

Correlational Descriptive Analysis of Digital Literacy Among Generation Z Prospective Teachers

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Abstrak— Tujuan penelitian ini adalah untuk menilai tingkat literasi teknologi digital pada calon guru Generasi Z serta mengkaji hubungannya dengan usia dan jenis kelamin. Penelitian ini menggunakan pendekatan kuantitatif dengan desain deskriptif korelasional. Sebanyak 722 mahasiswa dari empat program studi, yaitu sains, ilmu sosial, bahasa, dan seni, yang berusia antara 18 hingga 23 tahun, berpartisipasi dalam penelitian ini. Instrumen yang digunakan berupa kuesioner literasi teknologi digital yang terdiri atas 33 butir pernyataan dengan skala empat poin. Kuesioner tersebut mencakup lima indikator utama, yaitu komputer pribadi, telepon pintar, media sosial, keamanan daring, dan pembelajaran elektronik (*e-learning*). Instrumen menunjukkan konsistensi internal yang memadai dengan nilai Cronbach's Alpha sebesar 0,684 serta telah memenuhi uji validitas dan reliabilitas. Untuk menguji hubungan antara variabel demografis dan literasi digital, digunakan analisis chi-kuadrat (*chi-square*). Hasil penelitian menunjukkan bahwa tingkat literasi digital calon guru Generasi Z berada pada kategori tinggi dengan skor rata-rata sebesar 79%. Indikator telepon pintar, keamanan daring, dan komputer pribadi memperoleh skor tertinggi, sedangkan indikator media sosial dan pembelajaran elektronik (*e-learning*) berada pada kategori sedang. Analisis berdasarkan program studi juga menunjukkan tingkat literasi digital yang secara konsisten berada pada kategori tinggi, dengan skor berkisar antara 79% hingga 80%. Usia tidak memiliki hubungan yang signifikan dengan literasi digital, sedangkan jenis kelamin menunjukkan hubungan yang signifikan berdasarkan hasil uji chi-kuadrat (*chi-square*). Temuan ini mengindikasikan bahwa calon guru Generasi Z memiliki kesiapan yang tinggi dalam memanfaatkan teknologi digital, tetapi masih memerlukan penguatan pada aspek literasi media sosial dan pembelajaran elektronik (*e-learning*). Penelitian ini memberikan implikasi penting bagi institusi pendidikan dalam merancang kurikulum dan strategi pembelajaran yang mendukung peningkatan kompetensi digital calon guru di masa depan.

Kata Kunci: Literasi digital; Generasi Z; Calon Guru.

Abstract— The purpose of this study is to assess the degree of digital technology literacy among pre-service teachers in Generation Z and investigate how it relates to age and gender. The research employed a quantitative approach with a descriptive correlational design. A total of 722 students from four majors, namely science, social sciences, languages, and arts, aged 18 to 23 years, participated in this study. The instrument used was a digital technology literacy questionnaire consisting of 33 items on a four-point scale. The questionnaire covered five main indicators: personal computer, smartphone, social media, online safety, and e-learning. The instrument showed sufficient internal consistency, with a Cronbach's Alpha value of 0.684, and successfully passed validity and reliability tests. To examine the association between demographic variables and digital literacy, chi-square analysis was applied. The findings show that the digital literacy level of Generation Z pre-service teachers is in the high category, with an average score of 79 percent. The smartphone, online safety, and personal computer indicators achieved the highest scores, while the social media and e-learning indicators were in the moderate category. Analysis by major also revealed consistently high levels of digital literacy, with scores between 79 and 80 percent. Age and internet literacy did not significantly correlate; however, gender and digital literacy did, according to the chi-square test. These results indicate that Generation Z pre-service teachers have strong readiness in using digital technologies but still require strengthening in social media and e-learning literacy. The study provides important implications for educational institutions in designing curricula and learning strategies that support the advancement of digital proficiency in future teachers.

Keywords: Digital literacy; Generation Z; Prospective Teachers.

I. INTRODUCTION

Generation Z includes people who were born during the mid-1990s up to the early 2000s [1] or those born between 1995 and 2010 [2]. This generation is labeled as the boundary-less generation because they grew up in an environment where technology was widely used. In addition, Gen Z is also characterized by the influence of technology in their lives, namely that technology has become part of their character and personality [2], [3], [4], [5], [6]. They are also known as digital natives, having grown up with smartphones [4], internet access [5], and digital technology [3].

