

Digital Divide: A Critical Approach to Digital Literacy in ‘Making Indonesia 4.0’

Nadira Maurizka Kuputri^{1*}

¹*Department of Cultural & Media Studies, Graduate School, Universitas Gadjah Mada, Yogyakarta, Indonesia*

**Corresponding author. Email: nadiramrzk1998@gmail.com*

ABSTRACT

Aside from its facility, industrial revolution 4.0 brings a new issue to the block; the digital divide. This paper aims to find some antecedents of the digital divide and some solutions in Bourdieu’s digital sociology perspective that can maximize Indonesia’s potential human resources. Through the conducted literature study, this paper found that one of the antecedents is intergenerational poverty in urban and rural areas of Indonesia, which impacted the unequal digital infrastructure. If the infrastructure is evenly distributed and digital capital is owned to every students, they will be more motivated to develop their potential to gain 21st-century skills in order ‘Making Indonesia 4.0’.

Keywords: *digital divide, digital capital, intergenerational poverty, industrial revolution*

1. INTRODUCTION

Although most schools only saw the negative impact of social media on their students, it cannot be denied that social media is part of their lives [10]. Reference [10] saw the importance of using social media platforms in the teaching and learning process to support students’ school academic achievement. This gives the advantages to students who are categorized as digital natives. As someone who is digital natives, they are constantly in contact with each other, reading and writing through the internet and these all much influenced by interactions in the digital world [24]. And that is needed remembering this world is already entering the industrial revolution 4.0. Students are supposed to adapt because their generation is going to be much affected shortly soon.

The term industrial revolution 4.0 first used in 2011 by Germany, its identified with the digital revolution. McKinsey Global Institute analyzes that industrial revolution 4.0 will give an impact on the availability of working fields because today robots and machines are replacing human roles [16]. So if it does not anticipate earlier, lots of people who do not have appropriate 21st-century skills will lose their jobs. Specific skills such as management and evaluation, collaboration, critical thinking, creativity, and problem-solving [22] are needed in order not to be immersed in the digital splendor offered by industry 4.0. One of the government’s efforts, the Ministry of Industry particularly, by launching a roadmap named

Making Indonesia 4.0 that focuses on the implementation of the food and beverage industry (F&B), textile, automotive, electronics, and chemistry. In its execution, the Indonesian government also encourages the enhancement of skills and capabilities of the digital era’s workforce [16].

Therefore, the basic information and communications technology skills are much needed. The importance of information and communication technology (ICT) has become the United Nations main focus since the World Summit Information Society (WSIS) which held in 2003 and 2005. In the discussion, the UN places great emphasis on ICTs inequitable distribution of access, uses, and sharing information and knowledge to support socio-economic development and improve the life quality of the people [17]. ICT becomes a fundamental part of life as other basic things in life such as water, electricity, and roadway. Because in this era, information is also the everyday things we need. Claimed the internet of things, individuals are now must have equal access and capabilities to ICT to be able to survive. To balance the industrial revolution, infrastructure in Indonesia began to develop in the education field by doing hybrid/blended learning powered by SPADA Indonesia (Indonesian online learning system) [2].

Although the use of the internet in Indonesia has reached 64% of Indonesian total population [23], but it not yet determined if the readiness of infrastructure is in line with the readiness of its human resources. van Deursen and Helsper stated that the use of digital media is control by

one's socio-economy capital [20]. van Dijk added, the importance of information capital as one's ability to have proper information, is determined from the ownership of access to computers and internet networks, evaluation abilities, information-seeking motivation and its implementation. The ownership of information capital are related to 'digital capital' as one's ability to obtain and uses information as the foundation of digital literacy [21]. The digital and information capital are being key study to the Bourdieusian's concept of the digital divide in digital sociology perspectives. In which someone with excessive digital capabilities, can easily access information through the internet and certainly has more power to use it, compared to others who lack this ability. Digital capital makes user effectively use the internet, which then gives them an advantage in their personal and professional lives [7]. This ability is not only a problem of internet access gaps but also in the context of the users' life as a whole.

