From Digital Literacy to Digital Intelligence
A Comparative Study of Digital Literacy Frameworks

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ABSTRACT
Digital literacy is an essential requirement for every individual to survive in the digital society. Initiatives have been done to develop a comprehensive digital literacy framework in many countries. These initiatives use different names for the framework including digital literacy, digital competence, digital readiness, and digital intelligence. The paper argues that the use of different names and the inclusion of new elements in the development of digital literacy framework show a dynamic and progressive efforts in the development of more comprehensive and adaptive frameworks to face the challenge of industrial revolution 4.0. Digital literacy movement in Indonesia has been initiated in 2017 by the ministry of communication and information in cooperation with many elements of civil society. This initiative is a good start and should be followed by more systematic efforts to develop a comprehensive and measurable digital literacy framework to improve the quality of digital literacy in Indonesia. This comparative study is part of a bigger study related to the development of a systematic and comprehensive digital literacy framework, which can be used as a guidance for the future development of digital literacy movement in Indonesia.

Keywords: Digital, Literacy, Intelligence, Framework, Comparative

1. INTRODUCTION

One of the hopes of the presence of internet technology is its ability to provide democratic means in expressing individual identity or collective identity. The democratic face of the internet can be seen from its decentralized, anonymous, and highly endurance character [1]. In a democratic country, the internet has a strategic role because of its ability to provide efficient outlet as a supporter of other communication media. In a country that tends to be authoritarian, the internet acts as an alternative medium to counter the dominance of public space by rulers. The Internet in general has advantages over conventional media with its ability to deliver more interactive information exchanges, facilitate vertical and horizontal communication, relatively unconciliated communication processes, low costs, high communication speeds, and lack of limits and sensors [2]–[5].

The potential of conviviality presented by the internet technology is increasingly felt as leading to the freedom of users to create, modify and share information content according to their individual tastes (user generated content). The culture of participation can be interpreted as a culture that makes each individual contribution meaningful, allowing small barriers to artistic expression and civic engagement, strong support for creating and sharing copyrighted works as well as mentorship opportunities for newcomers to learn to the more experienced [4]. The culture of participation also contributes to encouraging the emergence of diversity that has been hidden in private spaces to emerge into public spaces. The globalization of information in the digital age has made the multicultural society an inevitable and no longer a unique phenomenon in just a few places. As Manuel Castells [6, p. xxxvi] said that 'We are not sharing a global culture. Rather, we are learning the culture of sharing our global diversity'.

The presence of the internet has also facilitated the emergence of a new era of communication which Castells [7] referred to as the era of mass-self communication. The delivery of information on the internet can be categorized as a mass communication activity because it has the potential to reach a wide audience globally such as when we upload videos on Youtube, or deliver messages through *mailing lists* or *groups* on social

media. At the same time, the messages we send over the internet can be referred to as individual communication because of the message that we create independently, we also choose what type of audience we want to go to and as an audience we can also selectively choose which message we will access. The birth of this new era of individual mass communication presents some challenges that must be anticipated to build a culture of civilized communication.

At the beginning of the development of the internet, the potential for participatory culture has not been widely recognized. Early generation of internet users still tend to get used to the culture of passive acceptance in the era of mass media so have not realized the potential to become active participants in this new medium. The introduction of applications such as weblogs, micro blogs and other forms of social media that are increasingly user friendly and allow users to play more significant role in content creation strongly supports the emergence of a culture of participation in the utilization of the internet. The development of internet technology has facilitated the transition from a culture of passive acceptance in the era of mass media in the late 20th century to a culture of active participation in the early 21st century [8].This cultural transition in practice elicited euphoria for internet users so that many internet users stuck to the concept of inappropriate freedom. Freedom of expression, which should be used responsibly, often turns into freedom of hate and freedom to distort information [9]. The freedom to criticize can turn into hate speech or defamation [10].

The huge growth of social media users in Indonesia has contributed significantly to the development of a culture of participation in internet use and the growth of a new form of 'social connection' in the virtual world [4]. This social connection is awakened through interactions built through networked publics as defined by danah boyd [11]. The interaction of internet users through their respective social media accounts has created a networked public, especially with features such as profiles, friend lists, comment rooms and updates of the latest information [11, p. 43]. Some popular social media platforms such as Facebook, Twitter and Instagram offer features that users can leverage to build social connections and build new imaginary communities beyond geographical boundaries.

