The Road to Developing Students' Digital Fluency: The Role of Personality Traits

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Abstract. The rapid development of technology, especially in the digital area, requires humans to develop. Understanding and the ability to use technology are no longer enough to deal with technological advances. Therefore, developing digital fluency in everyone is necessary, and higher education has a significant role in this. Personality description is chosen as the entrance to the development of digital fluency, especially for students. Using a questionnaire distributed through BINUS Maya, which was then connected to the Lumina Spark online system, we collected 2014 participants from various majors at the undergraduate level. Out of the 24 personality traits measured in the Lumina Spark, adaptable, flexible, and radical do not significantly correlate with personality. Through regression analysis, ten traits have a role in predicting students' digital fluency. The results of this study can be used to develop activity programs for students, especially in the classroom, so that the habituation process can run naturally along with lecture interactions.

1 Introduction

Technological development is an inseparable part of the development of human life. They started from steam engines, printing machines, electricity, computers, and smartphones to artificial intelligence. Regardless of the positive and negative sides, technological developments encourage changes in the way humans work, carry out activities, and communicate with others. Today's emerging technologies, such as artificial intelligence, robotics, *Internet of Things* (IoT), nanotechnology, *quantum computing*, smart vehicles, and *3-D printing*, enable automation in many ways. These technologies focus on digital connections that allow communication between machines and between machines and their products and vice versa [1] so that production machines are no longer just processing products. Still, the product can "communicate" with its production machines to direct what to do [2].

These technological developments are revolutionizing the way and process of working globally and pushing humans into the Industrial Revolution 4.0 [3]. In this revolution, according to [3], physical systems and virtual systems will collaborate flexibly, which allows customization in products and the creation of new work operating models. In this revolution, technology develops in various fields, whether physical, digital, to biological. However, the main character is not the development of technology, but rather the possibility of interaction between technologies in all these fields, which can also occur automatically and flexibly [3].

The Industrial Revolution 4.0 impacted human life, especially in the economy, business, and government, both at the community and individual levels [3]. These impacts have two sides. On the optimistic side, [3] also wrote that this revolution provides opportunities for strengthening and empowering all parties. While on the pessimistic side, there is a fear in society that many people will lose their jobs because they are replaced by machines or robots [4]. A reasonable suspicion, considering that technological developments also encourage an increase in work capacity, from previously only being able to make 20 items in one day involving five people to 100 items in a day using 1-2 machines. From once using the services of a photographer, we can process and edit photos independently through software. The capacity building itself then changes the way of working and the nature of a job, from being exclusive to being able to be used by everyone independently [4].

However, all changes must occur in accordance with the development of innovation and creativity that happens in society, and these developments cannot be turned off. Indeed, many jobs are taken over by machines, but many new jobs have emerged due to technological developments. One thing that needs to be done is adapting to change, namely by developing new skills to function effectively [4], especially skills related to mastering technology [5].

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Facing technological developments will require improvements in the area of education [4]. In the Industrial Revolution 4.0, technology is getting smarter. They can communicate with each other across technologies and can customize their own systems. Therefore, according to [4] , education is needed that is able to encourage each individual to be a *lifelong learner*, that is, independently capable and motivated to increase their capacity by learning from various sources so that they can continue to develop and survive in this era of smart technology. For this reason, education needs to equip each teaching participant with literacy about humans, technology, data [4] . In technological literacy, the emphasis is on understanding the individual about the basic principles of the technology used, while data literacy emphasizes the individual's understanding and ability to analyze data, especially big data, to find the meaning of the data and various information that continues to flood it throughout the entire world. the technological device he uses, is also able to know when and where to look for data or information [4]. Meanwhile, human literacy allows individuals to communicate and interact with others effectively and develop their own capacities to understand the differences between humans and have an overview of human behavior and the reasons behind each of these behaviors [4].

Those three literacies can be seen as part of digital literacy, which refers to the mastery of technology in the digital era and the skills in using technology and data to implement digital applications in various social contexts [6–9]. However, digital literacy is not enough to face the conditions of society that involve many developments in digital technology. According to experts, the digital era involves many changes and developments in technology, making the mastery of digital technology was not enough; it needs *digital fluency*, which emphasizes the individual's ability to adapt to technological changes, from choosing the right technology to maximizing its potential use [8], [10]–[12].

