The Connection between Competency in Digital Skills and Students' Self-Reliance in the Study of Biology

Lida Amalia[1*], Liana Liana[2], Chevi Ardiana[3s]

[1, 2, 3]Program Studi Pendidikan Biologi, Fakultas Ilmu Terapan dan Sains, Institut Pendidikan Indonesia (IPI) Garut Jl. Pahlawan No.32 Tarogong, Garut, Jawa Barat, Indonesia

*lidaamalia@institutpendidikan.ac.id

Abstract. The Covid-19 outbreak has led to an increase in internet usage for online education, emphasizing the need for digital literacy and student autonomy. Despite the pandemic's passing, online learning remains prevalent. Hence, this study seeks to assess students' digital literacy skills and self-sufficiency in biology education, as well as the correlation between digital literacy and student independence in biology learning. The study utilized a descriptive quantitative approach through a survey. The target population comprised all Class XI MIPA students at MAN 1 Garut, with samples selected using the Slovin formula: 15 students from Class XI MIPA 1, 14 from Class XI MIPA 2, 14 from Class XI MIPA 3, and 16 from Class XI MIPA 4. Instruments included a digital literacy questionnaire and a learning independence questionnaire. Analysis revealed that 1) students exhibit a high level of digital literacy in biology learning (70.00%), with indicators such as internet searches (68.47%), hypertext guidance (70.59%), information content evaluation (67.29%), and knowledge compilation (73.40%), 2) students demonstrate a high level of learning independence in biology education (82.49%), with indicators like self-confidence (67.37%), discipline (87.46%), initiative (74.92%), responsibility (87.80%), and motivation (94.92%), 3) a positive and significant association exists between digital literacy and student independence in biology learning at MAN 1 Garut, with a correlation coefficient of 0.48 categorized as medium.

Keywords: Biology Learning, Digital Literacy Ability, Learning Independence.

1   Introduction

The 21st century is characterized as an era of openness and globalization, marked by dynamic shifts in human life unlike previous centuries. The rapid advancement of information technology in this era of globalization significantly impacts the realm of education. Global imperatives necessitate the continual adaptation of educational practices to leverage technological advancements for enhancing educational quality. In the 21st century, learning mandates students to possess proficiencies, knowledge, and competencies in technology, media, and information domains [1]. Additionally, education in this era emphasizes the cultivation of learning and innovation skills,

proficiency in utilizing technology and information media, and the ability to navigate life with essential survival skills [2].

The Covid-19 pandemic that has hit Indonesia since 2020 has increased internet use and accelerated digitalization in daily life and has had a big impact on the world of education. Technological developments in the world of education have produced many new innovations to support the learning process, one of which is the increasing variety of learning media [3]. Indonesia must harmonize technology and literacy to implement digital-based literacy, because humans must continue to develop with the times.

Digital technology can be useful for changing student behavior in searching, collecting, documenting, processing and transferring teaching materials according to their needs [3]. This is what makes students more independent in mastering the material and carrying out assignments given by the teacher. Apart from that, digital technology makes it easier for students to access learning resources, but students must pay attention to the learning resources used so that the information they obtain is correct and accurate.

Digital literacy is everyone's ability to use and utilize existing technological tools. Digital literacy can help students use, understand and access technology wisely. Digital literacy is a skill in utilizing information and understanding various formats such as audio, video, text, images and animation presented by electronic devices [4]. All advances in the current digital era certainly have positive and negative impacts. Therefore, digital literacy is very important for the younger generation, especially students, so that they understand which information must be received and which sources of truth must be sought again.

Considering that the learning process carried out at school has limited time, independent learning is seen as something that absolutely must be done by students [5]. Learning independence is a student's ability to control cognitive aspects, monitor, regulate and motivate the student's own behavior when studying. Students who have independent learning will be able to work individually or in groups and have the courage to express their thoughts or ideas [6]. Learning independence is very important for students in the learning process. Student learning independence can be seen from the use of learning resources and time management skills, meaning that in the process of achieving understanding students do not depend on the material provided by the teacher [7]. High learning independence will lead students to learn by themselves without orders, students are more explorative, creative, able to make their own decisions and have high self-confidence. Learning independence can make students understand more about the learning process both online and offline.

