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Research Article

Intelligence Style and Digital Literacy

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Abstract

The last decade has been the theater of the rapidly growing introduction of information technology (IT) into the classroom, prompting teachers to embrace this change in their routine. Unfortunately, university training and school administrations are slow adherents. Although all teachers use a mobile phone for their personal needs, some may still be reluctant to use IT at large in the classroom. The digital literacy (DL) has been reported to be related to five capacities: information processing, communication, content creation, safety, and problem solving. It is thus important to have a better understanding of the extent of DL of the teachers, among these dimensions. Among the potential explanation for differences observed in the degree of mastering of IT, some research points on the possible impact of dominant style of intelligence. This paper reports on an exploratory survey to determine the actual level of DL of teachers, measured with different approaches, and to verify whether there is a relationship between DL and intelligence style. It also studies the relationship between the different components of literacy, digital skills and whether there is an important link between different types of intelligence. Findings show that respondents are moderately digital literate/competent, strong in Existential and Intrapersonal Intelligences. In addition, results show the correlations between Intrapersonal Intelligence and Safety, Content Creation, and Communication, while Musical Intelligence is significantly correlated with Problem Solving.

Keywords: Digital Literacy, Digital Competency, Multiple Intelligence, Education

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Introduction

In contrast to past eras, the 21st century sees many drastic changes in lifestyle, needed job skills, and even social behaviour, and with these transitions, technological innovation can be seen as playing a significant role. These developments have also brought with them challenges in coping with learning the technology, especially since more and more of life's daily routines have migrated to the Information Age – communication, banking, gaming, shopping, social media, and even medical and government services (OECD, 2019). Therefore, in this rapidly changing and highly interconnected world, it is important that each person has a wide range of skills and competencies and will need to learn them continuously throughout their lives (Council of the European Union, 2018; Uerz, Volman, & Kral, 2018; Benali, Kaddouri, & Azzimani, 2018; Van Laar, van Deursen, van Dijk, & de Haan, 2017).

With all these developments in internationalization and globalization, it is necessary to note that the skills needed to build a functioning society have also been created or changed (Schwab, 2016). Since the introduction of water and steam as a source of power for production, society has undergone drastic advances, with key goals of improving productivity and quality of life (Lu, 2017). These eras are widely known as (1) Industry 1.0 with water and steam, (2) Industry 2.0 with mass manufacturing and assembly lines, (3) Industry 3.0 with electronics and computer technology, and (4) Industry 4.0 with more sofisticated technologies and artificial intelligence (Benešová & Tupa, 2017; Lu, 2017; Schwab, 2016).

These new technologies have a significant influence on education, resulting in a more qualified and highly trained workforce, as the skills taught decades earlier differ significantly from what will be expected in the next few years (Benešová, & Tupa, 2017; McKendrick, 2015). In tandem, the term "literacy" has also taken a new meaning. From the traditional definition of being able to just read and write, literacy has now become multi-faceted and incorporating various new literacies such as multicultural literacy, social or civic literacy, media literacy, financial literacy, DL, ecological literacy, and creative literacy (De Leon, 2020). These developments have pushed governments to formulate reference frameworks focusing on learning outcomes to guide schools to produce graduates who are ready to meet the needs of their community and society. DL frameworks and plans to promote it have emphasized its importance for everyone (Law, Woo, De la Torre, & Wong, 2018).

The following are some of the significant frameworks crafted by major international organizations:

Table 1: Frameworks

Organization	Description
Organisation for Economic Cooperation and Development (OECD, 2019)	developed a framework that " provides a comprehensive strategy to document how students access and use ICT resources in and outside of school, and to identify how teachers, schools and education systems integrate information and communication technology (ICT) into pedagogical practices and learning environments.
Council of the European Union (2018)	recommends key competencies for lifelong learning, with the aim that "everyone has the right to quality and inclusive education, training, and lifelong learning to maintain and acquire skills that enable them to participate fully in society and manage successfully transitions in the labor market."
United Nations (UN, 2017)	set 17 global goals covering various socio-economic issues for all member nations to achieve by the year

	2030, and one of these goals focuses on education – "to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all"
Association of Southeast Asian Nations (ASEAN, 2016)	established the ASEAN Qualifications Reference Framework, which is equal to all and gives a universal standard on education criteria, or qualifications, across participating ASEAN Member States with the following objectives: (1) support recognition of qualifications; (2) encourage the development of qualifications frameworks that can facilitate lifelong learning; (3) promote the development of national approaches to validating learning gained outside formal education; (4) promote and encourage education and learner mobility; (5) support worker mobility; (6) improve understanding of qualifications systems; and (7) promote higher quality qualifications systems.