In contrast to digital literacy, which focuses more on understanding technology, digital fluency focuses on the ability to produce or create something new with technology, as well as knowing when and why to use the chosen technology and then using it smoothly [10], [13]. From a survey they conducted on professionals in the field of human resource development, [14] stated that in the Southeast Asia region, digital fluency is the top skill that a person needs to have, especially in the world of work. The next skill is resilience. This condition creates an urge for higher education to develop digital fluency in its students to be more prepared to face developments in the digital world so they can take a role in society.

1.1 Objectives

This study will focus on looking at the relationship and role of personality traits on digital fluency, especially at the student level. It is hoped that this research will have a pattern of personality traits that affect digital fluency, which can then be used to improve students' digital fluency through behavioral habits related to the personality traits.

2 Literature Review

Digital fluency is not about the ability to use technology but the ability to adapt to technology use. A person may be familiar and fluent in using the PowerPoint application to make presentations in front of clients, but when the pandemic forces him to use video conferencing applications to create presentations online, he may experience difficulties.

According to [11], digital fluency has three components: net-savviness, critical evaluative techniques, and diversity. *Net-savviness* refers to the practical understanding of how the internet or technology works, such as how search engines return results, how identity can be established and faked, or how images and videos can be altered. *Critical evaluative techniques* are the users' knowledge, ability, and action to assess the trustworthiness and accuracy of any digital information. These are both general critical thinking skills—such as understanding the difference between quality of evidence/information or triangulate source—and specific technological/online skills such as making videos or using online collaboration tools. *Diversity* refers to the extent to which users' online consumption is broad, varied, diverse, and aware of the cognitive biases that may be contained in any digital information. In line with that, [13] explains that digital fluency includes several fluencies, such as being fluent in asking questions, communicating especially communicating ideas, being fluent in using data for decision making, and being fluent in innovation. From this explanation, digital fluency includes the ability to analyze, synthesize, evaluate, and create in the context of technology and digital information.

Several factors can affect an individual's fluency in using digital technology. Personality is one of the factors that can be used to understand the development of digital literacy and individual fluency [15, 16]. In addition, personality can also be used to understand resistance to changes and developments in the use of technology in companies [17].

3 Methods

In this study, digital fluency is operationalized as the ability to interpret information and communicate ideas effectively and ethically in a digitally connected world and use relevant technology to construct meaning and create something. The preparation of the digital fluency questionnaire was carried out as part of the development of the BINUS Graduate Attributes measurement, which consisted of a total of 8 types of questionnaires. Adopting the three components of digital fluency from Miller and Bartlett [11] and the explanation from [13] , the researcher compiled a questionnaire using three components called a) ability to comprehend and

critically analyze to understand information, b) Ability to determine the right tools to simplify the implementation process, c) Ability to manipulate, transform, and move information across various media and platforms.

There are 14 numbers arranged using4-point Likert scale with response options: Strongly Disagree, Disagree, Agree, and Strongly Agree. This measurement has a very good level of reliability (α = .839) and good internal consistency (*r* = .399 - .583).

Table 1. Questionnaire Items for Digital Fluency

Components	Items
Ability to comprehend and critically analyze to understand information	I easily understand the information presented digitally in graphs and tables.
	I am able to relate the information received from various digital media to be used in my coursework.
	I check the validity of digital sources of information that I obtain digitally.
Ability to determine the right tools to simplify the implementation process	I have difficulty learning new media/technology.
	I have difficulty selecting the right software/application to support my lectures. (R)
	I am able to think critically to reveal the truth of information obtained digitally.
	I use media/technology effectively to help collaborate with friends.
	In searching for data/information to complete lecture assignments, I use the right media/technology.
Ability to manipulate, transform, and move information across various media and platforms	I feel confident with my ability in operating a computer. (R)
	The use of the appropriate media/technology to support the completion of my lecture assignments excites me.
	I am able to present information in various digital media that I know.
	I use supporting technology resources such as installing software, storage media (USB, cloud storage, etc.), supporting devices (webcam, mouse, keyboard, etc.), and so on.
	I process data/information appropriately by using a computer or other technology media.
	My limitations in using technology cause my tasks to take longer to complete. (R)

Notes. R = reverse coded

Personality measurement is done using Lumina Spark, which consists of 144 items. Lumina Spark is based on trait theory and measures 24 traits on a continuum [18]. Each quality is split into three personas, 1) underlying – how people function naturally; 2) everyday – people's everyday behavior; 3) overextended – how people sometimes overextend themselves. In this study, only everyday personas were used in the data processing.

