

Teachers' digital literacy of different teaching career phases at Muhammadiyah High Schools in Yogyakarta, Indonesia

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Abstract

The Indonesian Government makes English a compulsory subject and encourages the integration of technology into its high school teaching and learning process. Therefore, English teachers need to keep abreast with the fast-changing world's challenges, especially in integrating technology into the teaching-learning process. This is more evident in the post-pandemic situation, where learning has moved online or to a hybrid format. It is essential to understand English teachers' digital literacy to determine their technology literacy and the extent to which they integrate technology into their teaching and learning. This study used a qualitative phenomenology design. The participants are English teachers at Muhammadiyah High School in Yogyakarta from different generations and teaching phases. They are categorized by age and length of service to determine each group's characteristics. Data collection used an in-depth semi-structured interview to explore participants' perspectives, then analyzed using NVivo qualitative data analysis software. The research results describe teachers' perceptions of their digital literacy at the functional level, not yet at the expert level. The generation groups and career phases shape and differ their digital literacy, teaching adjustment, and professional development across those levels. This study has limitations, including small sample sizes, a single context, a qualitative design, and a cross-sectional design, which should be considered in future research. The contribution of this research is the mapping of teacher digital literacy across career paths and age groups as the input to customized teacher professional development.

Keywords:

Digital Literacy;
English Teachers;
Generation Groups;
Career Phases

1. Introduction

The lack of in-person interaction with teachers and other factors, such as family background and the technology divide, are contributing to learning loss during online schooling during the pandemic (Darling-Hammond, 2020; Godsey, 2020; Gupta & Khairina, 2020). This condition raised teachers' expectations for teaching students to meet their academic and social-emotional needs (Darling-Hammond, 2020). Meanwhile, teachers' competency in integrating technology into Indonesia's teaching and learning process still needs improvement (Rahayu, 2019; Berliyanto & Santoso, 2018). It is essential to know about the teachers' readiness to conduct an online teaching-learning process where the class can be in an "unpredictable combination of distance learning, blended learning, and in-classroom learning (Darling-Hammond, 2020, p. 457). Some research investigates teachers' perceptions of integrating technology into their teaching and learning processes, with participants including school

teachers and lecturers (Rahayu, 2019; Hutchison & Reinking, 2011; Share and Mamikonyan, 2020; and Hafifah and Sulisty, 2020). Research on English instructors at language centers added variety to the research topic and filled a gap left by other researchers.

This research measured the digital literacy, knowledge, and experience of English teachers at Muhammadiyah High School in Yogyakarta, Indonesia. The research examines teachers' perspectives on their digital literacy across different age groups and career phases to identify group differences. The significance of the research is that it provides information on teacher training and professional learning. If there are different levels of teachers' digital literacy across teacher groups, there is evidence of collaboration among teachers learning from each other (Bailey & Schurz, 2020). This research addressed three research questions: (1) How is the digital literacy of teachers at Muhammadiyah Schools in Yogyakarta? (2) Are there any differences in teacher digital literacy among high school teachers at different stages of their teaching career? (3) How does TDL differ among teachers at different teaching career phases? This specific setting is chosen because the researchers have access to it. At the same time, Yogyakarta city on Java Island is selected because it is well-known as an education city in Indonesia, with better access to education and technology, including the internet (Diki, 2013; Berliyanto & Santoso, 2018).

1.1 Literacy

The nature of Literacy is changing alongside cultural change (Baker, 2010; Leu et al., 2004). Furthermore, Leu et al. explained that Literacy is "deictic" because it changes with context. Literacy is also "a verbocentric word-based communication system" (Baker, 2010) that people use with reading, writing, and text in the real world (Barton and Hamilton in Baker, 2010). Ohler in Reyna et al. (2004) states that Literacy can decode and encode text. Barton and Hamilton divide Literacy into "literacy event," which is observable in what people do with the text, and "literacy practice," which is unobservable because it connects to beliefs, values, attitudes, and power structures (in Perry, 2012). So, Literacy relates to language and how it is processed in the mind.

There are some different perspectives on Literacy. Baker (2010) viewed literacy from five perspectives: behavioral, semiotic, and multiliteracies, as well as cognitive, sociocultural, critical, and feminist perspectives. Perry (2012) summarized the five into cognitive and psycholinguistics, sociocultural, and critical literacy perspectives. Cognitive and psycholinguistics focus more on the process of the mind. It can be seen through behavior in line with Piaget's constructivism concept that people are active constructors of the knowledge to acquire understanding of text and Saussure's semiotic study of a system (Dimitriadis & Kamberelis, 2006). The sociocultural perspective viewed language as the social activities that involve socio-context and culture as defined by Vygotsky (Dimitriadis & Kamberelis, 2006) for "understanding how people use literacy in their everyday lives" (Perry, 2010, p. 51). The critical theory emphasizes Literacy's practice from the power relation using Bourdieu's concept that language represents symbolic interaction and Freire's humanist education (Dimitriadis & Kamberelis, 2006; Sadovnik, 2016). Literacy may have a broad definition, or it narrows down based on the perspective from which it is viewed. Literacy is changing based on culture and context and is also influenced by the development of technology used for everyday life.