Keeping up with these global initiatives, the Philippine educational system has also made a major paradigm change. Shifting from the ten-year basic education program to the new 12-year program, or K-12 curriculum, Philippine education progressed from the traditional content-based education to outcomes-based education, allowing its graduates to be fully prepared and qualified for the workforce.

Some researchers discuss that the new generation of learners think and learn differently from the previous generations, having been exposed to digital technologies at a young age, making these innovations a part of their daily lives. They may have already gained much technical experience before they even reach the university (Lai & Hong, 2014). Prensky (2001), who coined the terms, "digital natives, digital immigrants, and digital aliens," suggested that higher education adapts and responds to these new types of learners, and has "more technology-driven, spontaneous, and multi-sensory" teaching-learning styles and strategies. With students being more familiar with technology and are more comfortable with a technology-rich learning environment, it is vital for schools to understand the importance of digital communication, to discover new ways of thinking and processing the learners' knowledge, and integrate it into their academic environments (Karakoyun & Lindberg, 2020; Buragohain, 2019; Krumsvik, 2014).

Educators, therefore, need to have more than just the basic literacy or competency on digital technologies, have positive attitudes to learn and apply, and have workplace support in order to have a successful integration in the classroom (Karakoyun & Lindberg, 2020; Michalakis, Vaitis, & Klonari, 2019). The Programme for International Student Assessment (PISA) 2021 initiative is developing a conceptual framework to assess the integration of ICT in the teaching-learning environment, mainly because (1) cognitive processes, well-being, and what is learned are affected by the learner's use of ICT; (2) educators' use of ICT in various areas is drastically increasing; and (3) literacy/competence, are vital skills needed in today's society (OECD, 2019). With this, it is the focus of this study to determine the DL of teachers, and to ascertain as to whether or not their multiple intelligence inclination has an effect on the development of such literacy.

Theoretical Background/Related Literature and Studies

Digital Literacy/Competence

As previously mentioned, the definition of literacy has shifted in the recent years. Its traditional definition states that literacy is the ability to read and write to communicate and/or get information (De Leon, 2020; Pate & Grote, 2011). Modern views of literacy have expanded its definition from *reading and writing* to *knowledge*, wherein

"new" literacies, such as DL, are now needed for successful participation and survival in the Information Age, including the development of 21st century skills such as collaboration, creativity, communication, and critical thinking (Alata & Ignacio, 2019; Envision, 2017; Campbell & Kresyman, 2015; Hixson, Ravitz, & Whisman, 2012; Voogt & Roblin, 2012). George-Palilonis & Watt (2018) defined digital literacy as the ability or skill to effectively make and share meaning in different types and media, to effectively create, collaborate, and communicate in digital settings, and to understand when and how digital technology can support these tasks. A summary of definitions of digital literacy and competencies taken from some studies are reflected in Table 2.

The incorporation of these new skills does not replace the conventional curricula on essential reading, writing, mathematical skills, as well as history, science, and others, but will also find instructional strategies and/or create instructional materials that represent the development of these skills or competencies and make learning more meaningful (Geisinger, 2016; Abril, 2013). These skills are more than rote learning as they focus more on experimentation, creativity, use of multimedia imagination, which allows learners to be participants and contributors of technology, and not just as consumers (Davidson, 2012; Davidson, 2016). Such critical and needed skills, not just knowledge, should be taught and instilled in the learners – skills that are crucial for success in an ever-changing, digitally dependent society (Schoen & Fusarelli, 2008; Siddiq, Gochyyev, & Wilson, 2017).

Table 2: Summary of Definitions of Digital Literacy and Competencies

Author	Definition
Radovanović et al (2020)	Ability to use formal operational skills, along with analytical, content creation and media literacy skills, to navigate the Internet and retrieve information
Eshet-Alkalai (2004) as cited in List et al (2020)	Includes a set of five, interrelated literacies, namely information literacy, branching literacy, photo-visual literacy, reproduction literacy, and socio-emotional literacy.
Cornell University as cited in Yazon, Ang-Manaig, Buama, and Tesoro (2019)	Ability to find, evaluate, utilize, share, and create content using information technologies and the internet
List, A. (2019)	Necessary competencies or skills that are interrelated with one another for success in the digital environment
Yazon, Ang-Manaig, Buama, and Tesoro (2019)	Includes a wide range of skills that are required to thrive in a growing digital environment
Council of the European Union (2018)	Involves the confident, critical and responsible use of, and engagement with, digital technologies for education, work, and participation in society
George-Palilonis and Watt (2018)	The ability or skill to effectively make and share meaning in different types and media, to effectively create, collaborate, and communicate in digital settings, and to understand when and how digital technology can support these tasks
Law, Woo, De la Torre, and Wong (2018)	The ability to access, manage, understand, integrate, communicate, evaluate, and create information safely and appropriately through digital technologies for employment, decent jobs, and entrepreneurship. It includes competencies that are variously referred to as

