure 5. Variable attribute in platform literacy framework



In identifying fixed and variable constructs, core constructs identified in Research Question 1 and 2 have been utilized. Attitudes, and general understanding encompass broader

concepts that extend beyond the platform realm. Table 10 provides a visual representation how the attributes of digital platforms are positioned within the digital literacy framework.

Table 10. Applying digital platform traits on digital literacy framework

| Digital platform traits | | Component of digital literacy framework |
|---|---|---|
| Exist within online context | → | User flow-access Technical skill |
| Constructed as a social system | → | Understanding of platform environment Technical skill |
| Use of digital technology | → | User flow-access Technical skill |
| Role of transaction, interaction, and value creation | → | User flow-apply, create, participate |
| Exchange of content (information, data, media, value) | → | User flow-apply, create, participate |
| Interaction among different actors | → | Understanding of platform environment User flow-participate |
| Multi-sided nature | → | Understanding of platform environment |
| Business domain | → | Understanding of platform environment Understanding of platform safety |

Table 11 offers descriptions of the user flow specifically tailored to the platform context. Along with digital literacies framework, it incorporates 7 essential steps in the user flow. It is important to note that while this serves as a general guideline, the flow may vary depending on the type of platform. For example, in the case of a social media platform where the primary function is communication with others, the platform application aspect may overlap with the participation sector.

Table 11. Platform specific user flow

| | |
|----------|--|
| Identify | Identify own needs for using platform Identify the scope of platform's function |
| Access | Search related services Download services |

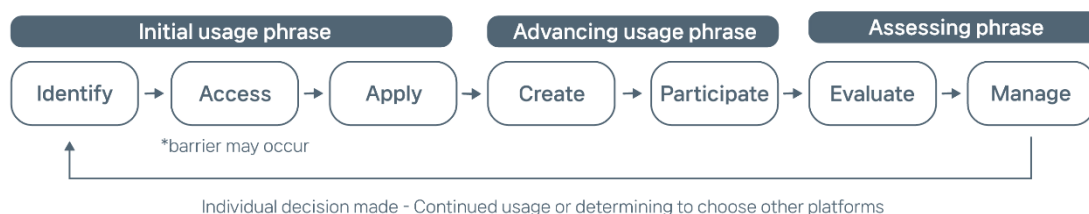
| | |
|-------------|--|
| Apply | Utilize platform Solve problems |
| Create | Transform the message Interpret the given message Analyze the service |
| Participate | Communicate with others Collaborate with others Share one's information Engage in social activity Develop one's network |
| Evaluate | Evaluate platform efficiency and effectiveness Evaluate platform's quality and relevance Evaluate platform's credibility |
| Manage | Manage data within platform Obtain feedback Categorize and organize information Record / archive / store Reflection Back-up |

Each process of digital literacy framework can be adapted to the platform context. The first step is to identify one's needs and the function of the platform. For example, when one desires to communicate with friends, determining the appropriate platform is crucial in assessing platform literacy. In this case, social media platforms such as Instagram, Facebook, or Twitter would be relevant choices. Next, platform access refers to the restrictions placed on the formation and use of a digital platform. This encompasses not only the download process but also the ability to access the platform using the required device and network (Iden et al., 2021, p. 2). The third step is the application of the platform, which is connected to its value creation. As emphasized by Iden et al (2021), the platform should meet customers' needs effectively (Constantinides et al., 2018; Hein et al., 2020; Iden et al., 2021). The type of value created may vary depending on the platform context, but it largely depends on the consumers' objectives in using specific digital platforms. The "Create" stage blurs the line between consumers and producers, elevating consumers to active actors within the platform ecosystem. However, in certain platform contexts, the "Apply" and "Create" stages may be intermixed, especially if the primary purpose of the platform is to create and publish content. "Participate" involves communication with others, encompassing not only traditional communication methods but also collaboration, sharing, social engagement, and network building. In the platform context, communication may include activities such as chatting, commenting, and expressing approval through likes. Sharing the message or content created during the "Create" stage with other actors on the platform constitutes platform participation.