In related research, Robinson draws Bourdieu's research map by refining the concept of the habitus of information about how the ability to use digital technology becomes something that is accustomed to the daily lives of those who can access information (information capital-cultural capital). Advantaged students (in terms of their socio-economic status) are accustomed to involving technology to develop their skills. On the other hand, disadvantaged students usually only use the internet for tasks [if there are necessities in them and if there is temporal urgency], which Bourdieu defines as 'taste for the necessary' [15]. This disparity inability will continue to enlarge the digital divide if only the 'competent' can get valuable information and the 'incompetent' will continue to spin in their structural poverty wheels. Access to the media and its supporting infrastructure is still felt stronger by the inhabitants of Java and other regions that have a strong economic system [13]. Decreasing the number of poor people to around 9.82% of the total population in Indonesia does not change 40% of the poor and vulnerable [18]. Although direct assistance from the government has been done, most of them are only temporary. In what follows, it can be concluded what the community needs are not only economic assistance, but also a hand to develop their social and cultural resilience elements to survive. Poverty has a wide impact on people's lives, one of which is preventing them from accessing education and even developing their potential to possess 21st-century skills as mentioned above.

Students with lower economic conditions tend to be identified with low knowledge and skills so they are required to improve their education and skills through informal channels, such as accessing matters relating to self-development and self-evaluation on the internet. Reference [12] study of high school students in Italy shows that students with middle economic conditions tend to make more use of their online time to socialize on social media or

play games. With a large percentage of social media usage in Indonesia, the digital divide becomes a matter of concern. Considering that social media is still widely trusted as a source of information, that turns out to only focuses on profits and commodities.

In addition to Bourdieu's concept of digital sociology, this study will further analyze digital disparities from the critical perspective of Golding & Murdock who assume to view media more holistically because I believe the connection between media content and human resources quality are inseparable in the near future. Remembering the production, distribution, and consumption of media takes place in a social, economic, and political environment that influences one another. Shallow media content gives the impression that the media loses its public character due to the absence of an overseeing party, including the state in its laws and regulations [13]. The use of social media as a leisure activity carried out without coercion will facilitate information received by individuals, this can have a bad impact if most of the information received is shallow and essentialist. If students as Indonesia's potential human resources continue to hold fast to information from social media without being accompanied by qualified digital literacy and information capabilities, Making Indonesia 4.0 will not be realized sooner.

This research aims to answer questions such as;

1. What factors hinder students' digital literacy access? Judging from the concept of Bourdieu's digital sociology.
2. How does that affect the social and cultural resilience of students to adapt to the era of the industrial revolution 4.0?

1.2. Paper Contribution

The development of Indonesia's education system is not comparable to the average infrastructure to support this development. Both poverty in urban and rural areas are the cause of the lack of student digital capital to achieve 'Making Indonesia 4.0', which requires 21st-century skills. Looking at the digital divide through the perspective of Bourdieu's digital capital, this research helps broaden our views to critically understand the way students use the internet to increase their potential can be influenced by their family habitus and environment [including school and friends]. Therefore, according to this paper, improving the economy of underprivileged families is something that must be done to close the gap.

1.2. Paper Structure

Section 2 of this paper introduces the main concept of Bourdieu's digital sociology which used to examine the case study of digital divide in 'Making Indonesia 4.0'. Section 3 presents the discussion on how the

digital capital could be the reason why intergenerational poverty broaden the gaps between students. And more indepth explanation at Section 4 on how intergenerational poverty works in hinder student’s digital literacy access. Finally, Section 6 concludes the paper and presents possible implications in tighten the gaps.

2. BOURDIEU’S SOCIO-DIGITAL THEORY PERSPECTIVES

This research is a descriptive analysis case study with an approach to Bourdieu's digital sociology. Bourdieu's concept of digital sociology has been widely used by researchers to examine digital inequality by using digital traces of individuals in online media. Bourdieu's sociology theory is considered capable of linking its relevance to the digital world because of the inherent nature of his theory with empirical research. Its concrete nature in combining elements of realism and constructionism, and the close links between the concepts he mobilizes with other disciplines and his participation in interdisciplinary research collaboration [7].

Bourdieu is a French sociologist. Bourdieu's initial thought about dominance began when Bourdieu, a child from a less educated family, received a government scholarship by attending ENS (*Ecole Normale Supérieure*), one of the A-list high schools in France. Without engulfed with the surrounding environment in his school which is mostly bourgeois, Bourdieu instead uses his inferiority complex to form his critical mindset in dismantling domination in society. According to Bourdieu, capital can be formed by assets such as economic, social, or cultural assets, which are understood to work in an arena that appears to be an arena of autonomous social life [6]. By using the basic focus of his analysis on the relations of economic production and culture, Bourdieu believes cultural resources [influenced by capital, arena, and habitus] have an important role for modern societies in determining their social position [9].