Based on observations of students at MAN 1 Garut, digital media has not been used optimally to support learning. There are still many students who use digital media for social networking, social media and playing games. Such circumstances undoubtedly influence students' autonomy in learning. This aligns with prior studies conducted on Riau University students, indicating that smartphones are predominantly utilized for gaming and social media activities, with many students spending over 5 hours daily on these platforms. Additionally, students frequently disclose personal details on social media and are exposed to hate speech and misinformation. Their

proficiency in information management is also rated as moderate, as they often utilize the internet as a resource for academic tasks without verifying the credibility of the sources. [8]. Therefore, research is needed which aims to determine: 1) students' digital literacy abilities in biology learning, 2) students' learning independence in biology learning, 3) the relationship between digital literacy abilities and students' learning independence in biology learning.

2   Method

The research methodology employed in this study is descriptive quantitative through a survey. Descriptive research aims to ascertain the value of each variable, whether single or multiple variables (independent), without making comparisons or establishing connections with other variables [9]. Quantitative research involves extensive numerical data usage throughout the process, from data collection to interpretation and drawing conclusions. A survey is utilized as the research method, utilizing questionnaires as research instruments administered to both large and small populations, with the data analyzed being derived from samples selected from the population. [10]. The research design [11] is as follows:
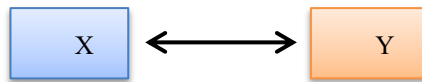

Fig. 1. Research Design (X=digital literacy ability, Y=learning independence)

This study was conducted at MAN 1 Garut in March 2023, during the academic year 2023/2024. The target population consisted of all students enrolled in the eleventh-grade science program (XI MIPA) at MAN 1 Garut. The sampling method employed was probability sampling, specifically simple random sampling [10]. In cases where the number of respondents is less than 100, the entire population is usually included, rendering it a population study. However, if the number of respondents exceeds 100, sampling ranges from 10% to 15%, 20% to 25%, or more [12]. In this study, a 10% sample size was chosen with a 95% confidence level from the total population, calculated using the Slovin formula [13] as follows:

$$n = \frac{N}{N\,(d)^2 + 1}$$

information:
n = number of samples
N = total population
$(d)^2$ = precision (set at 10% with a confidence level of 95%)

Based on this formula, the number of samples obtained is as follows:

$$n = \frac{N}{N\,(d)^2 + 1} = \frac{139}{139\,(0,1)^2 + 1} = \frac{139}{139(0,01) + 1} = 58,16 \approx 59$$

From a total sample of 59 respondents, the number of each sample was determined using the formula:

$$ni = \frac{Ni}{N} \times n$$

information:
ni = number of samples by stratum
n = total number of samples
Ni = total population by stratum
N = total population
Population and sample numbers can be seen in Table 1.

Table 1. Population and Sample Numbers

No	Class	Population	Sample
1	XI MIPA 1	35	15
2	XI MIPA 2	34	14
3	XI MIPA 3	34	14
4	XI MIPA 4	36	16
	Total	139	59

Data collection techniques are in the form of learning independence questionnaires and digital literacy questionnaires which are distributed to students via Google forms, using a Likert scale. The type of questionnaire used in this research is a closed questionnaire, that is, the answers are already available, so the respondent just has to choose.

The data used is based on student answer scores from the questionnaire on learning independence and student digital literacy abilities given. The data from the questionnaire in this research is quantitative data which will be analyzed in percentage form. Then interpreted based on Table 2 [14].