According to Stillman and Stillman (2018) [7] the characteristics of Gen Z include: Generation Z is a digital generation that combines physical and virtual spaces, has a highly personalized identity, is realistic, independent, collaborative, and driven to stay connected so as not to miss out on information. They also demonstrate competitiveness and an action orientation through their ability to learn independently, entrepreneurial tendencies, and enthusiasm for creating positive change through the use of technology. Social media, such as Facebook, is commonplace for them [8]. Because they want to get to the point as soon as possible, they read less than 20% of the material. For this reason, people would rather learn online than with paper-based resources [9].

Reasoning, critique, communication, and lifelong learning are all included in the notion of literacy. In other words, literacy can be defined as the transfer of acquired expertise and abilities into everyday life by interpreting them beyond reading and composing [10]. Furthermore, digital technology in education refers to the advancement of technology-based learning in the areas of academic research, administrative support, student registration, content creation, delivery, and sharing, communication between students, instructors, and the outside world, and presentation and lecture creation [11] or employing instructional strategies (e-learning, blended learning, and mobile learning) to enhance learning [12].

According to several sources, Generation Z tends to use technology more frequently to achieve specific goals [13], [14]. Other studies show no relationship between generation and technology use. Gallardo-Williams (2021) states that Students' use of technology and age have a limited correlation [15]. In addition, another study found generation Z's brains differ structurally from those of earlier generations. This is the outcome of how our brains react to our surroundings. Complex and sophisticated visual imagery has become a part of Generation Z. As a result, visual learning is more successful since the area of the brain responsible for visual talents is considerably

more developed. This generation of students likes participatory activities, group projects, experiments, challenges, and anything that can be observed or tried [9].

Researching digital literacy among Generation Z teacher candidates is very important because they are a group that will soon enter the teaching profession and play a strategic role in integrating digital technology in schools. Their readiness and digital literacy will determine how technology is implemented in the learning process, the quality of technology-based pedagogical interactions, and the ability of future students to face the digital era. Although Gen Z is known as a generation that is familiar with technology, there is no guarantee that their ability to utilize technology for pedagogical purposes is also high. Therefore, understanding the level of digital literacy of prospective teachers is the basis for ensuring that educational institutions produce teachers who are competent, adaptive, and ready to face the demands of digital education transformation.

Teacher digital competence is essential because it influences how educators design learning, select digital tools, and facilitate meaningful technology-supported instruction, making digital literacy a core requirement for future teachers. According to Redecker [16], digital competence enables teachers to integrate technology in ways that enhance creativity, collaboration, and personalized learning. Tondeur [17] emphasizes that teacher preparation programs must intentionally develop digital competence so that prospective teachers can successfully translate technology into effective pedagogical practice. Therefore, analyzing the digital literacy of prospective teachers is necessary to ensure their readiness to implement digital technologies in educational settings.

Although there is considerable research on the use of technology among Generation Z, studies that specifically assess the digital literacy level of Generation Z, especially from the perspective of aspiring educators, are still limited. In fact, understanding their digital literacy is very important for the development of lecture curricula, learning interventions, and policies aimed at improving digital competence in teacher education programs. Based on this background, this study analyzes the digital literacy of Generation Z prospective teacher students and examines how this literacy correlates with gender and age.

II. RESEARCH METHODS

This study employs quantitative methods to assess the extent of Generation Z teacher candidates' digital literacy. Quantitative research is data-oriented. It involves a systematic process

of investigating a phenomenon by collecting measurable data. This data is then organized, processed, analyzed, and interpreted using statistical, mathematical, or computational techniques. The assessment was supported by empirical data collected for better analysis [16]. The following are the study's research questions:

1. To what extent are Generation Z teacher candidates literate in digital technology?
2. What are the level of digital literacy of Generation Z prospective teachers based on their majors?
3. Are there a relationship between gender and the digital technology literacy of Generation Z prospective teachers?
4. Are there a relationship between age and digital technology literacy among Generation Z teacher candidates?

A digital technology literacy questionnaire served as the study's tool. A Google Form was used to produce the questionnaire using a 1-4 rating scale consisting of 33 statements. The instrument used in this study has been tested for validity and reliability. All questions in the questionnaire were valid, and the Cronbach's alpha reliability test yielded 0.684 ($r > 0.60$), indicating that the instrument was reliable [18]. The indicators contained in the instrument are presented in Table 1.

TABLE 1. INDICATORS OF THE QUESTIONNAIRE

Indicators	Number of statements
Personal Computer	6
Smartphones	14
Social Media	6
Online Safety	2
E-Learning	5
Total	33

The research sample consisted of 722 Generation Z students aged 18 to 23 years old from one of the universities in Riau. The sample came from four major fields of study, namely science, social sciences, languages, and arts. There were 202 male participants and 502 female participants. Generation Z is categorized as individuals aged 18-23 years. The research sample description is presented in Table 2.