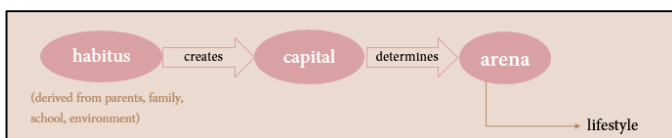


Figure 1 Bourdieu’s *Habitus* Framework

3. DISCUSSION

3.1 Intergenerational Poverty and Digital Capital Formation

The rapid development of infrastructure in urban areas has not been effectively curing the poverty in Indonesia, even worse. In September 2019, poverty in Indonesia has decreased to 9.22% of the total population of Indonesia [1]. However, as a result of the rapid development of infrastructure in the city, it has led to an increase in urbanization and implies an increasingly high land requirement. So that rural areas around big cities such as Bekasi, Depok, and Tangerang lose their agricultural land and make them unable to be independent of their production equipment. This condition shows rural opportunities as a source of labor for urban industries, but without seeing that the rural poor have limited skills and knowledge. This is the cause of increasing poverty in urban areas [18].

Various government programs have been deployed to overcome poverty levels in Indonesia, such as *Beras Miskin* (Raskin), *Bantuan Langsung Tunai*/ cash direct assistance (BLT), and also training such as the National Program for Community Empowerment (PNPM). Even so, these aids are less influential and are felt to be less on target and are momentary. Impoverished individuals in urban or rural areas have difficulty getting out of their poverty chains. It means that those born from poor families are trapped in poverty and then form new poor families. If economic assistance has not been able to overcome poverty in Indonesia, then that has not been the answer, therefore the poor also need help to be able to develop their socio-cultural resilience to survive [18].

The poverty issues are inseparable from world problems and must be dealt with and understood interdependently with other programs [8]. Poverty, which is an inevitable sight in developed countries, can impact a variety of other pitfalls, one of which is education which is the basic right of every human being. Education is a shield to eradicate ignorance and elude from structural poverty and part of the social and cultural resilience of an individual. However, there is rarely someone who is born with resilience, so the role of family and community [such as the environment and the school] has a major impact on building resilience [18]. Cultural capital is a form of one's ability to possess the knowledge, education, skills, and luck [5]. Cultural capital is derived from the habitus of their parents who continuously become one's mindset and shaping the way they behave in the social environment. Cultural capital becomes something that is 'given' by the family and the individual community. Eryanto and Rika indicated a benefaction from cultural capital to the academic achievement of students in Jakarta. The expertise and

knowledge passed on from their parents turned out to be prominent in shaping students into outstanding individuals, it can be concluded that these students have enough cultural capital [5]. In the other hand, Micheli [12] in understanding internet use by teenagers from different social backgrounds, found that cultural capital and parents occupational status do not associate with broader social media use, but instead it is positively related with online-information seeking, to be more concerned with capital enhancing activities. One of the adherents of cultural capital is digital capital which is a person's asset in the arena of their social life, which further enters Bourdieu's theory of digital sociology with the concepts of habitus, capital, and arenas [7]. In reference 7, they are digitalizing the digital back proposed by the Bourdieusian. That digital capital and digital information become key concepts in understanding the digital divide. The different amount of capital with each students gave some kind of separation that is binary between advantaged and disadvantaged students (in terms of their digital capital).

Digital capital and information capital that are part of cultural capital certainly do not merely emerge. Through Bourdieu's concept of habitus, the way individuals shape their thoughts can influence the capital they have and therefore impacts the arena they live in [and are interrelated]. Habitus is formed from a long process of individual experiences when they interact in the social world. Bourdieu shared three types of education that can form habitus, namely family, social, and school education [9]. Through this habitus, a lifestyle whose name is created through the process of socialization. The lifestyle of each individual determines their arena in the professional world, and this lifestyle determines a different class position. Individuals behave based on their habitus without thinking and without consideration, so that habitus can be said to be a social picture of someone [9]. The lifestyle that determines the position of an individual is influenced by the economic capital and cultural capital of a person, which also influences the way individuals use technology to facilitate themselves with qualified information to improve their quality of life. In his logic about the social world, Bourdieu said that *'the real is relational'* [3]. The meaning is, in looking at students' digital literacy, it is not necessarily only seen through their interests as individuals [seen separately], but we should examine as a whole, like comparing it with other students' digital literacy levels or with their daily lives at school and family, because of all it is interdependent.