1.2 New Literacy

As mentioned before, literacy is "deictic" or ever-changing; therefore, it is tricky to define what literature is and keep updated with the changes. Leu et al. gave the term "a dual-level theory of New Literacies" (p. 1156) to explain that the ever-changing fashion of Literacy is because of the technology and internet, which has a real-time one-click move. They differentiate the level using the small and capital letters of new literacies. The "new literacies" with little capital deal with a particular lens, technology, or context. The specification ranges from the specific area within new literacies or new technologies, with instant text messaging, a disciplinary base in linguistics, such as semiotics in media, or a distinctive conceptual approach in new literacies. The "New Literacies" with the capital letter "as the broader, more inclusive concept, includes those common findings emerging across multiple, lowercase theories" (p. 1157). Kalantzis et al. (2010) mention it as a shift from the dominance of print media to technology and digital platforms.

1.3 Digital Literacy

The concept of Literacy has developed as technology and the internet are involved in humans' daily lives. Literacy is not only a matter of decoding and encoding text from printed materials, as Baker, Pearson, and Rozendal proposed, "...by the ways we help our populace engage in technology-based communication. Finally, a new perspective may shed new light on the phenomena of reading and writing with technology (2010, p.3)." The term digital literacy has evolved from the basic theory of Literacy, and what makes them different is the media used to obtain and share information (Arthur, 2013; Bazalgette & Buckingham, 2013; Atkins, 2018; New London Group, 1996).

Paul Gilster (1997) introduced the term "digital literacy," which defines it as "the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers" (p. 1–2). Reyna et al. (2004) added that digital literacy is included in the multiliteracies concept, which is related to practical skills, analysis, evaluation, critical thinking, and responsibility to the community for the shared information's sociocultural aspects. Eshet-Alkalai (in Lankshear & Knobel, 2008, p.4) proposes digital Literacy from three aspects: technical skills, cognitive, and socio-emotional aspects. There are four characteristics of Literacy. They are semiotic, public, transitory, and product oriented. Literacy is a process of understanding a "multiple sign system" shared with others and enduring different dynamics of communicating with a specific audience (Baker, Pearson, Rozendal, 2010). They claimed a technology-rich literacy culture used technology to find and share information and insight. The sociocultural perspective shifts "the focus from individual cognition to cultural norms" (p.16)". Digital Literacy has the aspect of traditional Literacy to decode and encode speech acts in the technology era using the computer and internet. However, there is a shift from "the dominance of the medium of the book to the dominance of the medium of the screen" (Kress, 2003, p.1) that bear consequences on the process of the cognitive aspect that the accessibility and open access consider the sociocultural factors.

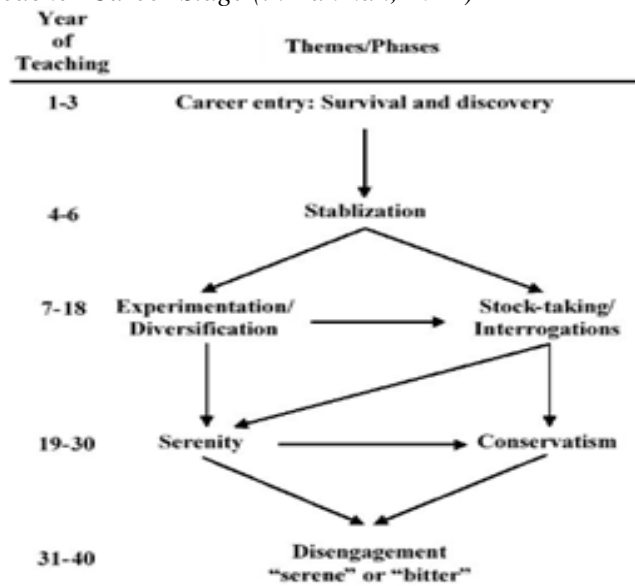
To put the theoretical view about digital Literacy, the term Information and Communication Technology (ICT) Literacy proposed a more technical definition. UNESCO (2013) combines several concepts, including ICT, as a new literacy construct. ICT Literacy Panel in Hafifah and Sulisty (2020, p. 186) defines "ICT literacy as the capability to practice digital technology, communication tools, and/or network access, integrate, manage, evaluate, and create information to function in a knowledge society." This research will use the new literacies perspective, focusing on specific and technical skills. The term Digital Literacy level is used to measure the teachers.