TABLE 2. RESEARCH SAMPLE DESCRIPTION

Sample											
Gender		Ages						Science	Social	Language	Art
Male	Female	18	19	20	21	22	23				
202	502	23	184	217	202	73	23	142	367	139	74

Data analysis was conducted in accordance with the research questions outlined as follows:

- 1) To what extent are Generation Z teacher candidates literate in digital technology? The percentage of respondents' answers was calculated using the following formula [19]:

$$\text{Percentage} = \frac{\text{Total of respondents choice}}{\text{Maximum Score}} \times 100\% \quad (1)$$

The percentage calculation was adjusted to the statement indicators on the questionnaire and then compared with the percentage of each indicator. Next, the percentage results obtained were categorized according to the criteria in Table 3 [20].

TABLE 3. LEVEL OF DIGITAL TECHNOLOGY LITERACY AMONG GENERATION Z

Percentage	Category
$x > 75$	High
$<50 \leq x \leq 75$	Moderate
$x < 50$	Low

- 2) What are the level of digital literacy among Generation Z teacher candidates based on their majors? To answer this question, data analysis was conducted by converting students' answers into quantitative data according to their answer choices. Next, the answers were grouped by major, and the percentages were calculated and interpreted according to the digital literacy level shown in Table 3. There were four majors in this study, namely science, social studies, language, and arts.
- 3) Are there a relationship between gender and digital technology literacy among Generation Z teacher candidates?

To answer this question, data analysis was performed using crosstab analysis with SPSS version 26 software. Crosstab analysis is a correlational analysis used to examine the relationship between two nominal-scale variables [21]. The data on digital technology literacy was categorized as high, medium, and low, and gender was categorized as male and female. The analysis results were interpreted by looking at the Pearson Chi-Square and Fisher's Exact Test results in the Asymp Sig (2-sided) and Exact Sig (2-sided) columns. If the significance was $p < 0.05$, it could be said that there was a significant relationship between gender and digital technology literacy. In this study, the Chi-Square test of independence

was used because all variables examined, namely gender, age categories, and digital literacy levels, were measured on a categorical scale. The digital literacy scores were converted into three nominal categories (high, moderate, and low), which did not meet the assumptions required for parametric statistical procedures such as normal distribution or interval-level measurement. Therefore, the Chi-Square test, a non-parametric technique commonly recommended for analyzing relationships between categorical variables, was considered appropriate [22], [23].

4) Are there a relationship between age and digital technology literacy?

This research question was analyzed in the same way as research question number 2, using crosstab analysis with SPSS version 26 software. For the age variable, there were six age categories, namely 18, 19, 20, 21, 22, and 23, while digital technology literacy had three categories (high, medium, and low). The analysis results were interpreted by looking at the Person Chi-Square and Fisher's Exact Test results in the Asymp sig (2-sided) and Exact sig (2-sided) columns. If the significance was $p < 0.05$, it could be said that there was a significant relationship between age and digital technology literacy.

III. RESULT AND DISCUSSION

1) To what extent are Generation Z teacher candidates literate in digital technology?

Based on the analysis of data obtained by distributing questionnaires to 722 prospective teacher students, the percentage of digital technology literacy is shown in Figure 1.

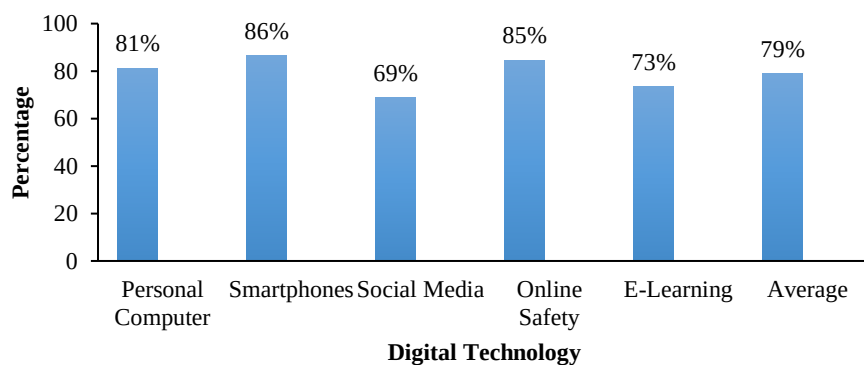


FIGURE 1. PERCENTAGE OF DIGITAL LITERACY LEVELS AMONG GENERATION Z

Based on Figure 1, it can be seen that the average percentage of digital literacy levels among Generation Z prospective teachers is at a high and moderate level. The highest percentages are in

smartphones, online safety, and personal computers, at 86%, 85%, and 81%, respectively. These results are consistent with Johnson and Sveen's (2020) research findings [4], which state that Generation Z prospective teachers grew up with smartphones. Zhitomirsky-Geffet and M. Blau (2017) [24] state that Generation Z prospective teachers use smartphones a lot in their daily lives. More than 50% of individuals choose to use mobile phones even when they have access to computers, according to a daily survey that looks at which devices people use more frequently to access the internet. At home, mobile phones are most frequently used to access the internet. Speed, ease of use, managing workloads, and the desire to use cell phones for leisure are some of the causes. [25], [26]. Compared to previous ways, smartphone searches for information have grown in frequency and intensity.