These new imaginary communities are created consciously or unconsciously through a personalized process created and facilitated by the creators of social media platforms. These communities are often built in limited circles of friendships and followers. The phenomenon of limited social connections built by these communities raises concerns about the occurrence of social alienation due to the emergence of strong tendencies in selectively filtering information and creating filter bubbles or algorithmic enclaves in a particular network that makes it impossible to enter information and opinions that contradict the views of most network members [9], [12].

Digital literacy is a key word in trying to build civil communication in the digital age[13]. The concept of digital literacy can be interpreted variously but can simply be defined as the ability required by everyone to be able to live, learn and work in a digital society [14], [15]. UNESCO formulates more specific definitions of digital literacy as the ability to access, manage, understand, integrate, communicate, evaluate and make information safe and feasible through digital devices and networking technologies as a form of participation in digital devices and networked technologies for participation in economic and social life [16]. The definition stipulated above illustrates how widespread the scope of digital literacy must be for everyone to live well in the digital age.

Some countries have developed more comprehensive and systematic digital literacy framework as a reference in society's digital literacy improvement program. Efforts to develop a digital literacy framework in Indonesia have also been made by several institutions involved in the digital literacy movement in Indonesia although not yet systematic and comprehensive enough. More serious efforts to develop a digital literacy framework in Indonesia are still urgently needed to build a civilized digital society. This research aims to discuss several efforts in the development of more comprehensive and adaptive frameworks to face the challenge of industrial revolution 4.0 that can be used as a reference for the development of digital literacy in Indonesia.

2. METHOD

This research uses a qualitative approach using desk study method with the focus of studies on the identification and comparison of concepts or models of digital literacy frameworks initiated and developed in several countries as well as models developed by digital literacy activists in Indonesia.

Various efforts have been initiated to create a systematic formula to identify important elements in digital literacy/competency that every individual in the digital community must have. From the preliminary research, researchers identified four digital literacy frameworks that have been compiled and implemented in several countries. The frameworks were chosen based on several criteria, namely: 1) The framework developed by an organization or government and not work of individuals; 2) There is a relatively complete and openly accessible written document; 3) Covers aspects or areas of competency along with specific competencies. Based on the above criteria four digital literacy frameworks were selected namely the digital literacy framework developed by the Provincial Government of British

Columbia Canada, the digital competency framework developed by the Joint Research Centre of the European Union, the digital intelligence framework developed by DQ Institute Singapore and the digital literacy framework developed by ICT Watch Indonesia.

3. RESULT AND DISCUSSION

One of the efforts to develop a comprehensive digital literacy framework was conducted by the Provincial Government of British Columbia Canada. The Government of British Columbia defines digital literacy as the interest, attitude and ability of individuals to appropriately use digital technology and communication tools to access, manage, integrate, analyze and evaluate information, construct new knowledge, create and communicate with others [17]. The Provincial Government of British Columbia elaborated 6 characteristics of digital literacy namely: 1) Research and information literacy, which includes the ability to apply digital devices to collect, evaluate and use information; 2) Critical thinking, problem solving and decision making. These characteristics include the use of critical thinking skills to plan and conduct research, manage various activities, solve problems and make information-based decisions using appropriate digital tools and resources; 3) Creativity and innovation, including the ability to demonstrate creative thinking skills, develop knowledge, and improve innovative products and processes using technology; 4) Digital Citizenship, including the ability to understand humanitarian, cultural and social issues related to technology and its legal and ethical aspects; 5) Communication and collaboration, including the ability to understand humanitarian, cultural and social issues related to technology and its use the digital media environment to communicate and work collaboratively, to support individual learning and its contribution in helping others learn; 6) The operation of technology and concepts, including the ability to demonstrate an adequate understanding of the concepts of technology, systems and operations. An overview of the framework of the Provincial Government of British Columbia can be seen in the following table:

Table 1. British Columbia Digital Literacy Framework

Characteristic	Competence
Research and information literacy	Information literacy
	Information processing and management
Critical thinking, problem solving and decision-making	Specialized and advanced skills for learning
Creativity and innovation	Specialized and advanced skills for creative expression