1.4. Teaching Career Phases across Generations

Teacher characteristics such as beliefs, prior knowledge, and experience play an important role in teaching style and professional development (Rahman, 2021). Digital literacy is part of the teacher's knowledge of the use of technology and how to integrate it into the teaching and learning process. This technological knowledge relates to generational identity, including millennials, Generation X, and Generation Z, because each generation's engagement with technology varies. According to Huberman (1993) in Rahman (2021), there are five stages of teacher career phases. Rahman explained that understanding where teachers are in their career phases is important for supporting their learning and development.

Figure 1

Huberman's Model of Teacher Career Stage (in Rahman, 2021)



Teaching career phases are developmental cycles related to psychological development. A teacher's career usually begins at about 20ish, when they graduate from teacher education. The first three years are the career entry when the novice teachers make efforts to survive and discover. The second cycle is when they enter their mid-twenties to mid-thirties, and they have around 4 to 6 years of experience, to enter the stabilization phase to experiment and diversify. By their thirties and early forties, with seven to eighteen years of teaching experience, they have entered a period of enthusiasm and growth, meaning they have already been stocktaking and have developed confidence and skills. The next phase is serenity, when they are in their forties and have 19 to 30 years of teaching experience, they settle into stability and routine. After the age of fifty, with 31-40 years of teaching experience, they enter the phase of disengagement, where experience dominates, but the motivation to learn may disappear. This is also the mark of career frustration and career wind-down because they are near retirement.

In relation to generational identity, these career phases are linked to teachers' learning and engagement with technology. The educational background, different learning styles, and experiences are factors that explain why the younger generation has different learning styles and digital literacy. Below is a table explaining the career phase and generation identity.

Table 1
Generational Name, Age Group, and Career Phases

Born	Generation name	Age (up to 2024)	Career phases	Teaching experience
1997-2012	Generation Z	12-27	Phase 1: Early 20s to mid-20s.	1-3 years
1981-1996	Millennials	28-43	Phase 2: Mid-20s to early 30s.	4-6 years
			Phase 3: Early 30s to mid-40s.	7-18 years
1965-1980	Generation X	44-59	Phase 4: Mid-40s to late 50s.	19-30 years

1946-1964	Boomers	60-78	Phase 5: Late 50s to retirement	31-40 years
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Sources: Dimock (2019); Huberman (1995) in Rahman (2021)

The table above shows the mapping of career phases across generational cohorts based on the birth year, age in 2024, years of teaching experience, and typical career phases. This information also provides a general description of how teachers from different generational cohorts interact with technology integration and how they learn to embrace technological advancements (Atkins, 2018; Rahmani, 2021).

2. Method

To explore the cross-path between generational cohort and teacher career phases, with an emphasis on the teacher's digital literacy, a qualitative research design with a phenomenological approach is well-suited to exploring participants' lived experiences. This approach allows the researchers to gain an understanding of teachers' experiences, focusing on the different career phases regarding their digital literacy, integrating technology into their teaching.

The first steps in designing this survey research are formulating the problems and creating research questions, then developing a literature review and research framework. Based on the literature review and theoretical basis, the researchers developed the interview protocols as guidelines for conducting semi-structured, in-depth interviews. The interview protocol comprises four categories: demographic questions (11), content mastery (5), teaching skills (7), and technology integration in teaching (4). Altogether, there were twenty-seven questions. The research instrument consists of open-ended questions. The demographic questions were designed to gather information about participants' age, length of service, and educational background. They also serve as questions to assess the teachers' technical skills in using technology in their instructions. The next three question categories were designed to assess teachers' pedagogical, content, and technological knowledge. The technology skills explored here were those related to integrating technology into their teaching and learning processes, not personal skills such as shopping online, using banking systems, or using personal social media.

The participants were selected using purposive sampling based on the setting, age, and length of teaching experience. The participants are teachers at Muhammadiyah high schools in Yogyakarta, Indonesia, at different stages of their teaching careers, who teach English at Muhammadiyah High School in Yogyakarta. Age-based grouping is used to determine which generation a participant belongs to. These generation groups are essential for understanding differences in digital literacy. Age also placed participants at different stages of their teaching careers. The complete generational names, age groups, and career phases are shown in Table 1. Previously, there were two participants per generation, for a total of eight: four males and four females. However, the research can only obtain six participants, with five females and one male. There are also only two generational representatives, Generation X and Millennials. The complete results for the participants are shown in Table 2, including their demographic information. The interview sessions lasted approximately an hour per participant and were conducted in August 2024.

