

Digital Literacy among Educators: A Study of Teachers' Competency in Manjung

Vijaya Letchumy A/P Baskaran, Syed Rujhan bin Syed Alwi, Parimalah A/P Vadiveloo, Zaliyatunnur binti Awang Kechik

Pejabat Pendidikan Daerah Manjung, Lorong Desa Selamat 1, Taman Selamat, 32000 Sitiawan, Perak, Malaysia

*Corresponding author email: vijayaletchumy78@gmail.com

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ABSTRACT - Digital literacy is becoming a crucial skill for teachers since the development of digital technology has changed learning environments. Using Chen's (2015) 9Cs Digital Literacy Framework, this study examines the digital literacy levels of educators in Malaysia's Manjung District. A total of 351 teachers participated in a quantitative survey in which nine characteristics of competencies—communication, teamwork, critical thinking, creativity, citizenship, character, curation, copyright, and connectedness—were evaluated. The findings showed a high degree of digital literacy overall, with the strongest competencies seen in ethical technology usage and digital citizenship. However, the aspects of creativity and connectivity were shown to be weaker. Based on years of teaching experience and gender, statistical studies showed substantial disparities in digital literacy, with male and less experienced teachers showing higher proficiency. These results highlight the necessity of focused professional development programs to close gaps and aid in the execution of Malaysia's policy on digital education. In addition to offering suggestions for inclusive, customised training, the study's conclusion calls for more investigation into the qualitative aspects of instructors' digital integration methods.

INTRODUCTION

The limited awareness and access of the internet and digital medium to the common public 20 years ago, had coined the term computer literacy. The term computer literacy was coined during that phase where it refers to one's ability to use computers effectively for a given purpose. Since then, with the expansion of the internet and other online and digital platforms, the term digital literacy has included many different definitions. Digital literacy includes one's ability to use e-resources, digital media, and online platforms in an open and flexible environment. This goes hand in hand with the advances happening in information and communication technologies (ICTs) which have connected people across the globe through the internet, digital mediums and online platforms (Spire et al., 2019). Digital literacy is essential to thrive in this digital world, one not only needs to have knowledge about these tools and platforms, but also the ability and skills to use them purposefully.

The rapid development of the world of information and communication technology together with the access of the internet has had a great impact and influence on the global socioeconomic environment and various aspects of community life. Therefore, the more developed a country is, the higher the dependence of its population on ICT to interact or perform activities in all aspects of life which correlates to social development and economic growth (Hashim & Dali, 2022). Aligning to the rapid development of digital skills globally, the importance of information and communication technology (ICT) have been used to augment the importance of implementing it in education. A study by Hanell (2018) had discussed the importance of digital literacy to be used as an instrument to improve educational standards, address economic problems and societal development.

The ubiquitous presence of technology in all aspects of education and changes in ICT policies embedded in the education systems have caused more digital educational platforms or assessment tools for learning and teaching, which exponentially triggered digital literacy development. Digital Literacy development has since become an instrument for better educational attainment (Hannell, 2018; Nguyen & Habok, 2021). The development of digital literacy among teachers is one of the key competencies as well as an essential factor in learning for students for them to be able to cope with the demands of globalization. Digital literacy is indispensable among teachers because it discusses teachers' ability to use digital technologies and tools that will allow them to enhance their teaching practices, including accessing, evaluating, creating and communicating information digitally, ultimately exposing the students with lifelong learning experiences. Digital literacy gives teachers the chance to teach students to use these tools to their advantage. It also gives students a learning environment where they can practice applying them in an educational setting. Since digital literacy is vital for teachers to provide meaningful learning experiences for their students, this study is being carried out to identify Manjung teachers' digital literacy competencies.

PROBLEM STATEMENT

Many aspects of life have altered because of the 21st century's advancements in ICT, and in order to remain competitive in the modern world, one must possess critical thinking, problem-solving, and scientific abilities (Atmojo, Saputri, & Fajri, 2022). Digital literacy is one of the six literacy skills that the World Economic Forum identified in 2015 as a 21st century life skill (Mason, Khan, & Smith, 2016).

The 21st century is known as the "digital century" because of the widespread digitalization brought about by ICT advancements (Gecikli, 2021). Children and adults alike should be proficient in digital literacy as a 21st-century survival skill since technological advancement and digitization are unavoidable in the present and the future (Ahsan, Ismail, & Ahmad, 2022). As one of the organizations that equips students to face and conquer the problems of the twenty-first century, educational institutions play a significant role in helping students build their digital literacy.

Therefore, on the 28th of November 2023, the Ministry of Education (MoE) launched Digital Education Policy (*Dasar Pendidikan Digital*) to produce digitally literate students who are competitive through increasing knowledge, skills and values. The Digital Education Policy (DPD) is a statement of commitment by the Malaysian Ministry of Education (KPM) to drive changes in the digital education landscape to produce a digitally literate generation that is empowered through improving the knowledge, skills and values of students, educators and educational leaders; provision of quality infrastructure, infrastructure and content along with active participation of strategic partners in an integrated and comprehensive manner from preschool to high school.