Furthermore, aspects in the moderate category are e-learning and social media, with average percentages of 73% and 69%. This study was conducted after the Covid-19 period, so the literacy of Generation Z prospective teachers regarding e-learning is higher than that of social media. Students' e-learning literacy improved as a result of the pandemic's move from in-person to online instruction. This is consistent with D. E. Marcial's research (2020) [27] which states that this generation values privacy and confidentiality. They believe that when they enter the workplace, they can become the most self-aware and risk-aware workers in terms of technology. The overall average Generation Z's prospective teachers degree of digital literacy is high, at 79%. This shows that, in general, Generation Z has good technological literacy because technology has become part of their character and personality [2], [3], [4], [5], [6].

2) What are the level of digital literacy among Generation Z prospective teachers based on their majors?

Figure 2 displays the findings of the examination of Generation Z potential teachers' digital literacy levels according to their specialties.

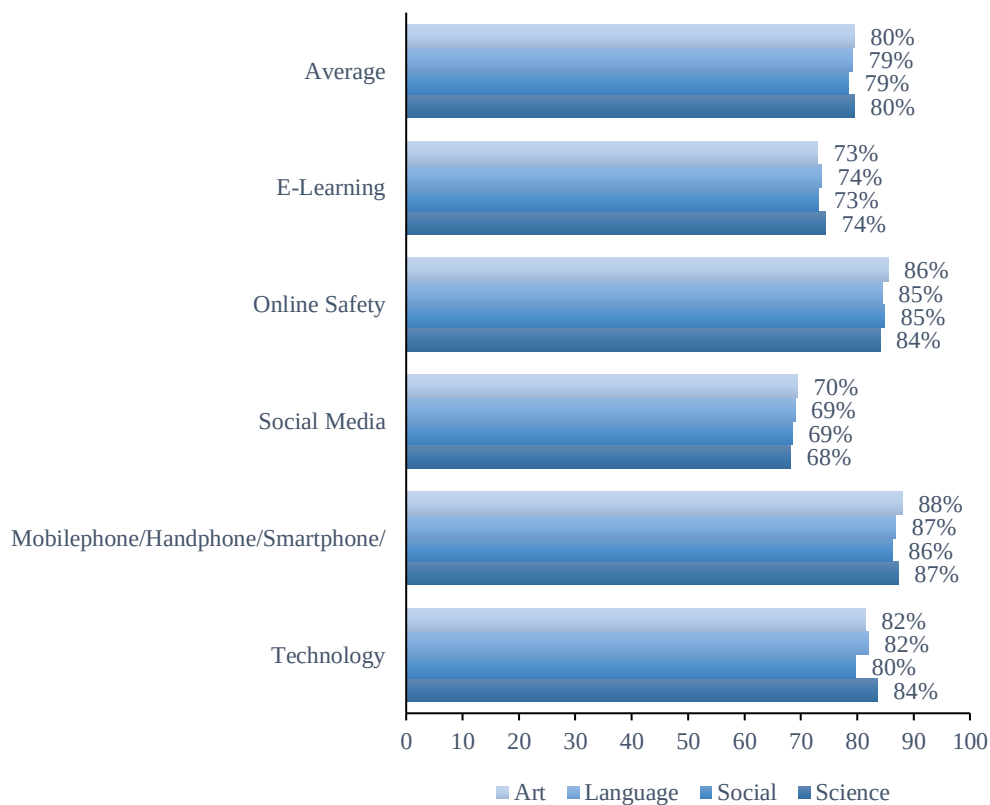


FIGURE 2. LEVEL OF DIGITAL LITERACY OF GENERATION Z PROSPECTIVE TEACHERS BASED ON THEIR MAJORS

Based on Figure 2, it is evident that the average digital literacy of Generation Z prospective teachers from all four majors is at a high level, ranging from 79 to 80%. This finding indicates that differences in educational background (major) do not substantially affect the digital literacy level of prospective teachers. This is consistent with the characteristics of Generation Z, who are referred to as digital natives who are accustomed to accessing, using, and adapting to digital technology from an early age [28], [29]. Furthermore, based on indicators, social media is the aspect with the lowest score (68–70%). This finding is interesting because it contradicts the common assumption that Gen Z is synonymous with intensive social media use. Several studies have found that although Gen Z are active social media users, their *literacy* levels in critical aspects, such as understanding algorithms, verifying information, or identifying privacy risks, are not always high. Zhitomirsky-Geffet and M. Blau (2017) [24] states that young people often have high technical abilities but tend to have low evaluative literacy skills when it comes to digital content. S. Ma and C. Chen (2023) [30] also highlights that intensive social media use does not