The data collection used an in-depth interview. The interview was then transcribed and shared with the participants for review and data confirmation. The data analysis used the transcribed interview recording as raw data. The next steps were to conduct preliminary readings and interpretations as a basis for coding. The reiterative process in reading the data resulted in saturated coding for the deeper. The coding from the initial reading was then imported into NVivo Qualitative Data Analysis for deeper, more comprehensive coding and analysis. The analysis was presented as themes, which served as the research results. The trustworthiness of the findings was corroborated by the inter-rater reliability, as the NVivo coding and analysis were discussed with the other research collaborator to achieve saturation of themes.

3. Results and Discussion

The results of this study are presented first by describing the participants' demographic information. Then, answer the three research questions posted for this research. The answer to the first research question describes teachers' perceptions of their digital literacy. The next section explains

whether there are any differences in their digital literacy across career phases, and how teacher digital literacy differs. These findings address the research problems by revealing differences in teacher digital literacy across teaching career phases that correlate with content mastery, teaching skills and professional development.

3.1 Demographic Information of the Participants

Participants are categorized by age, career phase, and generation name. The age and career phase refers to experience in teaching and the generation name related to technological experience as a digital native or digital immigrant, which may result in different technological skills and different ways of using technology and gadgets. The researcher was unable to meet all the criteria specified for purposive sampling. She can only reach out to male and female participants from the Generation X and Millennial generations. The findings are based on those who agreed to participate, which limits the scope of this study.

Table 2

Participants' Demographic Information

Generation Name	Age	Teaching Phase	Years of Teaching	Name	Gender	Education
Millennials (Born 1981-1996)	30	Phase 2	4	Ineke	Female	Master
	37	Phase 3	13	Yessi	Female	Master
	38		15	Elly	Female	Master
Generation X (Born 1965-1980)	46	Phase 4	20	Usi	Female	Bachelor
	48		20	Diana	Female	Master
	51		23	Wawan	Male	Bachelor

The participant categories are based on generation, teaching phase, age, gender, and education. There are 6 participants of 1 male and 5 females. The participants in the Generation X category are in the fourth phase of their teaching career, consisting of a male and two females aged 46, 48, and 51. Among the three of them, only one has a master's degree. Another category is Millennials, and all females. The youngest is in her second phase of teaching in her early 30s. Two of them are in their third phase and are in their late 30s. All millennial teachers hold a master's degree.

3.2 Teachers' Perception of Their Digital Literacy

Teachers at Muhammadiyah High School in Yogyakarta described their digital literacy using their perception. They stated that they had moderate levels of digital literacy. When they were rating themselves, they said they were between 3 and 7 on a 10-point scale and 3 on a 5-point scale. Elly stated, "If I rate myself, I will go between 6-7," while Yessi said, "I myself would say...if I need to level myself, on the scale of 1-5, I am in between...at level 3." They perceived their level of digital literacy as intermediate to advanced. They said they are fair or reasonable about technological knowledge, but do not think they are experts yet. This aligns with Rahayu's (2019) research, which indicates that teachers are not confident in their competence in integrating technology into teaching. They try to learn on their own, but they mostly rely on workshops and training. However, the workshops and training did not provide systematic instruction—the workshops mainly focused on technical skills and specific technological methods used in the classroom. Hafifah and Sulistiyo (2020) also shared the same concern about making the teacher training more meaningful.

There are differences in the level of technology integration in the teaching-learning process before and after the pandemic, as teachers use more and varied technology after the pandemic. They move from mostly offline media, such as video-based content, to online media. They tend to use technology minimally as an add-on. During the pandemic, they became more reliant on technology in their teaching and learning process. They shifted from basic technologies to more advanced ones, such as video conferencing and Learning Management Systems (LMS), which require greater skills and knowledge to operate. Ineke stated that "Before the pandemic, I used Canva...After the pandemic, use learning apps, quizzes, Google Forms, and YouTube." There is also an increasing length of time in using the technology after the pandemic, like what Wawan said: "Before the pandemic, the gadgets were used less than two hours per week. But after the pandemic, I put off the gadgets only before bedtime... now I

use gadgets 80% including for teaching.” They stated that they mostly used Google Classroom and its affiliates to conduct the teaching-learning process, as well as the Learning Management System (LMS), Canva, YouTube, WhatsApp, and Zoom for the online class. Teachers demonstrated their digital literacy at the functional level.