Table 2. Interpretation of Scores

No	Score Interpretation Interval	Criterion
1	$85 \leq \%\,skor \leq 100$	Very High
2	$69 \leq \%\,skor \leq 84$	High
3	$53 \leq \%\,skor \leq 68$	Medium
4	$37 \leq \%\,skor \leq 52$	Low
5	$20 \leq \%\,skor \leq 36$	Very Low

The research instrument was tested for reliability, based on the Cronbach's Alpha formula. In this study there were two reliability tests, namely the digital literacy ability questionnaire and the learning independence questionnaire. A research instrument can be said to be reliable if r-alpha is equated with the list of interpretations of the coefficient r [15] as follows:

Table 3. List of Interpretations of the r Coefficient

r coefficient	Reliability
0.8000-1.0000	Very High
0.6000-0.7999	High
0.4000-0.5999	Medium
0.2000-0.3999	Low
0.000-0.1999	Very Low

The reliability test results revealed a Cronbach's Alpha value of 0.69 for digital literacy ability, indicating a high level of reliability. Similarly, the Cronbach's Alpha value for learning independence was 0.89, signifying a very high level of reliability.

The data collected is quantitative and will be analyzed in percentage format. Subsequently, normality testing was conducted using the Kolmogorov-Smirnov test [10]. To assess the strength of the relationship between the predictor variable X and the response variable Y, a correlation analysis was performed. The results are represented by a correlation coefficient, calculated using the Product Moment formula [15]:

$$r = \frac{n \sum_{i=1}^{n} Xi\, Yi - (\sum_{i=1}^{n} Xi)(\sum_{i=1}^{n} Yi)}{\sqrt{[n \sum_{i=1}^{n} X_i^2 - (\sum_{i=1}^{n} Xi)^2][n \sum_{i=1}^{n} Y_i^2 - (\sum_{i=1}^{n} Yi)^2]}}$$

Next, the coefficient of determination is calculated which can be determined by squaring the correlation coefficient [15].

3   Results and Discussion

3.1   Digital Literacy Ability

Table 4 shows the percentage results of the digital literacy ability level questionnaire.

Table 4. Percentage Distribution of Students' Digital Literacy Ability Levels

Interpretation Interval Score	Criteria	Frequency	Percentage
85 ≤ % skor ≤ 100	Very High	1	1.69%
69 ≤ % skor ≤ 84	High	30	50.85%

53 ≤ % skor ≤ 68	Medium	24	40.68%
37 ≤ % skor ≤ 52	Low	4	6.78%
20 ≤ % skor ≤ 36	Very Low	0	0%
Total		59	100%

According to the findings from the study (Table 4), among the 59 students surveyed, 1 student (1.69%) exhibited a very high level of digital literacy, 30 students (50.85%) demonstrated a high level, 24 students (40.68%) showed a medium level, and 4 students (6.78%) had a low level of digital literacy. These results indicate that the majority of students possess a high level of digital literacy. This aligns with previous research by Irhandayaningsih, which also found high levels of digital literacy among students, possibly because students have access to platforms and need to seek relevant references for assigned tasks within the school environment [4].

Table 5. Average Percentage of Digital Literacy Ability

No	Indicator	Percentage of Each Indicator	Category
1	Internet Search	68.47%	High
2	Hypertext Direction Guide	70.59%	High
3	Information Content Evaluation	67.29%	Medium
4	Knowledge Compilation	73.40%	High
	Overall average	70%	High

Based on Table 5, the students' level of digital literacy ability is mainly high. Several indicators such as Internet searches, hypertext guidance, information content assessment and knowledge collection can provided evidence of this [16]. The results of the percentage analysis for each student's digital literacy indicator with a total of 16 statements meant the overall percentage of indicators was 70%. This showed that students' digital literacy indicators was in the high category, so this results in the level of students' digital literacy abilities in biology learning being categorized as high. Student digital literacy consisted of four indicators, and the highest percentage result was the Knowledge Composition indicator with a result of 73.40% and the lowest was the information content evaluation indicator with a result of 67.29%.