This policy is formulated to be in line with various national agendas including concepts of Malaysia's Digital Economy Blueprint (MyDIGITAL), National Fourth Industrial Revolution (4IR) Policy, National Digital Network (JENDELA), The Malaysian Education Development Plan (PPPM) 2013–2025 and Science and Technology Policy and National Innovation (DSTIN) 2021-2030 to ensure a structured and planned effort for the nation to face the (Fifth Industrial Revolution) 5IR challenge.

According to the data given in the MoE's Digital Education Policy Infographics, there are still 52.7% schools in Malaysia that have not reached excellence rating in the year 2019 for the equipment and digital atmosphere necessities. This was mostly contributed by lack of urgency among the school ecosystem towards digital literacy. Therefore, incomplete implementation and inconsistent governance issues may have occurred and impacted the students and the teachers at the receiving end, when the basic infrastructure for the digital ecosystem has not been provided.

International benchmarking studies, PISA 2018 and TIMSS 2019 had announced that the computing capacity of digital devices in Malaysian schools and the number of digital devices for teaching and learning activities at school are at a lower level. This situation has contributed to the lack of readiness among teachers in handling equipment like computers, digital devices, software and school broadband services in Malaysia which is also unsatisfactory.

The current era is known as the information age. Every aspect of life, including education, has been impacted by globalization. Even while schools have complete ICT infrastructure, many educators are

still incompetent in digital literacy, preventing it from reaching its full potential. Learning outcomes are being improved and the quality of education is being improved by new digital technologies. However, simply introducing these technologies in schools is insufficient to bring about change and innovation. This is because teachers who are proficient in digital technology are needed to support the use of ICT in the classroom.

These teachers will serve as facilitators and mentors for students, guiding them towards problem solving and innovation to address the new challenges of globalisation. Teachers must be able to construct student-centered learning settings that encourage creativity, metacognition, meta-literacy, cooperation, and communication among students. A superficial use of ICT in education will not produce the desired learning outcome; nonetheless, integrating ICT into pedagogy is critical to improving the teaching and learning process. This can only be accomplished if teachers are competent enough to use ICT tools and enable ICT integrated education.

The increasing usage of digital media in society necessitates the development of digital literacy among students for them to flourish academically and professionally. Proper use of digital devices, desktops, laptops, and smart phones by teachers, particularly the student community, is the first step towards digital literacy. Teachers and students must be confident in their digital skills in order to tackle the difficulties of today's rapidly changing digital environment. Digital literacy improves education by enabling teachers and students to use digital tools and resources to achieve academic goals (Hassan et.al, 2020). This study is carried out to identify the competencies of teachers because teachers are required to be digitally literate to help students in participation towards bridging a digital skills gap in the modern digital age and creating an agile learning environment.

RESEARCH OBJECTIVES

This study aims to investigate the following objectives

1. Identifying the level of digital literacy among Manjung school teachers based on 9C dimensions by Chen (2015), Digital Literacy Scale.
2. Differentiating the digital literacy level of Manjung school teachers based on genders according to 9C dimensions.
3. Differentiating the digital literacy level of Manjung school teachers based on teaching experiences according to 9C dimensions.
4. Differentiating the digital literacy level of Manjung school teachers based on type of schools according to 9C dimensions.

RESEARCH QUESTIONS

The first aim of the study was to find out the level of digital literacy competencies among Manjung school teachers. As such, the following research questions were identified:

1. What is the digital literacy level of Manjung school teachers based on 9C dimensions?
2. Is there significant difference in digital literacy level of Manjung school teachers based on genders?
3. Is there significant difference in digital literacy of Manjung school teachers based on teaching experiences?
4. Is there significant difference in digital literacy of Manjung school teachers based on type of school?

RESEARCH HYPOTHESES

Hypothesis 1: There is no significant difference in digital literacy level of Manjung school teachers based on genders

Hypothesis 2: There is no significant difference in the digital literacy level of Manjung school teachers based on teaching experiences.

Hypothesis 3: There is no significant difference in the digital literacy level of Manjung school teachers based on type of school.

LITERATURE REVIEW

The concept of digital literacy is gaining popularity in the twenty-first century. Growing workplace needs for digital literacy have inspired focused interventions and innovations in education to instill digital skills in the future workforce. Despite attempts, the digital skills gap persists globally. Therefore, this paper explores Manjung teachers' digital literacy competencies that can help them during their 21st-century learning and teaching and learning activities. Gaining competency in digital literacy will assist them in narrowing the digital skills gaps and preparing students for the future.