	computer literacy, ICT literacy, information literacy and media literacy
Uerz, Volman, and Kral (2018)	Refers to the ability to use technology in general and is not specifically related to teaching and learning
Sauro (2017)	Refers to having several skills and competencies in the context of ICT
Yu, Lin, and Liao (2017)	Includes the fundamental ICT operational skills and the capability to use or manipulate complex ICT communication applications
Greene, Yu, and Copeland (2014)	Refers to the cognitive processes that people engage by using computer-based knowledge found in different hypermedia
Ilomäki, Paavola, Lakkala, and Kantosalo (2014)	Defines that digital competence consists of technical competence, the ability to use digital technologies in a meaningful way for working, learning and in daily life, the ability to assess digital technologies critically, and the desire to engage and contribute in the digital culture
Meyers, Erickson, and Small (2013)	Includes aspects of cognitive authority, safety and privacy, ethical, and responsible use and reuse of digital media
Chase and Laufenberg (2011)	Offers a range of learning experiences, creativity, and opportunities for expression that were not previously accessible
UNESCO (2011)	For teachers, this refers to the ability to help students become collaborative, creative and problem-solving learners through the use of ICT so they will be effective citizens and members of the workforce

Author	Definition
Eshet-Alkalai and Chajut (2009)	The ability to use a wide variety of cognitive and emotional abilities in digital technology
Eshet (2004)	Requires more than just the ability to use software or use a digital device; it involves a wide range of diverse sociological, cognitive, emotional, and motor skills that users need to work successfully in digital settings
Ministry of Education, British Columbia, Canada	The interest, attitude and ability of individuals to use digital technology and communication tools appropriately to access, manage, integrate, analyze and evaluate information, construct new knowledge, and create and communicate with others

Digital literacy has many components. In Soo Jung Moon's and Sang Y. Bai's (2020) study, digital components of Radovanović, Hogan, & Lalić (2015) were the basis for predicting youth civic engagement and the role of social media news attention in South Korea. These components are formal operational skills, information retrieval, and analytical skills, digital communication skills, and creation skills. Voogt and Roblin (2012), in their comparative analysis of 21st-century competencies of various international frameworks, determined that digital literacy includes basic scientific, economic, technological visual and information, multicultural literacies, and global awareness. George-Palilonis & Watt (2018), together with the Professor Garfield Foundation, introduced the digital literacy

website to K-5 teachers in Midwest, USA, which emphasizes the 21st-century skills of creativity, critical thinking, collaboration, and communication, along with functional meaning-making, cultural and social understanding, finding and selecting information, and e-safety. The Ministry of Education in British Columbia, Canada elaborates that the characteristics of digital literacy are research and information literacy; critical thinking, problem solving, and decision making; creativity and innovation; digital citizenship; communication and collaboration; and technology operations and concepts. In addition, UNESCO, along with the European Commission, emphasizes the following dimensions of digital literacy: (1) research and information literacy, (2) critical thinking, problem-solving, and decision making, (3) creativity and innovation, (4) digital citizenship, (5) communication and collaboration, and (6) technology operations and concepts (Law, Woo, De la Torre, & Wong, 2018).

H1: There is a significant relationship between the different components of digital literacy/competency.

Multiple Intelligence

The concept, measurement, and development of intelligence have long been debated by many – psychologists and educators to name a few (Sternberg, 2003). It has been a question of nature versus nurture, individual versus group influence, or the classification of the different types of intelligence (Walinga & Stangor, 2014). Intelligence, which was initially regarded as a single entity acquired during birth, has been identified as one of the main factors in the teaching-learning environment and academic achievement (Dolati & Tahriri, 2017; Çeliköz, 2017). In the study of Mujis and Reynolds (2011), the Intelligence Quotient (IQ) Theory states that intelligence is the determining factor for people's ability to learn and achieve academically, which then allows them to assume leadership positions in society. Because of this view, standardized tests are given to measure IQ, which allows educators to have a glimpse of the learners' capacity to achieve (Çeliköz, 2017).