"Evaluate" plays a critical role in empowering consumers to be active and independent by assessing the efficiency, effectiveness, quality, relevance, and credibility of the platform. Understanding the digital platform environment entails the crucial role of trust, highlighting the significance of the evaluation process, particularly given the strong connection between credibility on platforms and personal data issues (Iden et al., 2021). Furthermore, in the context of digital platforms, data management involves the collection, storage, sharing, access, and monetization of data, and given that many platforms disclose their data collection practices, managing one's data and identifying backup services become critical components in assessing platform literacy levels (Iden et al., 2021, p. 2).

The user flow within the platform can be divided into three distinct phases. The first phase is the initial usage phase, where users enter the platform, identify their needs, and use it to achieve their initial goals. During this phase, users can enjoy the straightforward usage of the platform and access the features it provides. The second phase is the advancing usage phase, where users progress in their platform usage by actively participating and engaging with the platform. This phase goes beyond passive consumption, as users become content creators and contribute to the platform's community. The line between being a consumer and a producer blur as users take on a more active role within the platform. Lastly, the assessing phase focuses on managing one's data and evaluating the platform. Users who reach this phase have a deeper understanding of their data privacy, security, and the overall platform's value proposition. They are not limited to a specific platform but can explore and choose from a variety of platforms that better align with their needs and preferences. Figure 6 provides a visual representation of these three phases, illustrating the step-by-step progression of users within the platform.

Figure 6. User flow in each phase



Under the user flow, proficiency constitutes the foundation. First, acknowledging platform environment is critical part of platform literacy. This is highly connected to how

platform is operationalized based on the core constructs identified from Research Question 2. One key governance issue in the digital platform ecosystem is platform ownership, which can be classified into centralized, consortia, and decentralized forms (Iden et al., 2021). For example, in the case of centralized digital platforms that involve multiple actors, it is important to recognize and understand the interactions and processes within the platform context. Second is the platform safety. This includes copyright, privacy, and malware issue. The frameworks such as DIGCOMP and Jisc highlighted the importance of safety in its literacy framework, further distinguishing among copyright, creative commons, and public domains. Last is the technical capability. The necessary technical skill may be differed depending on the platform. In the literacy framework review, most frequently mentioned technical capabilities are use of different research method, device, software, and operating systems. The types of platforms determine the specific technical skills that need to be considered.

This study acknowledges the diverse and emerging nature of digital platforms. Different categorizations of digital platforms can be found in the existing literature. For example, Cusumano et al. (2019) propose two types of platforms: transaction platforms and innovation platforms. Transaction platforms facilitate the exchange of goods and services and include platforms like Twitter, Uber, Airbnb, and Amazon Marketplace. On the other hand, innovation platforms provide a technological foundation to create additional value (Gawer, 2021). Another distinction that emerges is between single-sided platforms and multi-sided platforms (Gawer, 2021). Single-sided platforms attract customers, while multi-sided platforms facilitate transactions between two or more customer groups. Yablonsky categorizes digital platforms into four different categories: technology platforms, internal platforms, network platforms, and business platforms (Yablonsky, 2020). Different criteria have been applied to categorize digital platforms. Gawer, for instance, defines the boundaries of digital platforms based on three standards: the firm's scope, the configuration and composition of platform sides, and the platform's interfaces (Gawer, 2021). The scholar further categorizes digital platforms into open and closed platforms based on the accessibility of platform modules to external agents (Gawer, 2021). For instance, the researcher identified different types of platforms: internal or company-specific platforms and external or industry-specific platforms depending on the scope within ecosystem (Gawer & Cusumano, 2014). Considering such a wide variety of digital platforms, utilizing variable attribute is critical to fit depending on the context.