3.3 Digital Literacy Across Career Path

There are similarities and differences in the teacher’s digital literacy across the career path. The analysis result presented in the themes presents patterns that describe the experience and perception of digital literacy. The discussion of digital literacy across the career path reveals characteristic patterns in the early, middle, and late career. There are three aspects that indicate the teacher’s digital literacy at Muhammadiyah High School in Yogyakarta.

Table 3

Digital Literacy Across Career Path

Career Phase	Phase 2 Career Entry-Stabilization (Less than 6 years)	Phase 3 Experimentation/ Diversification (7–18 yrs)	Phase 4 Serenity/Conservation (19-30 yrs)
Digital Literacy	<ul style="list-style-type: none"> • Frequent use of multiple tools • Quick to explore new platforms. 	<ul style="list-style-type: none"> • Moderate to high literacy • Balance tools effectively • Apply new strategies in class. 	<ul style="list-style-type: none"> • Basic to moderate digital literacy • prefer familiar tools • may struggle with advanced apps.
Teaching Skills and Knowledge	<ul style="list-style-type: none"> • Less experienced in Pedagogy, student needs, and education standards. • Rely on digital tools to structure lessons 	<ul style="list-style-type: none"> • Stronger curriculum adaptation • link content knowledge with methods • integrating technology based on pedagogical needs. 	<ul style="list-style-type: none"> • Deep pedagogical repertoire • strong classroom management • Excellent content knowledge, curriculum mastery, and assessment.
Professional Development	<ul style="list-style-type: none"> • Informal and self-learning • strengthen confidence through PD and workshops. 	<ul style="list-style-type: none"> • Active participation in professional organizations and workshops 	<ul style="list-style-type: none"> • Rely on school-provided training • selective adoption of technology (necessity and institutional policy).

Teachers need a balance between digital literacy and pedagogical competence, and the teaching career phases showed differences in this balance. Early-career teachers with less than 5 years of teaching experience exhibit higher confidence and greater fluency in using digital learning tools (DLT). As Ineke said that “*From the internet, I searched in Google...I tried to watch, compare on how people make the video*”. On the other hand, they have limited teaching experience, which makes them rely more on technology than on adapting methods to the existing curriculum. This contradicts the views of senior teachers with extensive pedagogical knowledge, strong classroom management skills, and a deep understanding of curriculum design. However, their digital literacy is not very good. Many senior teachers preferred basic tools such as Google Meet and Classroom. Others admit that they have low confidence in using new DLT without training. Between the early and senior teachers, the mid-career teachers occupy a middle position, combining growing ICT competence and seasoned pedagogical adaptation. Elly shared her experience: “*For the method, I usually choose... there were students whose technological skills are good...regular class like easy things...Advance class more focus on the competence mastery.*”

Comparing digital literacy, pedagogical expertise, and professional development across different teaching career phases highlights the importance of understanding teacher competence in each phase. These findings suggest that customized teacher training, tailored to each teacher’s experience with digital literacy and pedagogical competence, will improve teachers’ overall effectiveness in integrating technology into their practice. These findings are in line with a study by Rahman (2021) that used Huberman’s career phases to examine how teaching characteristics affect involvement in teacher

professional development. One important teaching characteristic is the years of teaching, the same aspects used in this study.

3.4. Technology Integration in Teaching

In this century and after the pandemic, teachers need to integrate the three knowledge domains, along with technology, into the teaching and learning process. First, content knowledge is the knowledge about the subject matter or what to teach. Second, pedagogical knowledge is the skill of teaching or how to teach. Third, technological knowledge is about the ability to integrate technology into the teaching-learning process. The participants have a repertoire of content and pedagogical knowledge, meaning they know how to integrate those three aspects and technology into their teaching-learning process. The knowledge is also supported by their master's degree. They are also active participants in professional organizations and training and workshops. Elly stated, *"I like to compile many articles from the training...Meeting at MGMP often discussed the teaching methods and technology integration that need to be implemented in the classroom"*. This section presents the teacher's perception of their competence in integrating technological, pedagogical, and content knowledge.

Teaching methods

Teaching before and after the pandemic requires different arrangements, as each has distinct characteristics. Teaching during and after the pandemic integrates more technology, as mentioned by Yessi: *"The easiest and practical way to assess is by using an evaluation or quiz...other than that during the asynchronous meeting, I will call students by name and ask them to answer the questions."* Both generations perceived that student-centered teaching, by accommodating learners' learning styles, should be focused on the teaching-learning process. The Generation X teachers in the fourth teaching phase focus more on practical learning through diverse teaching methods and the integration of technology. They also think they need more technical assistance. The Millennial teachers at the third level perceived that understanding the curriculum and preparing lessons using a lesson plan are necessary. They also think that collaboration with other teachers benefits them in conducting successful teaching and learning.