A new paradigm that counter-flowed with this one-standard-for-all intelligence viewpoint was the Theory of Multiple Intelligence (MI) which was discovered by Howard Gardner in 1983. This theory changed the way psychologists, educators, and even parents view the learners (Alhamuddin & Bukhori, 2016). It stresses that intelligence is not just developed logically nor linguistically, but is also developed in other ways (Alhamuddin & Bukhori, 2016). MI consists of different types that are not usually reflected in IQ tests, and that each one is equally important as the other types of intelligence (Gardner, 1993). This theory also notes the fact that each person is smart, but in vary in degrees of strength, which may even change from time to time depending on his/her exposure to different factors (Kennedy-Murray, 2016; Yaghoob & Hossein, 2016). The different intelligence types are logical-mathematical, verbal-linguistic, visual-spatial, bodily-kinesthetic, interpersonal, intrapersonal, musical, naturalistic, and existential (Gardner, 1993; Shearer, 2019; Shi, 2019; Çeliköz, 2017; Dolati & Tahriri, 2017; Kennedy-Murray, 2016; Alhamuddin & Bukhori, 2016; Yaghoob & Hossein, 2016; Walinga & Stangor, 2014).

Since individuals have all nine intelligences, though in varying degrees, and that these intelligences are dynamic – developed through time and various learning experiences – it may be safe to assume that individuals have more than one dominant intelligence and that each of these intelligences are interrelated with each other (Yaghoob & Hossein, 2016). According to Shi (2019), MI has the following characteristics: (1) different – there are nine (9) types of intelligence that vary in each individual; (2) practical – intelligence allows individuals to discover new knowledge, create and be innovative, and are able to solve problems; (3) integrity – all nine intelligences are interrelated and interact with each other; and (4) developmental – strength of each intelligence may change depending on the different learning opportunities, training, or

environment. The study of Overchuk and Niemczyk (2009) on the applicability of MI theory in pilot assessment and training shows that the respondents are strong in both intrapersonal and spatial intelligence. In addition, Çeliköz's (2017) study showed that prospective teachers of Yildiz Technical University are dominant in mathematical-logic, verbal, interpersonal, and intrapersonal intelligences.

H2: There is a significant relationship between the different multiple intelligence types.

H3: There is a significant relationship between digital literacy/competency and multiple intelligence types.

Statement of the Problem

This study assessed the perceived digital literacy levels of teachers pursuing their masteral or doctoral degrees and aimed to answer the following questions:

1. As perceived by the respondents, what is their digital literacy levels as to information processing, communication, content creation, safety, and problem-solving?
2. What is the multiple intelligence profile of the respondents?

Methodology

This study used the descriptive-correlational survey method to determine the digital literacy competencies and distribution of multiple intelligences of teachers pursuing graduate studies in the Province of Cebu, Philippines. These teachers come from different areas of the region, both in the urban and rural areas, as well as working in either private or public schools.

After permission from the deans of the colleges to conduct the research was granted, hard copies of two (2) questionnaires were distributed to 287 respondents, including a letter of consent to take part in the research. Confidentiality of data was emphasized, including proper storage of answered sheets.

The digital competency survey was adapted from the study of Al Khateeb (2017). The survey was used to measure the respondents' perception of their digital competencies and was based on the European Digital Competencies Framework for Citizens (DigiComp), which was formulated by the European Commission. The study of Law, Woo, De la Torre, and Wong (2018) through UNESCO, also referred to this framework to propose a global framework of reference for digital literacy skills for all. Indicators of the said framework are information processing, communication and collaboration, digital content creation, safety, and problem-solving. Scoring procedure is a 7-point Likert scale wherein competency levels are rated as "expert" at seven (7) and "digital illiterate" at one (1).

The second questionnaire on multiple intelligence was adapted from the study of McClellan and Conti (2008), wherein the authors have developed a reliable and valid instrument to measure the learners' preferences. There are three (3) groups with nine (9) statements in each group. Statements in each group are ranked where one (1) describes the respondent the most and nine (9) describes the respondent the least. Scores of each statement are tallied according to each intelligence type and sum of each type determines which is the dominant intelligence type of the respondent, as well as the least dominant type.

ANOVA, Cronbach's Alpha, and principal component analysis were done to treat the data before Pearson r was used to check the relationship of the variables.

Results and Discussion

Profile of the Respondents

Table 3 shows that the average of the respondents is 32 years. GradschoolHub.com (2019) mentioned that the average age of graduate school students is 33 years, with older students taking up doctoral degrees. Most of the respondents of Rungduin and Miranda (2018) in their

study on factors on completing graduate degree completion are within the 31-40 years age range. Most of the respondents are pursuing their masters degree, with 95 (33.1%) of the respondents are taking up Early Childhood Education. For the doctoral program, 17 (5.9%) of the respondents are taking up Special Education. The domination of female teachers (241 or 64%) can also be seen in the census taken by UNESCO Institute for Statistics (2018) wherein 91.08% are female teachers in pre-primary education in the Philippines.

Majority of the respondents are teachers (247 or 86.1%) working in the public sector (170 or 59.2%). It is interesting to note that despite knowing that public school teachers have more workload aside from teaching tasks, many still prefer to be part of the government service (David, Albert, & Vizmanos, 2019). This study focused on the data of the teachers.