5. Discussion

5.1 Implications

This study has a significant implication by developing a platform literacy framework. Considering the growing importance of digital platforms in the modern day, the ability to utilize and understand these platforms becomes critical. This study provides a foundation for measuring this ability within the platform-dominated context, expanding the academic scope of literacy, which was previously focused on education and library domains, to an industrial perspective. Furthermore, rather than remaining purely conceptual and theoretical, this study offers a concrete framework that can be applied to various settings. It begins with a systematic review of digital literacies and digital platforms, utilizing 119 collected definitions of digital platforms and 491 collected definitions of digital literacies to extract conceptual attributes. Additionally, it reviews 24 frameworks of digital literacies at the operational level, serving as a foundation for future empirical studies on platform literacy.

The systematic review of digital literacies conducted in this study holds significant academic implications. It deviates from the typical approach of relying solely on quantitative data from electronic databases by incorporating a manual identification of key data from collected articles. This comprehensive methodology enables a more meaningful analysis of digital literacies, encompassing research trends, definitions, and frameworks employed in previous studies.

Furthermore, the current review and framework developed in this study encompass four distinct literacies: information literacy, media literacy, ICT literacy, and digital literacy. As a result, it addresses various facets of digital literacies, spanning from the utilization of different mediums to the use of technological tools. The framework not only serves as a foundation for platform literacy but also exhibits potential for application across diverse contexts. While the study adapts this framework to the digital platform context, its potential extension to other digital environments remains feasible.

This study's practical implications extend beyond academia, benefiting various stakeholders such as regulators, customers, media educators, and platform providers. The absence of platform literacy poses a significant barrier to effectively measuring and evaluating individuals' literacy levels within the digital platform context. Accurate measurement in this domain can provide valuable insights tailored to specific platform types and diverse industries, where individuals may encounter unique challenges.

From a policy perspective, the accurate measurement of literacy levels is important as an evidence to advocate for increasing accessibility, to promote necessary education, and to

enforce relevant legal measures. For instance, according to the Digital Divide report by Institute for Information & Communication Technology Promotion, the digital divide is categorized into three levels: access, competency, and utilization. This categorization offers insights into areas that require focus and support. Similarly, platform literacy can serve as a guideline to identify areas where individuals are least proficient, thus indicating the need for social and business support. Particularly in the assessing phase, which involves data management and platform evaluation, individuals may require education and social support due to the limited interest shown by businesses. Not only locally, but such measurement is also critical as it can reveal the existence of a platform gap, which is often less visible compared to device and network gaps.

From a consumer perspective, digital platform literacy is crucial for fully utilizing digital platforms and enhancing productivity. Figure 6 illustrates how attaining the assessing phase reduces dependence on a single platform, empowering consumers to be more active on platform selection. This offers a potential solution to the challenges posed by platform domination. Moreover, within the educational context, measuring individual platform literacy can aid in tracking individual growth and designing targeted curricula.

From an industry standpoint, understanding customer literacy gaps is crucial for businesses to enhance their services. By identifying the specific stages where users struggle the most, platform providers can improve the user experience and address these challenges. Additionally, analyzing the platform literacy of different customer segments, such as the elderly and rural inhabitants, can guide market expansion strategies. Small-scale platform providers can benefit from conducting comprehensive surveys on digital platform literacy to enhance their business models. It can offer insights for addressing customer pain points and catering to niche markets within existing platforms ecosystem.

5.2 Limitations

There are several limitations to consider in this study. Firstly, the proposed conceptual framework for platform literacy has not yet been implemented practically. This limitation also applies to existing frameworks like DIGCOMP, indicating the need for future research to practically measure platform literacy in specific domain. Additionally, the current literacy frameworks do not explicitly mention the target of literacy. While previous literature frameworks may not focus on specific targets, distinguishing between individuals, organizations, and countries could yield more specialized implications. Also, in practical adaptation, it is crucial to precisely identify the target digital platform. Various digital