Characteristic	Competence
Digital Citizenship	Internet safety
	Privacy and security
	Relationships and communication
	Cyberbullying
	Digital footprint and reputation
	Self-image and identity
	Creative credit and copyright
	Legal and ethical aspects
	Balanced attitude towards technology
	Understanding and awareness of the role of ICT in society
Communication and collaboration	Technology mediated communication and collaboration
Technology operations and concepts	General knowledge and functional skills
	Use in everyday life
	Informed decision making
	Seamless use demonstrating self-efficacy
	Learning about and with digital technologies

Source: https://www2.gov.bc.ca/gov/content/education-training/k-12/teach/teaching-tools/digital-literacy

The next framework is one developed by the Joint Research Centre of the European Union that develops the Concept of DigComp (Digital Competence Framework for Citizens). The study and development of this framework has been started since 2005 and continues to be updated until now. In this framework, 21 types of digital competencies are identified and organized in 5 competency areas that must be owned by individuals in the digital community, namely: 1) Information and data literacy; 2) Communication and collaboration; 3) Digital content creation; 4) Safety; and 5) Problem solving. The detail description of this framework can be seen in the following table:

Table 2. DigComp Digital Competency Framework

Competency Area	Competence
1. Information and data literacy	1.1. Browsing, searching, and filtering data, information, and digital content
	1.2. Evaluating data, information, and digital content
	1.3. Managing data, information, and digital content

2. Communication and collaboration	2.1. Interacting through digital technologies
	2.2. Sharing through digital technologies
	2.3. Engaging in citizenship through digital technologies
	2.4. Collaboration through digital technologies
	2.5. Netiquette
	2.6. Managing digital identity
3. Digital content creation	3.1. Developing digital content
	3.2. Integrating and re-elaborating digital content
	3.3. Copyright and licenses
	3.4. Programming
4. Safety	4.1. Protecting devices
	4.2. Protecting personal data and privacy
	4.3. Protecting health and well-being
	4.4. Protecting the environment
5. Problem solving	5.1. Solving technical problems
	5.2. Identifying needs and technological responses
	5.3. Creatively using digital technologies
	5.4. Identifying digital competence gaps
	5.5.

Source: Carretero et al, 2017

The competencies that have been identified are then further divided into 8 levels of ability from entry level to high specialist level [18].

In addition to the above two frameworks there is one new framework developed by the DQ Institute a global initiative focused on developing a new type of intelligence called the Digital *Intelligence Quotient* (DQ). According to Yuhyun Park [19] founder of DQ Institute, the era of industrial revolution 4.0 requires a new type of intelligence to complement the *shortcomings of Intelligence Quotient* (IQ) born in the era of industrial revolution 2.0 and *Emotional Intelligence Quotient* (EQ) born in the era of industrial revolution 3.0. Park (2019) describes EQ as a comprehensive digital competency unit rooted in the universal moral values of individuals that can be used to use, control, and create technologies for the advancement of humanity. In its development, DQ is grouped into eight areas namely:1) Digital identity; 2) Digital Use; 3) Digital safety; 4) Digital security; 5) Digital emotional intelligence; 6) Digital communication; 7) Digital literacy; and 8) Digital rights. Details of the eight areas can be found in the following table:

Table 3. Eight DQ areas

Area	Competency Coverage
Digital Identity	The ability to build a wholesome online and offline identity
Digital use	The ability to use technology in a balanced, healthy, and civic way
Digital safety	The ability to understand, mitigate and manage various cyber-risks through safe, responsible, and ethical use of technology
Digital security	The ability to detect, avoid, and manage different levels of cyber threats to protect data, devices, networks, and systems
Digital emotional intelligence	The ability to recognize, navigate, and express emotions in one's digital intra and inter-personal interactions
Digital communication	The ability to communicate and collaborate with others using technology
Digital literacy	The ability to find, read, evaluate, synthesize, create, adapt, and share information, media, and technology
Digital rights	The ability to understand and uphold human rights and legal rights when using technology

Source: DQ Global Standards Reports (2019)