Classroom management

The successful teaching and learning process depends on how teachers manage the classroom. Classroom management is the orchestra that the teachers need to conduct to create successful learning. In this study, teachers perceive that classroom management is important, particularly when technology is integrated into language instruction. All participants reported teaching a large class of almost 40 students with mixed abilities, diverse backgrounds, and varying technological skills. So, the teachers need to find ways to engage and connect with students, especially in online classes. Elly mentioned that *"to manage the class is how to put students in order...to put the active students in one group and to recognize the slow learners. Teachers have the power to manage the class to be dynamic."* Another aspect of classroom management is balancing the curriculum with the online classroom setting and integrating technology during the process.

Assessment and evaluation

In the teaching-learning process, it is crucial to assess students' understanding to monitor their progress and achievement. Diana said that *"grade is not only a written test, but also the process of how they do the tasks."* Both generations of teachers use formative and summative assessments, including mid-term and final exams, as well as daily quizzes and feedback sessions. The teachers perceived they needed to use various methods to assess and evaluate students' effort and participation, rather than merely the product.

3.5. Teaching Skills and Professional Development

All participants, regardless of their generation category or teaching phase, actively participate in professional organizations such as MGMP. Diana mentioned that *"Since my early teaching career, the school has made me involved in MGMP."* They also joined various training, both offline and online, especially during the pandemic. They also participate in various workshops and conferences either as participants or speakers. Especially because of the pandemic and the need to conduct online classes, they are eager to learn how to integrate technology into their teaching. It can be said that teachers are motivated to develop their professionalism through different activities, like joining professional organizations, attending training and workshops, as well as participating in conferences

Teachers in the Millennial generation report on a greater variety of teaching responsibilities beyond their formal school teaching. They become the person in charge of extracurricular teaching, private tutoring, teaching at language centers, informal education, and teaching at different schools. Generation X, when discussing their teaching experience, mostly focuses on reflections, teaching challenges, and adaptations, especially during the COVID-19 pandemic. Their reflections include their aspirations for future teaching in Indonesia and the importance of parental involvement.

It can be said that there are differences between the two generations in how they give meaning to their teaching experience. Millennials, who are also in the third phase of their teaching careers, feel they want to gain as much experience as possible to broaden their teaching repertoire. Besides, they still have plenty of energy to take part in various activities. It may also be financial reasons, since they are still in the phase of gaining stability in their jobs. On the other hand, Generation X are in the fourth phase of their teaching career, where they are quite satisfied with their position and feel their career ambitions have been at least partially fulfilled. They are in the position of looking back on what they have done, so they kind of more reflective in manner. They have also already gained more experience to reflect on.

3.6 Teachers' insight into their Digital Literacy, Teaching Skills, and Professional Development

The thematic analysis of the interview data identified themes that provided teachers' insights into the relationships among digital literacy, teaching skills, and professional development. Four aspects consistently come up in the data. The first is the digital platforms and resources teachers use, including synchronous platforms like Google Meet and Zoom, asynchronous LMS like Google Classroom, Canvas, and Rumah Belajar, school LMS, and supplementary tools like Google Forms, YouTube, quizzes, and Canva to deliver lessons and assess students. The second is digital literacy and professional development. Teachers' digital literacy varies. Early-career teachers are generally more confident than middle- and senior-career teachers. Digital literacy raises teachers' awareness of their weaknesses and motivates them to engage in professional learning. All participants need to engage in professional development to some extent, from self-learning to structured workshops, which support growth in digital literacy.

Then, technology integration, pedagogical adaptation, and classroom practice involve teachers adjusting methods and technology to align with curriculum standards and student needs while managing challenges such as student disengagement, attendance, and plagiarism. The use of games and gamification fosters the students' motivation. Finally, the constraints teachers experience and how institutional support addresses these problems enable teachers to complete the learning process. Teachers usually face device shortages, poor internet connectivity, and heavy workloads. Institutions need to regulate technology integration. Schools must support the facility if they implement an LMS to support the teaching and learning process, for example, using the gadget and the internet. The teachers' perceptions of their digital literacy, which influence how they integrate the competence into the teaching process and professional development, align with the research by Hafifah and Sulistiyo (2020).