contexts should be acknowledged, as different platforms operate with unique characteristics and cultures (Belshaw, 2012; De Reuver et al., 2018). The categorization of platforms extends beyond the binary distinctions of single/multi-sided, transaction/innovation, and open/closed platforms, encompassing domains such as messenger platforms, e-commerce platforms, and social media platforms. As the current categorization in academia primarily remains at the conceptual level, and literacy pertains to operational level, the level of platform categorization should be reconsidered when adapting the framework in practice. Lastly, as decentralized platform is emerging with the advancement in block chain technology, different platform ownership from centralized, consortia, and decentralized should be concerned (Iden et al., 2021). There may be limitations in encompassing all the dynamics and types of digital platforms within a single framework. However, as highlighted by De Reuver et al. (2018), digital platforms are characterized by their large, complex, and dynamic nature (De Reuver et al., 2018). Therefore, a small-scale method may impede a holistic understanding, necessitating a comprehensive framework for a general understanding of digital platforms.

Appendix A. Article distribution by countries and continents

| Continent | Country | # | # of articles | Percentage |
|----------------------|--------------------|----|---------------|------------|
| Africa | Nigeria | 31 | 54 | 6.6% |
| | South Africa | 8 | | |
| | Ghana | 5 | | |
| | Tanzania | 5 | | |
| | Algeria | 1 | | |
| | Egypt | 1 | | |
| | Ethiopia | 1 | | |
| | Kenya | 1 | | |
| | Uganda | 1 | | |
| Asia | India | 58 | 263 | 32.0% |
| | Indonesia | 58 | | |
| | Turkey | 24 | | |
| | China | 20 | | |
| | Pakistan | 16 | | |
| | Russian Federation | 14 | | |
| | Malaysia | 13 | | |
| | Korea, South | 8 | | |
| | Iran | 7 | | |
| | Israel | 6 | | |
| | Philippines | 6 | | |
| | Singapore | 5 | | |
| | Thailand | 4 | | |
| | Japan | 3 | | |
| | Jordan | 3 | | |
| | Kazakhstan | 3 | | |
| | Saudi Arabia | 3 | | |
| | Oman | 2 | | |
| | Taiwan | 2 | | |
| | Vietnam | 2 | | |
| | Bangladesh | 1 | | |
| | Cambodia | 1 | | |
| | Kuwait | 1 | | |
| Lebanon | 1 | | | |
| Sri Lanka | 1 | | | |
| United Arab Emirates | 1 | | | |
| Europe | United Kingdom | 47 | 178 | 21.7% |
| | Spain | 22 | | |
| | Germany | 11 | | |
| | Netherlands | 10 | | |
| | Ukraine | 10 | | |
| | Finland | 8 | | |
| | Norway | 7 | | |
| | Sweden | 8 | | |
| | France | 7 | | |
| | Poland | 7 | | |

| | | | | |
|---------------|------------------------|-----|-----|--------|
| | Belgium | 4 | | |
| | Italy | 4 | | |
| | Portugal | 4 | | |
| | Slovakia | 4 | | |
| | Ireland | 3 | | |
| | Latvia | 3 | | |
| | Bosnia and Herzegovina | 2 | | |
| | Croatia | 2 | | |
| | CZ | 2 | | |
| | Estonia | 2 | | |
| | Romania | 2 | | |
| | Switzerland | 2 | | |
| | Bulgaria | 1 | | |
| | Denmark | 1 | | |
| | Georgia | 1 | | |
| | Lithuania | 1 | | |
| | Luxembourg | 1 | | |
| | Malta | 1 | | |
| | Slovenia | 1 | | |
| | United States | 248 | | |
| North America | Canada | 30 | 280 | 34.1% |
| | Mexico | 2 | | |
| | Australia | 34 | | |
| Oceania | New Zealand | 3 | 39 | 4.7% |
| | Fiji | 2 | | |
| | Brazil | 5 | | |
| South America | Peru | 2 | 8 | 1.0% |
| | Ecuador | 1 | | |
| | Multi-coded | 822 | 822 | 100.0% |

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