always correlate with digital literacy competencies, particularly those related to digital footprint management and personal data security.

Conversely, the mobile phone/smartphone indicator showed the highest score (86–88%). This finding is very much in line with the literature stating that smartphones are the main devices used by Generation Z in their daily activities, whether for communication, entertainment, learning, or accessing information [31]. Smartphones are the primary means for this generation to develop digital competencies, so it is not surprising that digital literacy in this aspect is more mature than other indicators. Online safety indicators are also in the high category (84–86%). This shows that Gen Z prospective teachers have a fairly good awareness of digital security aspects. This is reinforced by research [32] which found that younger generations have a higher tendency to understand digital security practices compared to older age groups.

The e-learning indicator shows a high score (73–74%), although not as high as other indicators. This achievement is reasonable considering that post-COVID-19 students have experienced intensive use of online learning. This good e-learning literacy is in line with the findings of Zhao (2021) [33], who found that direct experience in using digital learning platforms greatly improves students' e-learning competencies. The technology indicator is at a high level (80–84%), indicating that prospective teachers have good general technology mastery. This is in line with the findings of Y. H. Keung and F. C. A. Lai (2012) [34], which state that Gen Z has a strong tendency to use various types of technology for academic purposes.

3) Are there a relationship between gender and digital literacy among Generation Z prospective teachers?

Table 4 displays the findings of the data analysis concerning the correlation between gender and digital technology competency among Generation Z teaching applicants.

TABLE 4. RESULTS OF CORRELATION BETWEEN GENDER AND DIGITAL TECHNOLOGY LITERACY

	Value	df	Asymptotic Significance (2- sided)	Exact Sig. (2- sided)	Exact Sig. (1- sided)	Point Probability
Pearson Chi-Square	21.714 ^a	1	.000	.000	.000	
Continuity Correction ^b	20.832	1	.000			
Likelihood Ratio	20.699	1	.000	.000	.000	
Fisher's Exact Test				.000	.000	
Linear-by-Linear Association	21.684 ^c	1	.000	.000	.000	.000
N of Valid Cases	722					

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 50.64.

b. Computed only for a 2x2 table

c. The standardized statistic is -4.657.

Based on Table 4, it is known that the value of 0 cells is 0%, which indicates that there is no data with a value less than 5. Therefore, we will see the results in the Pearson chi-square in the Asymptotic Significance (2-sided) column = 0.000. This significance ($p < 0.05$) indicates that there is a significant relationship between gender and digital literacy. These findings are in line with the findings M. Zhitomirsky-Geffet and M. Blau (2017) which state that males exhibit significantly more functional/cognitive information-seeking behavior than females [24].

In addition to the significance values, each statistical indicator in Table 4 provides important theoretical meaning regarding the robustness of the association between gender and digital technology literacy. The Pearson Chi-Square statistic (21.714, $df = 1$) measures the extent to which the observed frequencies diverge from expected frequencies under the null hypothesis of independence; a value of this magnitude with $p < .001$ indicates a substantial deviation [35]. The Continuity Correction (Yates correction), applied specifically in 2×2 contingency tables, adjusts for potential overestimation of significance in discrete data, thereby producing a more conservative estimate [36]. The Likelihood Ratio value (20.699) serves as a complementary test that compares the likelihood of the observed data under models of independence versus dependence, and a significant likelihood ratio similarly supports the conclusion that the two variables are not independent. Fisher's Exact Test, which calculates the exact probability of obtaining the observed distribution, is particularly recommended when expected cell frequencies are small, and its p -value of .000 confirms the result's stability regardless of sample distributional assumptions [37]. Meanwhile, the significant Linear-by-Linear Association statistic (21.684) indicates a meaningful monotonic trend between the ordered categories of digital literacy across genders; this reflects a patterned rather than random association [36]. The standardized residual value (-4.657) further demonstrates that the observed cell frequencies differ markedly from expectation, supporting the conclusion that the association is both statistically robust and theoretically meaningful. Together, these tests validate the strength and consistency of the relationship and affirm that gender differences in digital literacy are unlikely to arise from random variation alone.