4. Conclusion

This research aims to reveal teachers' digital literacy in different career phases. The interview with the participants is categorized as being in the second, third, and fourth phases of their teaching career, indicating they are stable. This study shows that teachers at Muhammadiyah High Schools in Yogyakarta demonstrate different patterns of digital literacy across career phases, while sharing three common experiences that cut across these stages: the digital literacy showing the reliance on technology and digital platforms, continuous pedagogical adaptation and technology integration in the teaching and learning process, and ongoing growth in technological competence through professional development. The constructs used to determine their digital literacy were content mastery, teaching skills, and technology integration in teaching. The research also reveals that they are primarily good at integrating content mastery and teaching skills, but still need to learn more to integrate the technology into the teaching-learning process. They partly rely on workshops and training to improve their technological skills.

The findings revealed important implications. First of all, digital literacy varies across career stages. The novice teachers showed high confidence in digital platforms but were less mature in pedagogy. The senior teachers achieved strong pedagogical expertise but have moderate to low digital literacy. The findings highlight the importance of tailored professional development that meets teachers'

needs and enhances their professionalism. Training for early-career teachers should emphasize deepening pedagogical strategies, while programs for senior teachers should prioritize practical, hands-on digital training to strengthen confidence and fluency. Mid-career teachers, who balance both areas, can serve as peer mentors, sharing technological skills and pedagogical practices across generations of teachers.

Second, the centrality of institutional support—through reliable infrastructure, school policies, and accessible professional development—points to the need for systemic investment. Muhammadiyah High Schools can serve as important case studies of how faith-based institutions negotiate digital transformation. The evidence here indicates that sustained teacher development, aligned with career phase and supported by enabling school policies, is essential for maximizing the impact of digital literacy on teaching and learning. This aspect is in line with a study by Berliyanto and Santosa (2018) that makes an inquiry into the institutional support to the implementation of technology in the teaching learning process. The gaps and limitations in this research can serve as considerations for future researchers interested in similar topics. Researchers are advised to use large-scale studies across different contexts to enhance the generalizability of the survey research design. As this research uses the phases, the future study should consider longitudinal studies to gain more information, rather than cross-sectional studies that may lead to discontinuous fragmentation.

Although this study yields interesting findings, it has some limitations. This research employed a small sample of six participants, mostly females. The generation groups were not all represented; only Generation X and millennials were included among the four. The career phases were also represented by three phases: two, three, and four out of five phases. The site was a single context of Muhammadiyah schools in Yogyakarta. Because of the limitation, this study cannot be used as the basis for generalization. It presents an initial study and a specific description of how digital literacy evolves along career phases in the teaching learning process.

This research contributes to the study of teacher digital literacy in relation to teaching practice and professional development. This study provides insight into the fact that teacher digital literacy is not static but develops alongside teacher growth and professional development. Mapping differences in teacher digital literacy alongside their teaching practice provides empirical information for informed decision-making to customize teacher professional development programs and policy frameworks that align digital literacy with pedagogical and content knowledge. The result offers a model that can be applied to a similar context of high schools outside Muhammadiyah schools.

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<https://www.proquest.com/docview/3236373318?pq-origsite=gscholar&fromopenview=true&sourcetype=Dissertations%20&%20Theses>).

5. References

- Arthur, S. C. M. (2013). Digital Literacy in a global context in S. Kurbanoglu et. Al. (eds.): *ECIL 2013*, CCIS 397, pp. 141–147. Springer International Publishing Switzerland.
- Atkins, C. (2018). Exploring teachers' professional development and digital literacy: a grounded theory study, (January). <https://ethos.bl.uk/OrderDetails.do?uin=uk.bl.ethos.761433>.
- Baker, E. A. (2010). *The new literacies: Multiple perspectives on research and practice*. The Guilford Press.
- Bailey, J. P.; & Schurz, J. (2020). COVID-19 is creating a school personnel crisis. *American Enterprise Institute*. May 2020.
- Baker, A., Pearson, P.D., & Rozendal, M.S. (2010). Theoretical perspectives and literacy studies: An explanation of roles and insights in Baker, A., Pearson, P.D., & Rozendal, M.S. (editors). *The new literacies: Multiple perspectives on research and practice*. The Guilford Press.