3.2 Digital Divides in 'Making Indonesia 4.0'

Germany, as a role model for Indonesia in facing the era of the industrial revolution 4.0, states that

this era will sincerely change the work way and our life [11]. Anticipating significant changes in some crucial aspects in the industrial world, the Indonesian Ministry of Industry undertook a strategy in the form of Making Indonesia 4.0 to realize the vision of Indonesia as the top 10 countries with the strongest economy in 2030 [16]. One step to realizing this is through improving the quality of human resources. The Government of Indonesia, in its efforts to deal with the era of the industrial revolution 4.0 calls on educational institutions to execute a hybrid/ blended learning model through SPADA [Indonesian Online Learning System] since 2014 for higher education. The learning model, as a solution to, the high tuition fees; limited lecturers; and a large number of students, requiring the availability of adequate internet network infrastructure and the readiness of its human resources [14]. Prof. Moh. Nasir, the Minister of Research, Technology, and the Higher Education Republic of Indonesia, at the launch of Hybrid Learning through SPADA also stated that the community and the academic community are expected to have the ability of technology literacy, data literacy, and humanitarian literacy [2]. Hybrid Learning allows students to evaluate themselves, which parts of the offline class they lack in, they can cover through e-learning sessions, and *vice versa*.

Digital capital is still open in various debates, and it is seen as the ability to found out, access, and interpret information found through new media [19]. Of course with the internet and other supporting technologies such as computers, smartphones, or other electronic devices we can access information. Digital literacy skills can be influenced by people around us, like friends, teachers, and family. Considering that infrastructure in Indonesia has not been evenly distributed, gaps still arise regarding access and use of electronic devices to support the digital literacy capabilities of the community. Students in schools with sufficient socioeconomic status tend to use computers to solve problems, editing, planning, and conducting internet-based research. Whereas students in schools with low socioeconomic status tend to use their computers for more basic matters such as searching for definitions on the internet and practicing some other basic abilities [19]. The statement was also supported by Micheli which was mentioned in the introduction.

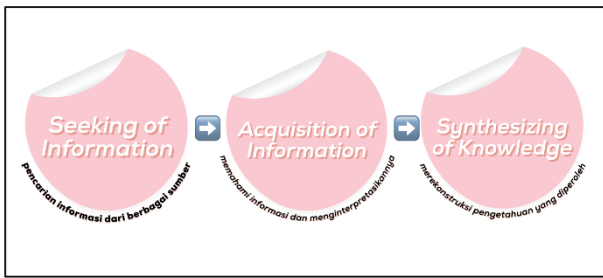


Figure 2 Steps in Blended Learning (SPADA).

Source:

https://sibatik.kemdikbud.go.id/inovatif/assets/file_upload/pengantar/pdf/pengantar_3.pdf

The first step, ‘Seeking for Information’, in order to push the 21st-century skills, student must have the ability to be creative and critical to look for various answers from multiple information reliable sources to discuss with their group and teachers.

Based on the concept of Habitus by Bourdieu, the digital divide faced by students in their efforts to develop their personalities to be better prepared to face the era of the industrial revolution 4.0, indicates the involvement of families. It is not to blame if students do not elaborate on their internet-based assignments when they have limited internet and computer access at home. Intergenerational poverty in Indonesia could be the reason for the large number of high school students in Indonesia having minimal digital literacy skills, especially vocational students who are the focus of the government in Making Indonesia 4.0. The level of student attention to the use of ICT is influenced by their family’s digital and information habits. Families who use ICT more frequently in their daily activities in the context of developing their information capital will better enable students to pursue achievements by maximizing the use of digital technology. conversely, families who were more inclined to use ICT for entertainment will focus more on using digital technology for entertainment [7]. Student who do not have access to internet and computer, is already struggling with the first step in blended learning (Figure 2). The urban poor need strong social networks to be able to survive in the rapid development of the city. While the poor in rural areas have low levels of education and skills [18], therefore prospective workers who are currently in economic difficulties, need greater attention to have digital capital so they can escape intergenerational poverty.