Table 3: Profile of the Respondents

Demographics		Frequency (n = 287)	Percentage (%)
Age (*Average age: 32)*			
	21 – 30	138	49.7
	31 – 40	89	32.1
	41 – 50	46	16.6
	51 and above	5	1.9
	Missing	9	
Sex			
	Female	241	84
	Male	43	15
	Prefer not to say	3	1
Program and Major			
	Masters	***254***	***88.5***
	Early Childhood Education	95	33.1
	Special Education	77	26.9
	Guidance and Counseling	32	11.0
	Administration and Supervision	23	8.0
	Other	27	7.1
	Doctoral	***33***	**11.5**
	Special Education	17	5.9
	Other	16	5.6
Occupation			
	Teaching	247	86.1
	Non-teaching	40	13.9
Institution Type			
	Public	170	59.2
	Private	88	30.7
	Non-academic or no affiliation	29	10.1

Digital Literacy/Competency Profile

Digital literacy in the 21st century has now become one of the important and fundamental competencies alongside reading, arithmetic, oral skills, and writing (Almås, A.G. & Krumsvik, R., 2007). Therefore, having digitally literate students, along with improving technology tools for blended learning, flipped classroom, online classes, and other innovative teaching strategies, will require teachers to also be

digitally literate. Table 4 gives a description of the digital literacy profile of the respondents.

Information processing, communication, and safety indicators scored high on the respondents' profile. Information processing is the ability to know what information is needed, to know how to properly search and recover data, and to verify the source and content of the information, including data management and organization (Law, Woo, De la Torre, & Wong, 2018). Teachers search the internet for various needs such as looking for affordable or free instructional materials, seminars for professional development, research, connecting the classroom to the world, and many more. Furthermore, the communication indicator is the ability to use digital technologies to collaborate, communicate, interact, and share information, among others. When physical presence or face-to-face meetings are not possible, teachers are able to meet with their students and continue lessons using various media. Lastly, the Safety indicator is being able to protect one's device and one's data privacy, especially that digital transactions and activities are becoming part of daily routine.

Table 4: Digital Literacy/Competency Profile

Indicators	Mean	Verbal Description
Information Processing	5.48	very literate/competent
Communication	5.55	very literate/competent
Content Creation	4.46	moderately literate/competent
Safety	5.53	very literate/competent
Problem Solving	4.71	moderately literate/competent
Overall Profile	**5.14**	**moderately literate/competent**

Legend: 1.00-1.86 digitally illiterate/incompetent, 1.87-2.72 very illiterate/incompetent, 2.73-3.58 mildly illiterate/incompetent, 3.59-4.44 fairly literate/competent, 4.45-5.30 moderately literate/competent, 5.31-6.16 very literate/competent, 6.17-7.00 digital expert

Results show that there is a need to update the digital literacy or competencies. Quality teaching and school leadership are two of the most important factors in increasing student achievement. In order to have quality and effective teachers, professional development to develop and hone their expertise and skills are one of the best practices of an institution (Mizell, 2010). A professional and upgraded teacher would have the confidence and credibility to teach, giving students a more engaging learning environment and experience. He/She is then updated with new teaching strategies that will meet or address the students' learning needs or challenges.

The new generation of students are more tech-savvy than the previous generation, using the internet and other digital resources in most of their daily activities. With the shift to focus on student learning, teaching with technology gives teachers a wide variety of strategies that enhance student outcomes. Teachers who are able teach with technology are, therefore, at an advantage. With the dependency on smart devices and technology, students are able to adapt quickly to technology-rich learning environments such as flipped classroom, blended learning, and online classes. With the rise of the corona virus-19 pandemic worldwide, teachers are forced to use technology to reach students who are not able to physically go to school (Anft, 2020). Teachers who are comfortable and are capable to use technology will find it easy to use any of these methods, while those who are not may find it challenging. Therefore, it is important and advantageous that digital literacy be integrated into the pre-service teachers' curriculum or that professional development on digital literacy be emphasized for teachers to be able to use various digital tools to meet the needs of their learners.

With all of the respondents taking up their masters or doctoral degrees, it is given that promotion is part of the goal. They will be involved more in educational administration or management than the teachers who have no postgraduate degrees. Digital literacy skills are important in accomplishing administrative functions which are, but not limited to, collation/submission of administrative reports, teacher evaluation reports, budget proposals, research, personnel files and monitoring, plotting of teacher class loads, facilities management, project management, online enrollment procedures and approvals, choosing the appropriate learning management system (LMS), and others (Aduwa-Ogiegbaen & Iyamu, 2005). As administrative procedures are transitioning from manual to digital, it is important that all teaching and non-teaching staff know how to process basic protocols online such as filing of leaves of absence, attendance logs, monthly accomplishment reports, facilities requests and purchases, computation of grades, making digital instructional materials, research, online banking, usage of the appropriate LMS, and many more.