- Bazalgette, C. & Buckingham, D. (2013). Literacy, media, and multimodality: a critical response. *Literacy UKLA*, 47(2), July 2013. Pp. 95-102.
- Berliyanto & Santoso, H. B. (2018). Indonesian perspective on massive open online courses: Opportunities and challenges. *Journal of Educators Online*, 15(1), January 2018. (EJ1168947).
- Darling-Hammond, L.; & Hyler, M. E. (2020). Preparing educators for the time of COVID ... and beyond. *European Journal of Teacher Education*, 43:4, 457-465, DOI: 10.1080/02619768.2020.1816961.
- Diki, D. (2013). International collaboration of distance learning universities for online learning in Indonesia. *LUX: A Journal of Transdisciplinary Writing and Research from Claremont Graduate University*, 2(1), Article 12. <http://scholarship.claremont.edu/lux/vol2/iss1/12>.
- Dimock, M. (2019). Defining generations: Where Millennials end and Generation Z begins. <https://www.pewresearch.org/short-reads/2019/01/17/where-millennials-end-and-generation-z-begins/>
- Dimitriadis, G. & Kamberelis, G. (2006). *Theory for education*. Routledge.
- Eshet-Alkalai, Y. (2004). Digital Literacy: A conceptual framework for survival skills in the digital era. *Journal of Educational Multimedia and Hypermedia*, 13(1), pp. 93-106.
- Gilster, P. (1997). *Digital Literacy*. John Wiley & Sons, Inc.
- Godsey, M. (2020). Preparing for the covid slide. *Literacy Today*, July/August 2020. Literacyworldwide.org.
- Gupta, D.; & Khairani, N. N. (2020). COVID-19 and learning inequities in Indonesia: Four ways to bridge the gap. *East Asia & Pacific on the Rise*, August 21, 2020. <https://blogs.worldbank.org/eastasiapacific/covid-19-and-learning-inequities-indonesia-four-ways-bridge-gap>.
- Hafifah, G. N.; & Sulistyono, G. H (2020). Teachers' ICT literacy and integration in ELT in the Indonesian higher education setting. *Turkish Online Journal of Distance Education-TOJDE*, 21 (3), No. 3 (3). Pp. 186-198.
- Hutchison, A.; & Reinking, D. (2011). Teachers' perceptions of integrating information and communication technologies into literacy instruction: A national survey in the United States. *Reading Research Quarterly*, 46(4), pp. 312-333. DOI: <http://doi.org/10.1002/RRQ.002>.
- Kalantzis, M.; Cope, B.; & Cloonan, A. (2010). A multiliteracies perspective on the New Literacies in E. A. Baker (ed.). *The new literacies: Multiple perspectives on research and practice*. The Guilford Press.
- Kress, G. (2003). *Literacy in the New Media Age*. Routledge.
- Leu, D. J.; Kinzer, C. K.; Coiro, J.; Castek, J.; & Henry, L. A. (2004). New Literacies: A dual-level theory of the changing nature of literacy, instruction, and assessment. In D.J. Leu Jr., C.K. Kinzer, J.L. Coiro, & D.W. Cammack (eds.). *Toward a theory of New Literacies emerging from the internet and other information and communication technologies*. International Reading Association.
- Lankshear, C. & Knobel, M. (2008). *Digital literacies: Concepts, policies and practices*. Peter Lang Publishing Inc.
- New London Group. (1996). A pedagogy of multiliteracies. *Harvard Educational Review*, 6 (1), Spring 1996.
- Perry, K. (2012). What is Literacy? –A critical overview of sociocultural perspectives. *Journal of Language and Literacy Education [Online]*, 8(1), 50-71. Available at http://jolle.coe.uga.edu/wp-content/uploads/2012/06/What-is-Literacy_KPerry.pdf.
- Rahayu, M. K. P. (2019). Barriers to use e-learning platform in Indonesian higher education: Factors related to people and organization. *Advances in Economics, Business and Management Research*, Vol 100. International Conference of Organizational Innovation (ICOI 2019). *Atlantis Press*. <http://creativecommons.org/licenses/by-nc/4.0/>.
- Rahman, A. (2021). At the heart of teacher professional development: Teacher matters. *Indonesian Journal of Learning Education and Counseling*, 3 (2), pp 206–220. DOI: doi.org/10.31960/ijolec.v3i2.961. <https://journal.ilinstitute.com/index.php/IJoLEC>

- Reyna, J., Hanham, J., & Meier, P.C. (2018). A framework for digital media literacies for teaching and learning in higher education. *E-learning and Digital Media*, 15 (4). 2018. pp. 176–190. DOI: 10.1177/2042753018784952. journals.sagepub.com/home/ldm.
- Sadovnik, A. R. & Coughlan, R. W. (2016). *Sociology of education: A critical reader (3rd ed.)*. Routledge.
- Share, J.; & Mamikonyan, T. (2020). Preparing English teachers with critical media literacy for the digital age. *Contemporary Issues in Technology and Teacher Education*, 20(1), pp. 37-54.
- UNESCO (2013). Global media and information literacy assessment framework: Country readiness and competencies. *UNESCO*