4) Are there a relationship between age and digital technology literacy among Generation Z teacher candidates?

Table 5 displays the findings of the investigation into the connection between Generation Z's age and digital literacy.

TABLE 5. RESULTS OF PEARSON'S CHI-SQUARE TEST AND FISHER'S EXACT TEST BETWEEN AGE AND DIGITAL LITERACY

	Value	df	Asymptotic Significance (2- sided)	Exact Sig. (2- sided)	Exact Sig. (1- sided)	Point Probability
Pearson Chi-Square	8.603 ^a	5	.126	.125		
Likelihood Ratio	7.975	5	.158	.166		
Fisher's Exact Test	8.359			.134		
Linear-by-Linear Association	.378 ^b	1	.539	.545	.282	.025
N of Valid Cases	722					

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.77.

b. The standardized statistic is .614.

Based on Table 5, it can be seen that 0 cells equal to 0% indicate that there is no data with a value less than 5. Furthermore, the Pearson chi-square calculation results show Asymptotic Significance (2-sided) of 0.126 ($p > 0.05$), indicating that there is no significant relationship between age and digital literacy among Generation Z prospective teachers. These findings are in line with research conducted by D. Wójcik *et al* (2021) [38], which states that technology use (e.g., computers) was negatively correlated with age. A. Schlomann, N. Memmer, and H. W. Wahl (2022) [39] state that the association between age and all technology-related actions is insignificant. Furthermore, the results of Fisher's Exact Test showed a significance value of 0.134 ($p > 0.05$). These results indicate that there is no relationship between age and digital technology literacy.

In addition to the non-significant p-values, each statistical indicator in Table 5 provides further insight into the absence of an association between age and digital literacy. The Pearson Chi-Square statistic (8.603, $df = 5$) evaluates the discrepancy between observed and expected frequencies under the assumption of independence, and its non-significant value ($p = .126$) indicates that the observed variations across age groups are within the range expected by chance [35]. The Likelihood Ratio (7.975, $p = .158$) serves as a complementary test that compares the likelihood of the data under competing models; its non-significance similarly reinforces the conclusion that age does not predict digital literacy levels in this sample. Fisher's Exact Test, which is particularly robust for small expected frequencies, also yields a non-significant result ($p = .134$), confirming that the conclusion remains stable regardless of distributional assumptions [37]. The Linear-by-Linear Association value (.378, $p = .539$) further indicates that no monotonic

trend exists between increasing age and digital literacy scores, suggesting that differences across the six age categories do not follow a patterned progression [36]. The standardized residual (.614) also remains within the acceptable range, signifying that none of the cells deviate substantially from expected values. Collectively, these indicators demonstrate that the relationship between age and digital technology literacy is statistically unsupported and that the distribution of literacy levels across age groups appears random rather than systematic.

IV. CONCLUSION

This study shows that the digital literacy of Generation Z prospective teachers is in the high category, with an overall average score of 79%. The most prominent aspects of literacy are smartphone use, online safety, and personal computers, which are in the high category, while e-learning and social media are in the moderate category. This confirms the characteristics of Gen Z as digital natives who have been accustomed to using digital devices from an early age. When viewed by major, the digital literacy levels of students from four fields, namely science, social studies, language, and arts, were all in the high category with a score range of 79–80%. These findings indicate that academic background does not significantly affect the digital literacy levels of prospective teachers. The analysis of the relationship between variables shows that Gender and digital literacy are significantly correlated, with males tending to demonstrate higher literacy in certain aspects. Conversely, age and digital literacy were not shown to be significantly correlated. This aligns with the traits of Generation Z, which has a relatively homogeneous age range and has grown up in a uniform digital environment. Overall, this study confirms that Generation Z teacher candidates have strong digital literacy, but still need reinforcement in certain aspects such as critical social media literacy and e-learning competencies. These findings can serve as a basis for educational institutions to design more adaptive learning interventions and curricula in preparing competent teacher candidates in the era of digital transformation.

REFERENCES

- [1] L. Rosen, *Rewired: Understanding the iGeneration and the Way They Learn*. 2010.
- [2] C. Seemiller and M. Grace, "Generation Z: Educating and Engaging the Next Generation of Students," *About Campus*, vol. 22, pp. 21–26, Jul. 2017, doi: 10.1002/abc.21293.
- [3] L. Beck and A. Wright, "iGen : What You Should Know about Post-Millennial Students Major Factors Shaping iGen," *College & University*, vol. 94, no. 1, pp. 21–26, 2019.
- [4] D. B. Johnson and L. W. Sveen, "Three key values of Generation Z: Equitably serving the next generation of students," *College and University*, vol. 95, no. 1, pp. 37–40, 2020.
- [5] A. J. Nicholas, "Digital Commons @ Salve Regina Preferred Learning Methods of the Millennial Generation," 2020.