Digital literacy can be captured through a variety of methods and viewpoints. Gilster (1997) established one of the first and most widely accepted definitions of digital literacy, describing it as the ability to use, assess, and coordinate multiple digital resources or tools in lifelong learning processes. This definition went beyond the narrow scope of technical skills and emphasized the importance of developing the concept of using technology to solve problems and acquire critical knowledge and skills in the digital context. Later, Nguyen and Habok (2022) steadily broadened the digital literacy definition based on new abilities and updated digital technology in diverse digitized situations.

The advancement of technology and its application in digitalization increased the demand for digital education. The reliance on digital technology is fast rising, and significant care must be given to how people use digital technology, how they interact online, and the skills they possess to carry out the activities related with digitalization. Aligning to that, the Ministry of Education (MoE) launched Digital Education Policy (*Dasar Pendidikan Digital*) on the 28th of November 2023 to produce digitally literate students who are competitive through increasing knowledge, skills and values. The Digital Education Policy (DPD) is a statement of commitment by the Malaysian Ministry of Education (KPM) to drive changes in the digital education landscape to produce a digitally literate generation that is empowered through improving the knowledge, skills and values of students, educators and educational leaders; provision of quality infrastructure, infrastructure and content along with active participation of strategic partners in an integrated and comprehensive manner from preschool to high school.

This policy is formulated to be in line with various national agendas including concepts of Malaysia's Digital Economy Blueprint (My DIGITAL), National Fourth Industrial Revolution (4IR) Policy, National Digital Network (JENDELA), The Malaysian Education Development Plan (PPPM) 2013–2025 and Science and Technology Policy and National Innovation (DSTIN) 2021-2030 to ensure a structured and planned effort for the nation to face the (Fifth Industrial Revolution) 5IR challenge.

This policy requires teachers to have a high proficiency level in digital literacy. Educators should improve their digital literacy skills to meet criteria (Spante, Hashemi, Lundin, et al., 2018). Information technology has emerged as a key driver of educational improvements. The emergence of new technology-assisted learning tools such as mobile devices, smartboards, MOOCs, tablets, laptops, simulations, dynamic visualizations, and virtual laboratories has transformed education in schools and institutions. The Internet of Things (IoT) has shown to be one of the most cost-effective ways to educate young minds. It is also a strong method for incorporating a world-class learning experience for everyone Dreimane, S. & Upenieks, R. (2022).

In recent years, teachers must be both an educator and guide for students. They have a responsibility to play in establishing students' digital literacy through digital media exploration so that they can educate themselves, be experienced, and become today's generation (Hoechsmann & Poyntz, 2012). Teachers play a crucial role in teaching students' digital literacy, including socio-emotional and cognitive aspects such as ethics, credibility, and security. While understanding digital technology is crucial, it is often not adequately taught in formal education due to the time-consuming nature of learning. (Güneş & Bahçivan, 2018).

There are many existing digital literacy models available out there that are designed to describe multiple components of a teachers' digital literacy. These frameworks provide teachers with specific guidelines on how to facilitate the recognition of digital components in teaching, learning and supporting activities

in line with curriculum. By following those models, teachers can monitor, deliver and acquire digital elements for teaching and learning programs. These frameworks are continuously revolving in order to cope with the pace of society. For example, according to a 2018 UNESCO initiative, teachers' ICT competences include a variety of components, including digital literacy. Accordingly, digital literacy is one of the abilities that teachers must possess to fulfil their pedagogical and professional competencies. Educators can use digital literacy to support students' learning by identifying and categorizing available resources.

Some countries adopted worldwide digital literacy frameworks to create and implement a national model for their own educational situation. For example, in 2012, the Spanish Ministry of Education, Culture, and Sport developed a digital competence model called the Common Framework for Digital Competence for Teachers (INTEF), which was adapted from DigComp (Carretero et al., 2017) and DigiCompEdu (Redecker, 2017b) for the Spanish context. Similarly, the Education and Teaching Foundation in Britain developed the Digital Teaching Professional Framework (Education & Training Foundation, 2019) to help teachers understand technology integration, cultivate the practice of teaching with technology, and supplement their professional development. Several methodologies and frameworks from various empirical investigations have also contributed to the evaluation of digital literacy (Mishra & Koehler, 2006), including the technological pedagogical content knowledge (TPACK) model. This model demonstrates successful teaching with technology. However, the paradigm is limited in that it does not provide a conceptualization of digital literacy for teachers.

Digital literacy is an essential ability for empowering persons in a digital environment. It has become an important component in teaching and learning across the various educational phases that have been addressed since the late decade of the twentieth century in the fields of open, distant, and digital education. The literature defines digital literacy as a combination of cultural and historical understandings and practices related to the use of information through digital technologies in daily life (Canchola-Gonzalez & Glasserman Morales, 2020; Cetindamar Kozanoglu & Abedin, 2020; da Silva & Behar, 2019; Nichols & Stornaiuolo, 2019; Reyes & Avello-Martínez, 2021).