4 Data Collection

Data collection was carried out on all undergraduate students at Bina Nusantara University from August to December 2021. Each student received a notification to fill out the BINUS Graduate Attribute (BGA) measurement, which consisted of 8 types of questionnaires, one of which was digital fluency. After filling out one of the BGA questionnaires, students get a link to fill out the Lumina questionnaire. There are 5934 participants who were recorded as filling out the questionnaire, but only 2014 participants filled out all the questionnaires completely, namely 8 BGA questionnaires and one personality questionnaire. Each participant who fills in completely gets a personality measurement report from Lumina Learning. Most participants who filled in completely were male and came from the first-year cohort.

Table 2. Participants' Demographics based on Gender and Cohorts

Gender	Cohorts	n	%	∑	%
Female	Fifth year	80	8.9	900	44.7
	Fourth-year	3	.3		
	Third-year	184	20.4		
	Second-year	158	17.6		
	First-year	475	52.8		
Male	Fifth year	108	9.7	1114	55.3
	Fourth-year	1	.1		
	Third-year	291	26.1		
	Second-year	217	19.5		
	First-year	497	44.6		

5 Results and Discussion

5.1 Numerical Results

Digital fluency and personality data were analyzed in 2 stages. First, the researcher analyzed the correlation between the two using the Spearman correlation because the data were not normally distributed.

Table 3. Correlation Analysis between Digital Fluency and Personality Traits

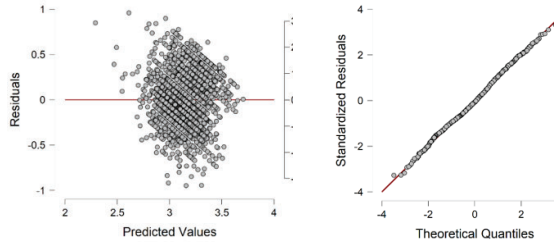
Personality traits	Digital fluency			Personality traits	Digital fluency	
	r	p			r	p
Accomodating	.126	< .001		Intimate	.076	< .001
Adaptable	-.010	.648		Logical	.181	< .001
Cautious	.060	.007		Measured	.205	< .001
Collaborative	.260	< .001		Observing	.306	< .001
Competitive	.176	< .001		Practical	.109	< .001
Conceptual	.331	< .001		Purposeful	.348	< .001
Demonstrative	.173	< .001		Radical	.039	.077

Empathetic	.265	< .001		Reliable	.362	< .001
Evidence-based	.126	< .001		Sociable	.110	< .001
Flexible	.011	.636		Spontaneous	-.065	.003
Imaginative	.249	< .001		Structured	.321	< .001

From the table above, there are 3 personality traits that do not have a significant relationship with digital fluency, namely adaptable (r= - .010, p> .05), flexible (r= .011; p> .05), and radical. (r= - .039; p> .05). This can be interpreted that digital fluency has no relationship with the tendency of individuals to adjust goals to conditions, avoid planning, or not following the general method.

5.2 Graphical Results

The second step is regression analysis to see the effect of each personality traits to digital fluency. As the result of unsignificant correlation, three traits—adaptable, flexible, and radical—were not included in the regression model. Regression analysis was carried out after proving that the assumption of homoscedasticity, normality, and linearity, as shown in Fig. 1, has not been violated.



(a) (b)

Figure 1. Residual plots: (a) Residual vs. Predicted, (b) Q-Q Plot Standardized Residuals

Regression analysis was carried out using the stepwise method (backward entry) to get a better predictive model with only a significant predictor. From table 4 it can be seen that the regression model with 10 personality traits can significantly predict 23.5% of the digital fluency variance ($F(10,2003)$= 62,986, p< .001, *Adj.* R^2= .235).

Table 4. Regression Analysis for Predicting Digital Fluency Using Personality Traits

Personality traits	**β**	**t**	**p**	**95% CI**	
				Lower	**Upper**
(constant)	1.878	29.626	< .001	1.754	2.003
Cautious	-.031	-2.777	.006	-.053	-.009
Collaborative	.040	3.396	< .001	.017	.063
Conceptual	.083	7.512	< .001	.062	.105
Empathetic	.039	3.383	< .001	.016	.061
Logical	.029	2.758	.006	.008	.050
Observing	.059	5.278	< .001	.037	.081
Purposeful	.060	5.207	< .001	.037	.083
Reliable	.057	4.828	< .001	.034	.080
Sociable	-.025	-3.140	.002	-.041	-.010
Tough	.036	3.349	< .001	.015	.057

Note. $F(10,2003)=62,986$, p< .001, Adj. R^2 = .235

Cautious and sociable have a negative role in digital fluency, which means individuals with a high tendency to stick to the usual ways or always build social networks have low digital fluency. On the other hand, *conceptual*, *purposeful*, *observing*, and *reliable* traits have the most prominent positive role in digital fluency.