- [6] D. Schwieger and C. Ladwig, "Reaching and Retaining the Next Generation: Adapting to the Expectations of Gen Z in the Classroom," *Information Systems Education Journal (ISEDJ)*, vol. 16, no. 3, p. 16, 2018.
- [7] D. Stillman and J. Stillman, *Generasi Z: Memahami Karakter Generasi Baru yang Akan Mengubah Dunia Kerja*. Gramedia Pustaka Utama, 2018. [Online]. Available: <https://books.google.co.id/books?id=QyXezwEACAAJ>
- [8] C. Giunta, "An Emerging Awareness of Generation Z Students for Higher Education Professors," *Archives of Business Research*, vol. 5, no. 4, pp. 90–104, 2017, doi: 10.14738/abr.54.2962.
- [9] P. Poláková and B. Klímová, "Mobile technology and generation Z in the English language classroom – A preliminary study," *Educ Sci (Basel)*, vol. 9, no. 3, pp. 1–11, 2019, doi: 10.3390/educsci9030203.
- [10] A. Vasalou *et al.*, "Appropriation of literacy technologies in the classroom: reflections from creative learning design workshops with primary school teachers," *J Res Read*, vol. 45, no. 3, pp. 324–341, 2022, doi: 10.1111/1467-9817.12390.
- [11] F. P. Tulinayo, P. Ssentume, and R. Najjuma, "Digital technologies in resource constrained higher institutions of learning: a study on students' acceptance and usability," *International Journal of Educational Technology in Higher Education*, vol. 15, no. 1, 2018, doi: 10.1186/s41239-018-0117-y.
- [12] M. B. Moya, M. Irene, and A. Robinah, "Management attitude, support and integration of information communication technologies in higher education in Uganda," 2011.
- [13] G. Kennedy, T. Judd, B. Dalgarno, and J. Waycott, "Beyond natives and immigrants: Exploring types of Net Generation students.," *J Comput Assist Learn*, vol. 26, pp. 332–343, 2010, doi: 10.1111/j.1365-2729.2010.00371.x.
- [14] C. Jones, R. Ramanau, S. Cross, and G. Healing, "Net generation or Digital Natives: Is there a distinct new generation entering university?," *Comput Educ*, vol. 54, no. 3, pp. 722–732, 2010, doi: <https://doi.org/10.1016/j.compedu.2009.09.022>.
- [15] M. T. Gallardo-Williams, "Designing Diverse Virtual Reality Laboratories as a Vehicle for Inclusion of Underrepresented Minorities in Organic Chemistry," *J Chem Educ*, 2021, doi: 10.1021/acs.jchemed.1c00321.
- [16] C. Redecker, *European Framework for the Digital Competence of Educators: DigCompEdu*. 2017. doi: 10.2760/159770.
- [17] J. Tondeur, N. Pareja Roblin, J. van Braak, J. Voogt, and S. Prestridge, "Preparing beginning teachers for technology integration in education: Ready for take-off?," *Technology Pedagogy and Education*, vol. 26, Jun. 2016, doi: 10.1080/1475939X.2016.1193556.
- [18] N. George, N. Barrett, L. McPeake, R. Goett, K. Anderson, and J. Baird, "Content Validation of a Novel Screening Tool to Identify Emergency Department Patients with Significant Palliative Care Needs," *Academic Emergency Medicine*, vol. 22, no. 7, pp. 823–827, 2015, doi: 10.1111/acem.12710.
- [19] Z. Febliza, A., Afdal, "Statistika Dasar Penelitian Pendidikan," Pekanbaru: Adefa Grafika, 2015.
- [20] L. Istighfarin, F. Rachmadiarti, and J. Djoko Budiono, "Profil Miskonsepsi Siswa pada Materi Struktur dan Fungsi Jaringan Tumbuhan," *BioEdu*, vol. 4, no. 3, pp. 991–995, 2015, [Online]. Available: <http://ejournal.unesa.ac.id/index.php/bioedu>
- [21] M. Setyowati, "Petunjuk Praktikum SPSS (Statistical Product and Service Solutions)," pp. 1–81, 2017.