According to Tiernan (2022), there has been an increasing social need in recent years for teachers to improve their digital literacy as technology continues to transform the landscape of education. This demand represents a realization of teachers' critical role in properly integrating technology into pedagogical practices to suit the changing requirements of learners in the digital era (Medrano, 2020). As indicated by Wong, Reichert, and Law (2023), academics have increasingly concentrated on studying techniques to strengthen teachers' digital abilities and effectively manage technology in educational settings (Jiang, Zhi, & Xiong, 2018; Murtadho, Rohmah, Jamilah, & Furqon, 2023).

As technology in education has grown rapidly, there has been a growing recognition of the crucial need to improve teachers' digital literacy, as stated by Widana (2020). Digital literacy, broadly defined as the ability to access, evaluate, and use digital information, has emerged as a critical component of modern education. It includes not just technical skills, but also critical thinking, creativity, and ethical considerations in digital situations (Hui, 2009; Luo and Yuan, 2017; Medrano, 2020; Murphy and Lebars, 2009). The concept of digital literacy has evolved from basic computer literacy, which was primarily focused with operational skills for hardware and software, to a larger range of competencies (Jiang, Zhi, & Xiong, 2018; Murtadho, Rohmah, Jamilah, & Furqon, 2023).

Furthermore, the rapid pace of technological innovation makes it increasingly challenging for teachers to keep up with emerging technology and creative instructional strategies. As Mishra and Koehler (2009) stated, teachers frequently struggle to adapt their teaching methods to incorporate new technologies in meaningful ways, resulting in low student engagement and learning outcomes. Furthermore, the COVID-19 pandemic has emphasized the importance of digital literacy in allowing remote and hybrid learning environments, emphasizing the need to address these challenges (Hodges et al., 2020). To evaluate the critical significance of technology usage in promoting teachers' digital literacy, much more must be learnt about successful technology management techniques. Therefore, this paper is discussing Manjung teachers' competency level in digital literacy based on the 9C's of Digital Literacy by Chen (2015).

Chen 9C's framework has been referred to since it appears to be the most comprehensive to date with a focus on almost all the skills that may be required to not to use digital tools and platforms effectively, but also in a responsible and socially beneficial way. Those 9 C's for digital literacy are communication,

collaboration, critical thinking, creativity, citizenship, character, curtail, copyright and connectedness. Gaining these competencies may not only help a person to use the online and digital platforms effectively, but also to become responsible and beneficial citizens in the virtual world.

Communication Online reading, writing, speaking and listening skills	Collaboration How to work with everyone online, not just with their friends	Critical Thinking To solve problems, analyze deeply, and question frequently through digital platforms
Creativity To become online content creators not just consumers of knowledge	Citizenship To use technology responsibly and legally	Character To be active advocates of online ethical practices even if not legally required
Curation To understand digital research skills and how to analyze the credibility of the web content	Copyright Understanding and following online and digital copyright laws	Connectedness To become active participants and contribute to the global community by helping the people online.

9 Cs of Digital Literacy by Chen (2015) Adapted

METHODOLOGY

Research Design

This study employed a quantitative research design using a survey method to examine digital literacy competencies among teachers in the Manjung district. Quantitative research was deemed appropriate due to its capacity to provide measurable insights and generalize findings to a larger population (Chua, 2006). A structured questionnaire based on Chen's (2015) 9Cs Digital Literacy Scale was used to assess competencies across nine digital literacy dimensions.

Participants

The target population consisted of 3,651 teachers from the Manjung district. Using Krejcie and Morgan's (1971) sample size table, a sample of 351 respondents was determined to be sufficient. Participants were selected using stratified random sampling to ensure representation across primary and secondary school teachers, as well as varying years of teaching experience.

Instruments

Data were collected using the Digital Literacy Scale (DLS), adapted from Chen's (2015) 9Cs framework, which evaluates competencies across nine dimensions: communication, collaboration, critical thinking, creativity, citizenship, character, curation, copyright, and connectedness. The questionnaire consisted of 36 items rated on a 5-point Likert scale. A pilot test conducted with 35 teachers yielded a Cronbach's Alpha value of 0.907, indicating high internal consistency and instrument reliability.

Table 1 Total Item for each construct

No	Dimensions	No of item
1	Communication	7
2	Copyright	4
3	Critical Thinking	3
4	Character	3

continued

5	Citizenship	4
6	Curation	3
7	Connectedness	5
8	Creativity	4
9	Collaborators	3
	Total Number of Items	36

Before the study was conducted, researchers sought approval from the District Education Department of Manjung and schools in Manjung. The result will be discussed in the following section. Descriptive statistics were used to assess overall competency levels, while inferential analyses (independent t-tests and one-way ANOVA) examined significant differences based on gender, teaching experience, and school type. Mean scores were interpreted using guidelines provided by the Malaysian Ministry of Education's Bahagian Perancangan dan Penyelidikan Dasar Pendidikan (BPPDP, 2006).