Multiple Intelligence (MI) Profile

The theory of MI gives opportunities for diverse teaching strategies to maximize learning. Since intelligence is dynamic, it believes that a person's intelligence strength or weakness may change over time through exposure to different factors. Furthermore, a person can be "smart" in more than one area. Table 4 shows the profile of the MI of the respondents, with "A" as the primary strength and "B" as the secondary strength.

Table 5: Multiple Intelligence Profile

Intelligence Type	A	B	Total
Bodily-Kinesthetic	53 (18.5%)	49 (17.1%)	102 (35.6)
Existential	72 (25.1%)	60 (20.9%)	132 (46%)
Interpersonal	40 (13.9%)	53 (18.5%)	93 (32.4%)
Intrapersonal	55 (19.2%)	63 (22.0%)	118 (41.2%)
Logical-Mathematical	46 (16.0%)	33 (11.5%)	79 (27.5%)
Musical	42 (14.6%)	31 (10.8%)	73 (25.4%)
Naturalistic	16 (5.6%)	21 (7.3%)	37 (12.9%)
Verbal	15 (5.2%)	15 (5.2%)	30 (10.4%)
Visual-Spatial	27 (9.4%)	29 (10.1%)	56 (19.5%)

Results show that most respondents are existentialists as the primary strength and intrapersonal as secondary strength. Existentialists have strong intuitions and have a solid belief system that enable them to understand others and, eventually, the world around them (Kelly, 2019). McCoog (2010) stated that existentialists are very introspective, recognizing that in order to understand the world, they need to understand themselves first. Filipinos are innately religious, with emphasis on the question, "Who am I?" as part of the development of their whole persona (Ramos, 2017). Culturally, the belief in God, who is the reason for existence, is the very nature of Filipinos.

In addition, understanding how life is through their own experiences, most existentialists are also strong in intrapersonal intelligence (McCoog, 2010), as seen in the results of this study. Intrapersonal intelligence, as compared with interpersonal intelligence, is the awareness of one's strengths and weaknesses, and how to use these effectively in life (Parker, 2016).

Correlations Between Digital Literacy and MI

Digital literacy/competency is an important skill, especially in the 21st century teaching-learning environment. It is interesting to know how each MI strength of the

respondents affects the way the respondents develop their digital skills.

Table 6 used Pearson r Correlation Coefficient to find out whether there are relationships between the different components of digital literacy/competency at 0.01 level of significance using two-tailed test. All coefficient values showed that there are positive and significant correlations between the paired literacies, namely: information processing and communication (r =.763, p < 0.01), information processing and content creation (r =.565, p < 0.01), information processing and safety (r =.709, p < 0.01), information processing and problem solving (r =.763, p < 0.01), communication and content creation (r =.647, p < 0.01), communication and safety (r =.733, p < 0.01), communication and problem solving (r =.668, p < 0.01), content creation and safety (r =.649, p < 0.01), content creation and problem solving (r =.745, p < 0.01), safety and problem solving (r =.742, p < 0.01). Therefore, hypothesis is supported.

Table 6: Correlation between the different components of digital literacy/competency (Pearson correlation with sig 2-tailed)

	Communication	**Content Creation**	**Safety**	**Problem Solving**
Information Processing	r=.763** sig=.000,n=244	r=.565** sig=.000, n=243	r=.709** sig=.000, n=242	r=.614** sig=.000, n=245
Communication		r=.647** sig=.000, n=245	r=.733** sig=.000, n=243	r=.668** sig=.000, n=246
Content Creation			r=.649** sig=.000, n=242	r=.745** sig=.000, n=245
Safety				r=.742** sig=.000, n=245

The above-mentioned components are equally important for one to be able to participate fully in the digital society (mediasmarts.ca, 2019). They are interrelated and as one navigates through the digital platform, each component is actively seen.

Table 7 presents the correlations between the different multiple intelligence types using Pearson Product Moment Correlation Coefficient.