Internet of things era makes digital literacy a necessity for all people to be able to survive in this disruptive era. One of the reasons that Indonesia has not been able to touch the era of the industrial revolution 5.0 is because we have not yet finished with the 4.0 era, ever far from it. There are still many individuals who have not felt the positive impact of digital on their development process. The digital divide is often associated with aspects of the

political economy related to the unequal ownership of capital of stakeholders who control information and policies in using the internet. Dahlberg [2015] in his article concluded, from the many enthusiasm of social media users, it turns out that there is a lot of inequality between owners and users. Dahlberg’s article tries to find out the inequality of empowerment resulting from the structure and relationship of ownership of social media platforms that control the communication system. That what is viral on social media arises because of the control of the owners of social media capital, where they only bring up something that benefits them without thinking that social media has a strong influential stream that only leads to commodification. By having digital capital, individuals will be wiser in choosing information that is beneficial for themselves on a commodified social media platform.

4. CONCLUSION

The issue of the digital divide cannot be seen separately. Family habits and digital capital greatly influence how individuals behave to develop their potential. Certainly bound to their socio-economic aspects that lead to widening the gap in the use of digital technology. Some of the causes of the digital divide that are based on this article is intergenerational poverty in rural and urban areas in Indonesia which results in uneven infrastructure development, as one of the causes of a person’s low digital capital. Thus, the impact on the use of the internet is underutilized, because there are still many of the students who spend their time on the internet for entertainment only and not for enhancing their information capital to have resilience in this era.

Digital capital has become a person’s fundamental ability in the era of industrial revolution 4.0, considering that ICTs are an inseparable part of everyday life. By owning this digital capital, individuals can also simultaneously become watchdogs of social media content to improve the quality of media itself [13], which are more democratic and public-side. If adolescent as Indonesia’s potential human resources continue to hold fast to information from social media without being accompanied with enough digital and information capital, Making Indonesia 4.0 is going to be a ‘failed goals’ by 2030. Just having the motivation to be a literate generation of the industrial revolution is not enough to fulfill ‘Making Indonesia 4.0’, it takes concrete steps and cooperation between the government, educational institutions, and industry to achieve it. Such as maximizing government strategies through SPADA (Indonesian Online Learning System) with its blended learning.

If this hybrid/blended learning is more occupied with the teaching and learning process both in school and in college, the value of student self-evaluation increases, and they will be more self-assured in determining what is suitable and what is not for them. Making it easier for them to develop their potential. Then, strengthening the hybrid learning model by the government and the academic community will make it easier for students to deal with unexpected learning situations such as the COVID-19 pandemic that was taking place at the time of this article was written.