Table 2 Mean Score and Interpretation

Mean Score	Interpretation
1.00-1.89	Very Low
1.90 - 2.69	Low
2.70 - 3.49	Average
3.50 - 4.29	High
4.30 - 5.00	Very High

BPPDP (KPM, 2006)

RESEARCH FINDINGS

Respondents' Profile

Respondents' Profile	Categories	Frequency	Percentage (%)
Gender	Male	63	16.1
	Female	328	83.9
Type of School	Primary School	312	79.8
	Secondary School	79	20.2
Working Experiences	0-5 years	34	8.7
	6-10 years	51	13.0
	11-15 years	88	22.5
	16 years and above	218	55.8

The table above explains the respondents in detail. A total of 391 teachers have answered the questionnaire. From that number, 63 (16.1%) teachers are male, and 328 (83.9%) teachers are female. It can be explained that there are more female teachers who answered the questionnaire compared to male teachers. Meanwhile, there are more primary school teachers, 312 (79.8%) than secondary school teachers, 79 (20.2%). Looking into working experiences, there are more teachers who have 16 years and above teaching experiences, 218 (55.8%) compared to only 34 (8.7%) teachers with less than 5 years of teaching. The number of teachers with 6-10 years of teaching are 51 (13.0%) and teachers with 11 -15 years of teaching are 88 (22.5%) of them.

Descriptive Analysis

Analysis of Digital Literacy Competency Based on 9C Digital Literacy Scale.

RQ1: What is the digital literacy level of Manjung school teachers based on 9C dimensions?

The table below discusses on understanding and competency level of Manjung school teachers on Digital Literacy based on Likert Scale. The Likert Scale is represented by SD: Strongly Disagree, D: Disagree, N: Neither Disagree / Agree, A: Agree and SA: Strongly Agree. The data had been analyzed to represent the teachers' Digital Literacy level based on Digital Literacy Scale by Chen (2015).

Table 3 Understanding and competency level of Manjung school teachers on Digital Literacy

Bil	Item	SD f %	D f %	N f %	A f %	SA f %	Mean	SD
COMMUNICATION								
1	COM 1	6 1.5	5 1.3	26 6.6	173 44.2	181 46.3	4.3248	.78405
2	COM 2	12 3.1	39 10	98 25.1	158 40.4	84 21.5	3.6726	1.01791
3	COM 3	2 .5	26 6.6	81 20.7	202 51.7	80 20.5	3.8491	.83834
4	COM 4	1 .3	8 2.0	54 13.8	240 61.4	88 22.5	4.0384	.68393
5	COM 5	1 .3	7 1.8	67 17.1	225 57.5	91 23.3	4.0179	.70688
6	COM 6	1 .3	1 .3	33 8.4	238 60.9	118 30.2	4.2046	.61526
7	COM 7	37 9.5	151 38.6	113 28.9	76 19.4	14 3.6	2.6905	1.00455
COPY RIGHT								
1	HAK 1	3 .8	17 4.3	38 9.7	230 58.8	103 26.3	4.0563	.77586
2	HAK 2	1 .3	6 1.5	14 3.6	231 59.1	139 35.5	4.2813	.63053
3	HAK 3	4 1.0	8 2.0	59 15.1	233 59.6	87 22.3	4.0000	.74075
4	HAK 4	5 1.3	26 6.6	149 38.1	174 44.5	37 9.5	3.5422	.80552
CRITICAL THINKING								
1	CRIT 1	0 0	8 2.0	43 11.0	254 65	86 22	4.0691	.63878
2	CRIT 2	1 .3	4 1.0	33 8.4	252 64.5	101 25.8	4.1458	.62160
3	CRIT 3	15 3.8	79 20.2	176 45	100 25.6	21 5.4	3.0844	.90613
CHARACTER								
1	CHAR 1	5 1.3	1 .3	16 4.1	186 47.6	183 46.8	4.3836	.69882
2	CHAR 2	0	1	10	164	216	4.5217	.56288