According to Irhandayaningsih's study regarding information usage, participants were able to identify sources relevant to the subject matter and distinguish between the content of various references utilized in completing assignments assigned during online learning sessions. [4]. In addition, students would present information to their friends, parents and other relatives using sentences which could be easily read and included the appropriate pictures or audiovisuals so that it became understandable and reliable. This indicates that students transmitted information, accompanied by appropriate images or videos, in addition to use text elements.

However, the used of digital literacy requires supervision from parents and teachers by providing or limiting digital ethics, as part of digital literacy that must be instilled in students. So that students have a responsible character and avoid negative impacts. Schools, teachers and the community can direct digital literacy during learning, providing encouragement and enthusiasm, so that a superior generation wold be created now and in the future [17].

Student Learning Independence

Table 6 shows the percentage results of the questionnaire on student learning independence level.

Table 6. Percentage Distribution of Student Learning Independence Levels

Interpretation Interval Score	Criteria	Frequency	Percentage
85 ≤ % skor ≤ 100	Very High	12	20.34%
69 ≤ % skor ≤ 84	High	27	45.76%
53 ≤ % skor ≤ 68	Medium	16	27.12%
37 ≤ % skor ≤ 52	Low	4	6.78%
20 ≤ % skor ≤ 36	Very Low	0	0%
Total		59	100%

Independent learning refers to the endeavor of acquiring knowledge through experience and education by engaging in a process that leads to behavioral changes [7]. As per the findings from Table 6, among the 59 students, 12 students (20.34%) demonstrated a very high level of learning independence, 27 students (45.76%) exhibited a high level of learning independence, 16 students (27.12%) possessed a moderate level of learning independence, and 4 students (6.78%) showcased a low level of learning independence. Consequently, the majority of students displayed a high level of learning independence. This aligns with Marfu'ah's research, which indicated that students exhibited a high degree of independence in learning mathematics online [18]. Furthermore, other studies have shown a significant positive correlation between learning independence and mathematics learning outcomes, indicating that higher levels of learning independence lead to better learning outcomes [19; 20]. The indicators and list of questionnaire statements regarding student learning independence were adapted from research conducted by Widodo, namely: self-confidence, discipline, initiative, responsibility and motivation [21].

Table 7. Average Percentage of Student Learning Independence

No	Indicator	Percentase of Each Indicator	Category

1	Confidence	67.37%	Medium
2	Discipline	87.46%	Very High
3	Initiative	74.92%	High
4	Responsibility	87.80%	Very High
5	Motivation	94.92%	Very High
Overall average		82.49%	High

Based on Table 7, the indicators for student learning independence with a total of 20 statements, the average percentage of the overall indicator for learning independence was 82.49%. There were five indicators for learning independence, and the highest percentage result was the motivation indicator with a result of 94.92%, and the lowest was the self-confidence indicator with a result of 67.37%. This showed that the indicator of learning independence was in the high category, so this results in the level of student learning independence during biology learning being categorized as high.

The Connection between Competency in Digital Skills and Students' Self-Reliance

The results of the data normality tested using the Kolmogorov Smirnov formula obtained a result of 0.081 < 0.1588, which shows that digital literacy abilities had a normal distribution and learning independence obtained a result of 0.107 < 0.1588, so it had a normal distribution. Next, a correlation test was carried out to see the relationship between digital literacy ability and student learning independence in biology learning at MAN 1 Garut. From the test results, a correlation value of 0.480 was obtained with a Sig (2-tailed) value of 0.000. The correlation coefficient is classified as significant if the test result value Sig (2-tailed) < α is used. Because the Sig (2-tailed) value is $0.000 < α = 0.05$ or $0.000 < α = 0.01$, the correlation coefficient is significant. Conclusion: "There is a significant positive relationship between variable x and variable y, with a large influence of variable x on variable y of r2 x 100% or 0.482 x 100% = 23.03%" [22]. It could be said that the higher a student's digital literacy ability, the higher the student's learning independence. On the other hand, the lower a student's digital literacy ability, the lower their learning independence. The magnitude of the influence of digital literacy ability on learning independence was 23.04% and the rest is influenced by other factors not discussed in this research.