- [22] M. McHugh, "The Chi-square test of independence," *Biochem Med (Zagreb)*, vol. 23, pp. 143–149, Jun. 2013, doi: 10.11613/BM.2013.018.
- [23] F. J. Gravetter and L. B. Wallnau, *Statistics for The Behavioral Sciences*. Cengage Learning, 2016. [Online]. Available: <https://books.google.co.id/books?id=K7saCgAAQBAJ>
- [24] M. Zhitomirsky-Geffet and M. Blau, "Cross-generational analysis of information seeking behavior of smartphone users," *Aslib Journal of Information Management*, vol. 69, no. 6, pp. 721–739, 2017, doi: 10.1108/AJIM-04-2017-0083.
- [25] S. Gerber, M. Fry, J. Kay, B. Kummerfeld, G. Pink, and R. Wasinger, "PersonisJ: Mobile, Client-Side User Modelling BT - User Modeling, Adaptation, and Personalization," P. De Bra, A. Kobsa, and D. Chin, Eds., Berlin, Heidelberg: Springer Berlin Heidelberg, 2010, pp. 111–122.
- [26] A. K. Karlson, B. R. Meyers, A. Jacobs, P. Johns, and S. K. Kane, "Working Overtime: Patterns of Smartphone and PC Usage in the Day of an Information Worker BT - Pervasive Computing," H. Tokuda, M. Beigl, A. Friday, A. J. B. Brush, and Y. Tobe, Eds., Berlin, Heidelberg: Springer Berlin Heidelberg, 2009, pp. 398–405.
- [27] D. E. Marcial, "What Generation Z Knows About Emerging Technologies and Technological Risks: Views of Japanese and Filipino Students," *International Journal of Scientific Engineering and Science*, vol. 4, no. 5, pp. 46–51, 2020.
- [28] C. Seemiller and M. Grace, *Generation Z: A Century in the Making*. 2018. doi: 10.4324/9780429442476.
- [29] B. Mbinda, S. Usadolo, and I. Maome, "The effective use of smartphones for teaching and learning among undergraduates in higher institutions," *International Journal of Business Ecosystem & Strategy (2687-2293)*, vol. 6, pp. 242–251, Aug. 2024, doi: 10.36096/ijbes.v6i3.517.
- [30] S. Ma and C. Chen, "Are digital natives overconfident in their privacy literacy? Discrepancy between self-assessed and actual privacy literacy, and their impacts on privacy protection behavior," *Front Psychol*, vol. 14, 2023, doi: 10.3389/fpsyg.2023.1224168.
- [31] A. Febliza, A. Kadarohman, S. Aisyah, and N. Abdullah, "Generation Z and the Use of Digital Technology: A Review from 2014 to 2023," *Jurnal Pendidikan Sains Indonesia*, vol. 13, no. 1, pp. 53–67, Jan. 2025, doi: 10.24815/jpsi.v13i1.40797.
- [32] A. Lareki, J. I. Martínez de Morentin, J. Altuna, and N. Amenabar, "Teenagers' perception of risk behaviors regarding digital technologies," *Comput Human Behav*, vol. 68, pp. 395–402, 2017, doi: <https://doi.org/10.1016/j.chb.2016.12.004>.
- [33] Y. Zhao, M. C. Sánchez-Gómez, A. Pinto-Llorente, and L. Zhao, "Digital Competence in Higher Education: Students' Perception and Personal Factors," *Sustainability*, vol. 13, p. 12184, Nov. 2021, doi: 10.3390/su132112184.
- [34] Y. H. Keung and F. C. A. Lai, "Students' Age Difference Of Confidence In Using Technology For Learning In Higher Education," 2012.
- [35] A. Agresti, *Statistical Methods for the Social Sciences*. Pearson, 2018. [Online]. Available: <https://books.google.co.id/books?id=AS9EtAEACAAJ>
- [36] A. Field, *Discovering Statistics Using IBM SPSS Statistics*. SAGE Publications, 2018. [Online]. Available: <https://books.google.co.id/books?id=JlrutAEACAAJ>
- [37] J. H. McDonald and U. of Delaware, *Handbook of Biological Statistics*. Sparky House Publishing, 2009. [Online]. Available: <https://books.google.co.id/books?id=AsRTywAACAAJ>

- [38] D. Wójcik *et al.*, “Informal Dementia Caregivers: Current Technology Use and Acceptance of Technology in Care,” *Int J Environ Res Public Health*, vol. 18, p. 3167, Mar. 2021, doi: 10.3390/ijerph18063167.
- [39] A. Schlomann, N. Memmer, and H. W. Wahl, “Awareness of age-related change is associated with attitudes toward technology and technology skills among older adults,” *Front Psychol*, vol. 13, no. September, pp. 1–8, 2022, doi: 10.3389/fpsyg.2022.905043.