continued

		0	.3	2.6	41.9	55.2		
3	CHAR 3	1	1	42	228	119	4.1841	.64200
		.3	.3	10.7	58.3	30.4		
CITIZENSHIP								
1	CITI 1			5	199	187	4.4655	.52449
				1.3	50.9	47.8		
2	CITI 2			17	200	174	4.4015	.57280
				4.3	51.2	44.5		
3	CITI 3			13	218	160	4.3760	.54944
				3.3	55.8	40.9		
4	CITI 4	1		7	211	172	4.4143	.55673
		.3		1.8	54.0	44		
CURATION								
1	CUR 1		1	15	230	145	4.3274	.55953
			.3	3.8	58.8	37.1		
2	CUR 2		16	85	207	83	3.9130	.76635
			4.1	21.7	52.9	21.2		
3	CUR 3		23	126	177	65	3.7263	.80657
			5.9	32.2	45.3	16.6		
CONNECTEDNESS								
1	REL 1	5	57	189	110	30	3.2634	.84712
		1.3	14.6	48.3	28.1	7.7		
2	REL 2	16	107	187	65	16	2.8926	.87044
		4.1	27.4	47.8	16.6	4.1		
3	REL 3	6	46	186	123	30	3.3197	.83672
		1.5	11.8	47.6	31.5	7.7		
4	REL 4	6	81	149	123	32	3.2404	.92459
		1.5	20.7	38.1	31.5	8.2		
5	REL 5	35	102	157	80	17	2.8517	.98891
		9.0	26.1	40.2	20.5	4.3		
CREATIVITY								
1	CREAT 1	28	128	169	55	11	2.7263	.89115
		7.2	32.7	43.2	14.2	2.8		
2	CREAT 2	12	93	160	103	23	3.0818	.92457
		3.1	23.8	40.9	26.3	5.9		
3	CREAT 3	22	123	151	70	25	2.8798	.98104
		5.6	31.5	38.6	17.9	6.4		
4	CREAT 4	16	136	181	54	4	2.7289	.78653
		4.1	34.8	46.3	13.8	1.0		
COLLABORATION								
1	COLLAB 1	3	23	83	221	61	3.8031	.79717
		.8	5.9	21.2	56.5	15.6		
2	COLLAB 2	4	26	114	193	54	3.6829	.83001
		1.0	6.6	29.2	49.4	13.8		
3	COLLAB 3	2	20	92	218	59	3.7980	.77300
		.5	5.1	23.5	55.8	15.1		
Total Mean Of Digital Literacy Level							3.7489	0.7628

Based on the table above, teachers' Digital Competency had been measured based on 9C s. The 9 C s are Communication, Copyright, Critical Thinking, Character, Citizenship, Curation, Connectedness, Creativity and Collaboration. In each dimension, there is one item that has the highest mean that represents teachers' Digital Literacy level. In the communication dimension, item COM 1 has the highest mean value, 4.3248 with standard deviation of 0.78405. COM 1 discusses on the ability of teachers to read online contents easily from the screen. This mean value had proved that teachers are more comfortable to read contents or reading materials from an online source. Approximately, 351 teachers have agreed that reading or getting information from an online source is much more convenient. Meanwhile the lowest mean was recorded by COM 7, where respondents have shown more interest for online listening through headphone and speakers.

The Copyright dimension had 4 items. HAK 2 has the highest mean value which is 4.2813 with SD:0.63053. This item discusses on respondents' knowledge when plagiarizing copyright work. HAK 4 had recorded the lowest mean value, M: 3.5422, SD: 0.80552. This item discusses on the using Turnitin or other similar software to check unintentional plagiarism. The dimension of Critical Thinking has a total of 3 items. The highest mean in this dimension was recorded by Item 2, where it shows that respondents can use many different information and able to put them to overcome any issues. The lowest mean was recorded by Item 3 (M: 3.0844, SD:0.90613). Many respondents are still not very familiar with journal writing, especially using online platform.

In the dimension of Character, the highest mean was recorded by Item no 2, where respondents have agreed to avoid posting negative online comments and poking in other's discussion and chatting. Meanwhile the lowest item is Item 3 that explain the many quite a few respondents that choose to not to remain neutral and tolerant during online discussions. The dimension of Citizenship that discusses on using technology wisely and responsibly had Item 1 recording the highest mean value (M: 4.4655, SD:0.52449). It explains on the how respondents can communicate with others in a respectable way while using technology.

The dimension of Curation discusses on how digital skills are being used in research and respondents can analyze the credibility of the web content. Item 1, which discusses on the ability of respondents finding material from renowned websites. Not many respondents are able to add value to the information available or updating the online information. Connectedness is the dimension that discusses on how respondents actively able to contribute to society through online platform. In this dimension, the item that has recorded the highest mean value is Item 3, that explains on how respondents are eager to participate in online campaigns for community development. The mean value is M: 3.3197, SD: 0.83672. The Creativity dimension discusses on respondents' creativity in creating content. Item 2, with M: 3.0818, SD:0.92457 explains about how respondents like to do their own videos and post them online. The last dimension is on Collaboration, where respondents not only will work with their friends but also other users in the online platform. In this dimension, Item 1 has the highest mean value, (M: 3.8031, SD: 0.79717). It discusses the ability of respondents to work well with others in groups.

Inferential Analysis

RQ 2: Is there significant difference in digital literacy level of Manjung school teachers based on genders?

Ho1: There is no significant difference in digital literacy level among Manjung school teachers based on genders.

		Mean	Std Deviation	t	df	Sig
Male	63	3.9221	.39125	3.119	389	0.002
Female	328	3.7580	.38071			

RQ3: Is there significant difference in digital literacy of Manjung school teachers based on teaching experiences?

Ho2: There is no significant difference in the digital literacy level of Manjung school teachers based on teaching experiences.