REFERENCES

- [1] Badan Pusat Statistik. [2020, Januari 15]. Persentase Penduduk Miskin September 2019 turun menjadi 9,22 persen. *Badan Pusat Statistik*. <https://www.bps.go.id/pressrelease/2020/01/15/1743/persentase-penduduk-miskin-september-2019-turun-menjadi-9-22-persen.html>
- [2] Belmawa [Dit. Akademik]. [2018, Mei 13]. Menristekdikti Luncurkan *E-Learning/ Hybrid Learning*. Strategi Pendidikan Tinggi untuk Kaum Millennial. *Lembaga Layanan Pendidikan Tinggi*. <https://ldikti12.ristekdikti.go.id/2018/05/13/menristekdikti-luncurkan-e-learning-hybrid-learning-strategi-pendidikan-tinggi.html>
- [3] Bourdieu, P. [1995]. Physical Space, Social Space and Habitus. *University of Oslo*, 1–20.
- [4] Dahlberg, L. [2015]. Expanding Digital Divides Research: A Critical Political Economy of Social Media. *The Communication Review*, 18[4], 271–293. <http://doi.org/10.1080/10714421.2015.1085777>
- [5] Eryanto, H., & Rika, D. [2013]. Pengaruh Modal Budaya, Tingkat Pendidikan Orang Tua dan Tingkat Pendapatan Orang Tua Terhadap Prestasi Akademik Pada Mahasiswa Fakultas Ekonomi Universitas Negeri Jakarta. *Jurnal Pendidikan Ekonomi dan Bisnis*, 1[1], 39–61. <https://doi.org/10.21009/JPEB.001.1.3>
- [6] Halford, S., & Savage, M. [2010]. Reconceptualizing Digital Social Inequality. *Information, Communication & Society*, 13[7], 937–955. <https://doi.org/10.1080/1369118X.2010.499956>
- [7] Ignatow, G., & Robinson, L. [2017]. Pierre Bourdieu: Theorizing the digital. *Information, Communication & Society*, 20[7], 950–966. <https://doi.org/http://dx.doi.org/10.1080/1369118X.2017.13015119>
- [8] Ishatono, & Raharjo, S. T. [2016]. Sustainable Development Goals [SDGs] dan Pengentasan Kemiskinan. *Share: Social Work Journal*, 6[2], 154–272. <https://doi.org/10.24198/share.v6i2.13198>
- [9] Krisdinanto, N. [2014]. Pierre Bourdieu, Sang Juru Damai. *KANAL*, 2[2], 107–206.
- [10] Krutka, D. G., & Carpenter, J. P. [t.t.]. Why Social Media Must Have a Place in Schools. *Kappa Delta Pi*, 52, 6–10. <https://doi.org/10.1080/00228958.2016.1123048>
- [11] Kusdiyanti, H., Zanky, M. N., & Wati, A. P. [2020]. Blended Learning for Augmented Reality to Increase Student Competitiveness the Filling Subject Toward Making Indonesia 4.0. *KnE Social Sciences*, 2020[The 3rd International Research Conference on Economics and Business], 88–100. <https://doi.org/10.18502/kss.v4i7.6845>
- [12] Micheli, M. [2015]. Digital Distinctions and Inequalities. *Communication and Information Technologies Annual*. 55-87. Bingley. UK: Emerald Group Publishing Limited.
- [13] Nugroho, Y., Siregar, M. F., & Laksmi, S. [2012]. Engaging Media, Empowering Society: Assessing Media Policy and Governance in Indonesia through the Lens of Citizens' Rights [Edisi Bahasa Indonesia]. CIPG dan HIVOS. <http://cipg.or.id/wp-content/uploads/2015/06/MEDIA-1-Kebijakan-Media-2012.pdf>
- [14] Risdianto, E. [2019]. Analisis Pendidikan Indonesia di Era Revolusi Industri 4.0. *unpublished*, 1–16.
- [15] Robinson, L. [2009]. A Taste for The Necessary: A Bourdieuan Approach to Digital Inequality. *Taylor and Francis*, 12[4], 488–507. <https://doi.org/10.1080/13691180902857678>
- [16] Satya, V. E. [2018]. Strategi Indonesia Menghadapi Industri 4.0. *Puslit BKD RI*, X[09], 19–24.
- [17] SDPPI Kominfo. [2005, Desember 4]. Eksekutif Summary Laporan Delegasi RI World Summit on the Information Society [WSIS]. *SDPPI Kominfo*. <https://www.postel.go.id/berita-eksekutif-summary-laporan-delegasi-ri-world-summit-on-the-information-socie-6-1318>
- [18] Thung Ju Lan [Ed.]. [2019]. *Tinjauan Kritis Ketahanan Sosial Masyarakat Miskin Perkotaan dan Perdesaan: Ruang Sosial, Kebijakan, dan Pola Kerentanan Sosial*. LIPI Press. <http://penerbit.lipi.go.id/data/naskah1579059735.pdf>
- [19] Underwood, C., Parker, L., & Stone, L. [2013]. Getting it together: Relational habitus in the emergence of digital literacies. *Learning Media and Technology*, 38[4], 487–494. <http://dx.doi.org/10.1080/17439884.2013.770403>
- [20] van Deursen, A., & Helsper, E. J. [2015]. The third level digital divide: Who benefits most from being online? In L. Robinson, S. R. Cotten, J. Schulz, T. M. Hale, & A. Williams [Eds.]. *Emerald Group Publishing Limited*, 10, 29–52.
- [21] van Dijk, J. A. G. M. [5M]. *The Deepening Divide: Inequality in the Information Society*. Sage Publication.
- [22] van Laar, E., van Deursen, A. J. A. M., van Dijk, J. A. G. M., & De Haan, J. [2019]. The Sequential and Conditional Nature of 21st-Century Digital Skills. *International Journal of Communication*, 13[2019], 3462–3487.
- [23] We Are Social, & Jayani, D. H. [2020, Februari 26]. Orang Indonesia Habiskan Hampir 8 Jam untuk Berinternet. *Databoks*. <https://databoks.katadata.co.id/datapublish/2020/02/26/indonesia-habiskan-hampir-8-jam-untuk-berinternet>
- [24] Williams, W. S., & Moody, A. L. [2019]. Analyzed Selfie: Stereotype Enactment, Projection, and Identification Among Digitally Native Black Girls. *Taylor and Francis*, 42[3–4], 366–384. <https://doi.org/10.1080/02703149.2019.1622901>
- [25] M. Young, *The Technical Writer's Handbook*. Mill Valley, CA: University Science, 1989.