Table 7: Pearson correlation between the different multiple intelligence types (2-tailed sig])

MI	Existential	Inter-personal	Intra-personal	Logic	Musical	Naturalistic	Verbal	Visual
Bodily Kinesthetic	r=.060 sig=.351, n=243	r=.247** sig=.000, n=243	r=.111 sig=.085, n=243	r=-.035 sig=.586, n=243	r=.038 sig=.556, n=243	r=.222** sig=.000, n=243	r=-.151* sig=.019, n=243	r=-.009 sig=.885, n=243
Existential		r=.245** sig=.000, n=243	r=.462** sig=.000, n=243	r=.118 sig=.067, n=243	r=-.043 sig=.506, n=243	r=-.068 sig=.289, n=243	r=-.105 sig=.101, n=243	r=-.036 sig=.575, n=243
Inter-personal			r=.248** sig=.000, n=243	r=.107 sig=.097, n=243	r=-.012 sig=.858, n=243	r=-.028 sig=.663, n=243	r=.024 sig=.705, n=243	r=-.026 sig=.685, n=243
Intra-personal				r=.272** sig=.000, n=243	r=-.015 sig=.816, n=243	r=-.103 sig=.110, n=243	r=-.041 sig=.525, n=243	r=-.089 sig=.167, n=243
Logic					r=.046 sig=.480, n=243	r=.142* sig=.027, n=243	r=.029 sig=.654, n=243	r=.121 sig=.059, n=243
Musical						r=.020 sig=.752, n=243	r=.110 sig=.088, n=243	r=.035 sig=.590, n=243
Naturalistic							r=.181** sig=.005, n=243	r=.023 sig=.723, n=243
Verbal								r=.250** sig=.000, n=243

The results revealed that some correlations of the paired intelligences were positive while others were negative. Moreover, 10 correlations out of 36 are statistically significant but having weak correlations. The positive and significant correlations were bodily-kinesthetic and interpersonal ($r = .247$, $p < 0.01$), bodily-kinesthetic and naturalistic ($r = .222$, $p < 0.01$), existential and interpersonal ($r = .245$, $p < 0.01$), existential and intrapersonal ($r = .462$, $p < 0.01$), interpersonal and intrapersonal ($r = .248$, $p < 0.01$), intrapersonal and logic ($r = .272$, $p < 0.01$), logic and naturalistic ($r = .142$, $p < 0.05$), naturalistic and verbal ($r = .181$, $p < 0.01$), and verbal and visual ($r = .250$, $p < 0.01$). These correlations, therefore, support the hypothesis. On the other hand, bodily-kinesthetic and verbal ($r = -.151$, $p < 0.05$) had a negative and significant correlation, and therefore do not support the hypothesis.

There are several possible factors that influence the development of an intelligence type, such as environmental conditions or opportunities that foster its development (Ahvan & Pour, 2016; Raissi Ahvan, Zainalipour, Jamri, & Mahmoodi, 2016). A person may have, not just one, but multiple intelligences due to motivational, cultural, and experiential factors (Luo & Hwang, 2018; Gardner & Hatch, 1989 as cited in Ahvan & Pour, 2016).

Table 8: Analysis of Differences of Literacy and Intelligence Style

	VarInfo Processing	Var Communication	VarContent Creation	VarSafety	VarProblem Solving
MIF BodilyK	F=0.496, sig=0.610	F=0.419, sig=0.658	F=0.334, sig=0.716	F=0.049, sig=0.952	F=1.183, sig=0.308
MIF Existential	F=0.669, sig=0.513	F=1.358, sig=0.259	F=1.514, sig=0.222	F=1.007, sig=0.367	F=0.221, sig=0.802
MIFInter	F=0.646, sig=0.525	F=0.152, sig=0.859	F=1.652, sig=0.194	F=0.560, sig=0.572	F=0.080, sig=0.923
MIFIntra	F=2.120, sig=0.122	F=3.342, sig=0.037	F=3.054, sig=0.049*	F=4.667, sig=0.010**	F=2.414, sig=0.091
MIFLogic	F=0.338, sig=0.713	F=0.619, sig=0.539	F=1.185, sig=0.307	F=1.033, sig=0.357	F=0.223, sig=0.800
MIFMusical	F=1.336, sig=0.264	F=2.542, sig=0.081	F=2.596, sig=0.076	F=1.844, sig=0.160	F=3.946, sig=0.20**
MIF Nature	F=1.136, sig=0.322	F=2.039, sig=0.132	F=0.410, sig=0.664	F=0.498, sig=0.608	F=2.113, sig=0.123
MIFVerbal	F=0.368, sig=0.693	F=0.303, sig=0.739	F=0.729, sig=0.483	F=0.042, sig=0.959	F=0.219, sig=0.804
MIFVisual	F=0.310, sig=0.734	F=1.132, sig=0.324	F=1.915, sig=0.149	F=0.352, sig=0.703	F=0.871, sig=0.420

Table 8 presents the ANOVA test conducted between the codification of preferred intelligence style (A, B or other) and the summary measure of each of the five dimensions of digital literacy. As an example, in the computation of MIFBodilyK, "A" means that it is chosen as the first preferred style, "B" that it is the second preferred style and "C" that it is another choice. The coefficients presented in the table reflect the existence of a difference or not in the digital literacy of respondents given their intelligence style preferences.