The Test of Homogeneity of Variances analysis showed $p > 0.05$, not significant which indicates the equal variances was assumed. The hypothesis tests if the digital literacy level among Manjung school teachers differs based on teaching experiences (Group 1: 0-5 years, Group 2: 6-10 years, Group 3: 11-15 years, Group 4: 16 years and above). The Anova results suggest that the digital literacy level across the different years of teaching experience type of school among teachers does differs significantly ($F_{3,387} = 7.484, p < 0.05$), there Ho2 is **rejected**.

The table below show the one-way Anova test result to investigate whether there is significant difference in the digital literacy level of Manjung school teachers based on teaching experiences.

Group	N	Mean	Std. Deviation	df	F	Sig.
0-5 years	34	4.0377	.37367	3	7.484	.000
6-10 years	51	3.8109	.04876			
11-15 years	88	3.8248	.04020			
16 years and above	218	3.7225	.02604			

p<0.05

RQ4: Is there significant difference in digital literacy of Manjung school teachers based on type of school?

Ho3: There is no significant difference in the digital literacy level of Manjung school teachers based on type of school

The Test of Homogeneity of Variances analysis showed p>0.05, not significant which indicates the equal was assumed. The hypothesis tests if the digital literacy level among Manjung school teachers differs across the type of school. (Group 1: Primary School, Group 2: Secondary School). The Anova results suggest that the digital literacy level across the type of school among teachers does not differs significantly (F_{1,389}=1.264, p>0.05), there Ho3 is **accepted**.

The table below show the one-way Anova test result to investigate whether there is no significant difference in the digital literacy level of Manjung school teachers based on teaching experiences.

Group	N	Mean	Std. Deviation	df	F	Sig.
Primary School	312	3.7734	.38111	1	1.264	.262
Secondary School	79	3.8281	.40744			

p>0.05

DISCUSSIONS

The acquisition of Digital Literacy for Manjung teachers is at a high level- M:3.7489, SD: 0.7628. The level was measured based Chen’s (2015) theoretical framework,9C Digital Literacy Framework. Those 9C’s for digital literacy are communication, collaboration, critical thinking, creativity, citizenship, character, curation, copyright and connectedness. Out of the 9 constructs of the framework, Citizenship has the highest mean (M:4.4143, SD: 0.48735). Citizenship in the Digital Literacy scale discusses on ways to use technology responsibly and legally.

Being courteous and respectful, being accountable, and contributing positively to society are traditionally cited as the basic principles of citizenship (Impero Software & Digital Citizenship Institute, 2016). Traditional citizenship and digital citizenship share many of the same principles (Somyürek, 2019). The young people of today, known as digital natives, require direction to learn how to apply citizenship principles in the digital world, just as all children throughout human history have needed assistance from their parents and teachers to become good citizens (Impero Software & Digital Citizenship Institute, 2016; Fingal,2020).

Students and teachers began using digital tools intensively during the COVID-19 pandemic, both at home and in the classroom, and their use has since become essential (Ranchordas, 2020). Individuals who use digital tools frequently should be ready to interact and work together in a responsible and safe manner when using the internet (Parent and Community Impact, Technology, 2018; Tan, 2011). The idea of digital citizenship has emerged as a result of the necessity to build safe and responsible online communication and collaboration (Ribble et al., 2004; Ribble, 2008; Shelley, 2004).

The mean level for digital literacy is at the lowest for the dimension of Creativity among teachers-2.8542, SD: 0.65841). Digital literacy and creativity are intertwined, as digital tools enable individuals to explore creative ideas, express themselves, and engage in innovative problem-solving, fostering a more engaging and dynamic learning environment. Being creative digitally is about being able to use

digital tools and technologies to explore creative ideas, apply different approaches, and find new ways of displaying your work and research. This could be taking a photo, recording a video or doing something fancy in a presentation. It might mean using digital tools to develop or explore non-digital material or outputs.

Teachers who are creative in teaching will help students to be successful in achieving the objectives of a topic in particular and in deepening a subject in general. This creativity includes through activities carried out, building materials and questioning techniques (Raja Ismail and Ismail 2018). The creativity among teachers must be aligned to the current needs of the world of education which often experiences changes over time. Changes and developments in technology play a major role in changing teachers' creativity in teaching and learning from traditional teaching to information technology-assisted teaching, the use of digital equipment and the internet such as computers, smart boards, electronic books (e-books), the latest electronic gadgets such as tablets, as well as the widespread use of the internet.

The findings of Mohammad Rusdi Ab Majid's (2017) study is also similar to the study conducted here, where it shows that only the teachers' Pedagogical Knowledge in that study is at a high level, while the rest, namely Technological Knowledge, Content Knowledge, Content Technology Knowledge, Pedagogical Technology Knowledge, Content Pedagogical Knowledge and Content Pedagogical Technology Knowledge are only at a mediocre level. Therefore, learning skills of this century which emphasizes the use of technology must be integrated in teachers teaching creatively (Ainun Rahmah Ibrahimi, Zamri Mahamod & Wan Muna Ruzanna Wan Mohamad 2017).