Table 4. 24 DQ Competencies

Area	Competence
Digital identity	Digital citizen identity
	Digital co-creator identity
	Digital change-maker identity
Digital use	Balanced use of technology
	Healthy use of technology
	Civic use of technology
Digital safety	Behavioral cyber-risk management
	Content cyber-risk management
	Commercial and community cyber-risk management
Digital security	Personal cyber security management
	Network security management
	Organizational cybersecurity management
Digital emotional intelligence	Digital empathy
	Self-awareness and management
	Relationship management

Area	Competence
Digital communication	Digital footprints management
	Online communication and collaboration
	Public and mass communication
Digital literacy	Media and information literacy
	Content creation and computational literacy
	Data and artificial Intelligence literacy
Digital rights	Privacy management
	Intellectual property rights management
	Participation rights management

Source: DQ Global Standards Reports (2019)

Efforts to develop a digital literacy framework in Indonesia have also been made and need to be appreciated even though it is not yet comprehensive. For example, there is a digital literacy framework developed by ICT Watch, a non-governmental organization, that develops a digital literacy framework with a focus on 3 aspects of digital literacy namely protection, rights, and empowerment. Protection aspects include personal data protection, online security, and individual privacy. Aspects of rights include freedom of expression, intellectual property, and social activism. While the empowerment aspect includes citizen journalism, entrepreneurship, and information ethics [20]. An overview of this framework can be seen in the following table:

Table 5. ICT Watch Digital Literacy Framework

Aspect	Competence
Protection	Protection of personal data
	Online security
	Individual privacy
Rights	Freedom of expression
	Intellectual property
	Social activism
Empowerment	Citizen Journalism
	Entrepreneurship
	Ethics information

Source: ICT Watch (2017)

In addition to the framework mentioned above, the researchers have not found other initiatives to formulate and create a comprehensive digital literacy framework for strengthening digital competencies in Indonesia.

Of the four digital literacy frameworks selected in this study each framework has uniqueness in the grouping or identifying the specific competency included, but similarities are also found in the competencies identified in every framework. Competencies that are found in all frameworks can be seen as significant and universal competencies which need to be included for the development of digital literacy frameworks globally, while different aspects can be further reviewed for the development of frameworks that suit local needs.

In terms of the use of name for each framework is also interesting to review. The framework developed by the provincial government of British Columbia and ICT Watch Indonesia uses the name *digital literacy* framework, while the framework developed by the Joint Research Centre of the European Union uses the name *digital competence*. The latest concept developed by DQ Institute uses the name digital *intelligence*. The use of the terms digital competence and digital intelligence shows a tendency to expand the scope of knowledge and skills that every individual in the digital community must have and demonstrates the need for continuous improvement in the development of a digital literacy framework capable of adapting to technological developments and the dynamics of digital societies.

The results of this study also show that the discourse of developing a digital literacy framework in Indonesia is still in its infancy and needs to get more serious attention from governments and non-governmental institutions that have concerns about the development of digital literacy. The Government of Indonesia through the Ministry of Communication and Informatics has initiated an excellent initiation in 2017 by initiating the digital literacy movement and developing collaboration through siberkreasi (cyber-creation) programs. However, digital literacy programs both initiated by the government through siberkreasi and various other initiatives developed by non-governmental institutions still appear to be not integrated and have not been systematically directed to face the challenges of an increasingly complex digital society.

4. CONCLUSION

Several local and global initiatives in developing comprehensive digital literacy frameworks have been initiated to strengthen people's digital competencies in the era of the industrial revolution 4.0. These initiatives indicate a dynamic and progressive efforts in the development of more comprehensive and adaptive frameworks to face the challenge of a fast-growing digital society. More serious efforts to develop a digital literacy framework in Indonesia are still urgently needed as a guideline to build a civilized digital society. The digital literacy movement that has been launched in 2017 as well as various initiatives that have been run by various elements of society in driving digital literacy should be continued with more systematic efforts in drafting a comprehensive and measurable digital literacy

framework to improve the quality of digital literacy of Indonesian society.

AUTHORS' CONTRIBUTIONS

The authors confirm contribution to the paper as follows: study conception and design: Taufiqur Rahman, Ayu Amalia and Zuhdan Aziz.; data collection: Taufiqur Rahman and Ayu Amalia; analysis and interpretation of results: Taufiqur Rahman, Ayu Amalia and Zuhdan Aziz; draft manuscript preparation: Taufiqur Rahman.

ACKNOWLEDGMENTS

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