As the reader sees, only three (3) statistically significant differences are observed. The Content Creation skill is different for those with "intra," or intrapersonal, intelligence style (F=3.054, sig=.049); similarly, the Safety component is different for those with that type of intelligence (F=4.667, sig=.010). Finally, Problem Solving may be different or those

with "musical" as preferred intelligence style. Since there are only three (3) significant relationships, one should exercise caution in the interpretation of these results.

This is also seen in the study of Sherman (2014) wherein findings showed that verbal-linguistic intelligence did not have significant correlation with digital literacy. Most common intelligence with correlations to digital literacy is the intrapersonal intelligence, specifically with the communication, content creation, and safety components. It is not surprising because working in the digital setting is often an individual activity, allowing the person to be aware of his/her own personal thoughts, experiences, and behaviour while online. Musically-inclined individuals often use their right brain and are typically more creative when looking for a solution to a problem (Sholihah, Saefudin, & Priyandoko, 2020).

Discussion

Given the importance of information technology in life and in education of new generations, this study focus was to determine the literacy level of teachers and explore its potential relationship with their dominant style of intelligence. From our respondent's self-estimation, it appears that they report having a competency profile varying from moderately literate / competent (content creation and problem-solving) to very literate/competent (information processing, communication and safety). As teachers, digital literacy/competency is a necessity especially when doing blended or online teaching.

Our paper proposed three hypotheses: the first one was about the existence of a significant relationship between the five dimensions of the concept of literacy /competency. A Pearson correlation study was made among those, which resulted into high coefficient, ranging from .565 to .763, all with a 2-tails significance of .000. Clearly the literacy/competency is sufficiently captured by the 62 questions of the instrument. The second hypothesis was suggested the existence of a significant relationship between the nine intelligence types.

Results show the "existential" style as the primary intelligence type and "intrapersonal" as the secondary intelligence type. All the components of digital literacy/competency are correlated to one another, as each one is equally important to have a successful and effective digital experience. Significant and positive correlations between MI pairs are found, such as (1) bodily-kinesthetic and interpersonal, (2) bodily-kinesthetic and naturalistic, (3) existential and interpersonal, (4) intrapersonal and logic, (5) logic and naturalistic, (6) naturalistic and verbal, and (7) verbal and visual. The most important relationship is found for existential – intrapersonal intelligence style (r=.462). However, bodily-kinesthetic and verbal had a negative and significant correlation. Only 13 of the 36 correlations were found statistically significant; this may indicate the effect of the hazard, since the coefficients are relatively low, even for those with a significance of .000.

The third hypothesis postulated the existence of a correlation between intelligence type and digital literacy skills. Findings showed that intrapersonal intelligence is significantly correlated with communication, content creation, and safety, while musical intelligence is significantly correlated with problem-solving. Although the results of this study indicate some associations between certain intelligences and digital literacy skills, only 5 out of 45 are significant, with a low coefficient "r", the highest being .177, limiting confidence on the reality of the observed relationship.

Conclusion

This study has shown that teachers master many aspects of the main dimension of digital literacy. It has also indicated that intelligence style might not be so important to explain or impact the digital literacy level.

This study suffers from several limits and flaws. It was conducted among a limited

number of teachers on a single university in Philippines. It is suggested that a more representative sample of teachers be taken from the country to eliminate the bias due to this convenience selection of respondents. Additionally, the self-assessment of competencies should be compared to objective tests, although the instrument was based on literature review. Further research is suggested in order to overcome these limitations, namely a more objective measure of literacy could be used to correlate skills with intelligence style.

This study has opened a first step to the understanding of the role (or the impact) of intelligence on digital literacy. Our mixed results suggest that a better understanding is needed of both constructs. The information technology is not a monolithic knowledge and the five dimensions used as surrogate of this construct might not be sufficient to assess it. Also, this study shows that digital literacy might have a different meaning depending on the society in which it is used so further studies may be done to understand the cultural and contextual impact of environment.

Authors suggest also that since the education of the 21th century will largely rely on technology, studies should be conducted to take into account the psychological aspects of dematerialization of the teaching, giving more importance to computers for information transmission (prepared by a technology skilled teacher) and more importance to the teacher for supporting projects, class animation and personal motivation, especially given the growing popularity of flipped classroom. As students' interactions and teacher interactions are expected to be more mediated by technology, authors suggest that studies be conducted in the area of sociology to examine the capacity of teachers to efficiently manage interactions in the classrooms. The authors are actually planning a replication of their study with Canada, in order to see if economic development and or cultural differences can provide a better understanding.

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