The acquisition of Digital Literacy for Manjung teachers is at the highest level- $M:3.7489$, $SD: 0.7628$. The level was measured based Chen's (2015) theoretical framework, 9C Digital Literacy Framework. Those 9C's for digital literacy are communication, collaboration, critical thinking, creativity, citizenship, character, curation, copyright and connectedness. Out of the 9 constructs of the framework, Citizenship has the highest mean ($M:4.4143$, $SD: 0.48735$). Citizenship in the Digital Literacy scale discusses on ways to use technology responsibly and legally.

Even when the digital literacy scale is at a high level, H_01 has been rejected. It discusses on the significant difference in digital literacy level among Manjung school teachers based on genders. The hypotheses proved that gender plays a big part in digital literacy level. The results showed that the mean of male's digital literacy was higher than female which concludes that male teachers are more digital literacy savvy than the female teachers. The result is similar to the study conducted by Rizal et.al (2021), which studied on Gender Differences in Digital Literacy Among Prospective Physics Teachers. In this study, the digital literacy of male teachers were also better than female teachers. This scenario could be contributed by male teachers using digital devices more to create digital content, creating documents, analysing data, creating interesting animations, effectively search, store and evaluate information and communicate interactively more than female teachers.

Discussing on H_02 , which focuses on significant differences in the level of digital literacy among teachers based on teaching experiences has been rejected too. The result has shown that there is significant differences in the digital literacy level among teachers based on their teaching experiences. Teaching experiences does impact the digital literacy level among teachers. The mean is showing a slight decline as teaching experiences is increasing. The era of digitalization has increased anxiety among teachers in the form of digital stress. Digital stress triggers high levels of professional anxiety which was contributed by increase of working hours, the difficulties that occurs due to the lack of physical contact, the complexity of digital migration due to technical circumstances, the inadequate equipment for online teaching and the limited technical competences of teachers and students. In a way all these reasons had affected the digital literacy level among teachers.

Some suggested strategies for implementing digital literacy and citizenship in the context of education in Malaysia including strengthening digital literacy and implementing digital citizenship education in teaching and learning as well as the national curriculum. Strengthening digital literacy can be done in schools by providing a basic syllabus on the use of web 2.0 digital tools for students. This strengthening includes efforts to diversify methods of completing tasks and apply web 2.0 digital tools as the main medium in teaching, learning and assessment aspects in schools. The syllabus can be included in any appropriate curriculum such as citizenship subjects, industrial design, or life skills where the existing curriculum also needs to be overhauled according to the current needs of the world that require basic digital skills. This can reduce the burden of the existing curriculum, and even the assessment of the use

of web 2.0 applications to encourage young people to develop online capabilities, engagement and creativity as well as foster awareness of the implications of each of their online activities.

CONCLUSION

According to the study's findings, teachers in the Manjung district have a high degree of digital literacy overall, especially when it comes to topics like digital citizenship and responsible technology use. Teachers showed mastery of the fundamentals of digital skills, with the greatest level of competency observed in responsible communication and technology use. Lower levels of creativity and connectivity, however, suggest that although teachers are at ease with consuming digital content, fewer are actively producing content or participating in global digital communities.

Additionally, the results show statistically significant variations in digital literacy by years of teaching experience and gender. In general, younger or less experienced instructors had greater ability with digital tools, while male teachers demonstrated higher levels of digital literacy than their female colleagues. These variations point to the necessity of tailored and varied professional development initiatives that fill in particular gaps among various teacher populations.

While Malaysia's Digital Education Policy provides a strategic framework for digital transformation in education, the successful realization of its goals depends heavily on the preparedness and adaptability of educators. Strengthening digital literacy among teachers must be a continuous effort, supported by comprehensive training, accessible infrastructure, and a culture of digital innovation within schools.

To further advance the integration of digital literacy into educational practice, future research should expand its scope to include a more diverse and larger sample across various regions. Additionally, qualitative studies exploring teachers' lived experiences and challenges in digital integration could provide deeper insights into contextual barriers and enablers.

Although Malaysia's Digital Education Policy offers a strategic framework for the digital transformation of education, educators' readiness and flexibility are crucial to the policy's successful achievement. A culture of digital innovation in schools, thorough training, and easily available infrastructure are all necessary to support the ongoing endeavour to increase teachers' digital literacy.

Future studies should broaden their scope to include a wider and more diverse sample from other areas in order to better improve the integration of digital literacy into educational practice. Further insights into contextual barriers and enablers may also be obtained from qualitative research that examine instructors' lived experiences and difficulties integrating digital technology.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest. This includes financial, political, personal, or professional relationships that could be perceived as influencing the content or conclusions of this manuscript.

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AUTHORS CONTRIBUTION

All listed authors have made a significant scientific contribution to the research in the manuscript, approved its claims, and agreed to be an author.

DECLARATION OF GENERATIVE AI

During the preparation of this work, the authors used ChatGPT (OpenAI) to enhance the clarity and readability of the manuscript. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

ETHIC STATEMENTS

Not applicable.

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