5.3 Proposed Improvements

This result indicates that individuals who have a high tendency to work with abstract concepts, work effectively with clear goals, not in a hurry to act, and able to control themselves well are individuals who tend to have good digital fluency. Based on these results, we can develop digital fluency among students by helping them to identify the goals they want to achieve by using technology, willing to slowly learn the existing technology, and not rushing to choose an application just because it is famous or often used.

5.4 Validation

[16] and [15] said that personality is one of the factors that can be used to understand the development of digital literacy. The results of this study reaffirm it, however, not all personality traits have a role in digital fluency. Ten personality traits have role to predict digital fluency.

6 Conclusion

Digital fluency is not about the ability to use technology but actively learn new technologies and use them to achieve their goals. It includes the ability to analyze, synthesize, evaluate, and create in the context of technology and digital information. This study shows that these abilities can be predicted through personality traits. From the results of this study, it can be believed that individuals who have a good level of digital fluency are those who tend to be rational, able to work effective when they have clear goals, like to work with abstract concepts, able to control themselves well, and are not in a rush to do an action. In addition, digital fluency also covers human literacy, as seen in the collaborative and empathetic traits, which indicate that those who are digitally fluent can use technology for the common good. On the other hand, it is also seen that individuals who are high in digital fluency has the courage to try

new ways and not only use technology merely to socialize.

References

[1] B. Sniderman, M. Mahto, and M. J. Cotteleer, *Industry 4.0 and manufacturing ecosystems: Exploring the world of connected enterprises*. Deloitte University Press, 2016.
[2] W. MacDougall, *Industrie 4.0: Smart manufacturing for the future*. Berlin: Germany Trade and Invest, 2014.
[3] K. Schwab, "The fourth industrial revolution: What it means and how to respond," *www.weforum.org*, 2016. .
[4] J. E. Aoun, *Robot-Proof: Higher education in the age of artificial intelligence*. Cambridge, MA: The MIT Press, 2017.
[5] M. Gwata, "To flourish in the Fourth Industrial Revolution, we need to rethink these 3 things," *World Economic Forum*, 2019. .
[6] H. Beetham, "Revisiting digital capability for 2015," *Jisc Building Digital Capability Blog*, 2015. .
[7] A. M. Bjørgen and O. Erstad, "The connected child: tracing digital literacy from school to leisure," *Pedagogies*, vol. 10, no. 2, pp. 113–127, 2015.
[8] S. Park, *Digital capital*. London: Palgrave Macmillan, 2017.
[9] K. Ala-Mutka, "Mapping digital competence: Towards a conceptual understanding," 2011.
[10] S. Niessen, "What is digital fluency?," 2013.
[11] C. Miller and J. Bartlett, "'Digital fluency': towards young people's critical use of the internet," *J. Inf. Lit.*, vol. 6, no. 2, p. 35, 2012.
[12] N. Watts, "Developing digital fluency in higher education: A study in the acquisition of digital capability by academics in Irish higher education settings," University College Dublin, 2018.
[13] J. Sparrow, "Digital fluency: Preparing students to create big, bold problems," *Educause Review*, p. 54, 2018.
[14] LinkedIn Learning, "Workplace learning report 2021: Skill building in the new world of work," 2021.
[15] R. M. Green, "Predictors of digital fluency," Northwestern University, 2005.
[16] S. Ahmed and T. Rasheed, "Relationship between personality traits and digital literacy skills: a study of university librarians," *Digital Library Perspectives*, vol. 36, no. 2. pp. 191–206, 2020.
[17] J. A. Colquitt, J. R. Hollenbeck, D. R. Ilgen, J. A. Lepine, and L. Sheppard, "Computer-assisted communication and team decision-making performance: The moderating effect of openness to experience," *J. Appl. Psychol.*, vol. 87, no. 2, pp. 402–410, 2002.
[18] E. Brenstein and S. Desson, "Lumina Spark validity study" (unpublished manuscript), 2013.