One of the factors that influenced digital literacy is internet searches. Students who was able to master technology could find information on the internet via Google or a browser, so students could do their own work. Students was able to direct themselves in utilizing existing learning resources and use learning strategies to overcome difficulties that occur in learning activities. By utilizing digital media, students could search for wider information and many trusted sources for learning, could see interesting displays that attract students to explore further and arouse curiosity to learn. Students become active in learning, in contrast to read textbooks which tend to be boring. Extensive knowledge was one of the causes of an independent learning process.

This was also reinforced by Elpira's statement, that by implementing digital literacy, students could obtain various information in a wider and deeper scope, thereby increasing student insight and helping students complete their tasks in finding information from digital content that was appropriate, accurate and timely relatively short [23]. Digital literacy had advantages, with digital literacy students could save time in doing assignments, could search for reading sources and find the information they need more quickly, easily and in a variety of ways. In digital literacy, there was not only reading, but videos and other things available that make learning easier and more varied, making it easier for students to find information.

Students require learning independence to take responsibility for organizing and disciplining themselves. Additionally, independent learning fosters the development of self-directed learning abilities. These attitudes are essential as they signify the maturity of an educated individual. Independent students can identify their learning objectives, seek out relevant learning resources, and engage in self-assessment activities. This was in accordance with Sekarini's research, that technological literacy ability had a strong relationship with independent learning, with independent learning habits within students that could broaden students' insight and knowledge [24]. As well as researched by Sudyana and Surawati, that the utilization of learning resources through digital literacy could increase student learning independence in studying lesson materials provided by the teacher even though they are at home [25].

There was a relationship between digital literacy and learning independence because digital literacy could be useful for changing student behavior in searching, collecting, documenting, processing and re-transferring teaching materials according to needs [3]. This was what makes students more independent in mastering the material and carried out assignments given by the teacher. Apart from that, digital technology made it easier for students to access learning resources, so that students could learn independently anywhere and at any time. High learning independence would make students learn without encouragement from other people, so that students learn more exploratively, able to solve problems, make decisions, be confident and creative. Thus, through digital literacy, learning would be more effective so that students can broaden their horizons and knowledge. Likewise with learning independence, through digital literacy students could develop learning independence.

Conclusion

Through the analysis of data concerning the connection between digital literacy skills and student autonomy in biology education at MAN 1 Garut, the following conclusions can be drawn: 1) Students' digital literacy proficiency in biology education falls within the high range (70.00%), involving 59 students across four areas - internet searches (68.47%), hypertext guidance (70.59%), assessment of information content (67.29%), and knowledge compilation (73.40%), 2) Student independence in biology learning is categorized as high (82.49%) among 59 students, encompassing self-confidence (67.37%), discipline (87.46%), initiative (74.92%), responsibility (87.80%), and motivation (94.92%), 3) A significant positive association exists be-

tween digital literacy skills and student autonomy for Class XI students at MAN 1 Garut, supported by a correlation coefficient of 0.48, indicative of a medium level of correlation.

Acknowledgments

References

[1]   E.Y. Wijaya, D.A. Sudjimat, A. Nyoto, Transformasi Pendidikan Abad 21 sebagai Tuntutan Pengembangan Sumber Daya Manusia di Era Global, Prosiding Seminar Nasional Pendidikan Matematika Universitas Kanjuruhan Malang, 1– ISSN 2528-259X, 2016, pp. 263-278. https://repository.unikama.ac.id/840/

[2]   K.B. Dinata, Analisis Kemampuan Literasi Digital Mahasiswa, Jurnal Pendidikan, 19(1), pp. 105-119. https://d1wqtxts1xzle7.cloudfront.net/87717505/pdf

[3]   A. Irhandayaningsih, 2020. Pengukuran Literasi Digital pada Peserta Pembelajaran Daring di Masa Pandemi COVID-19. *Jurnal Undip*, 4(2), pp. 231-240. https://ejournal2.undip.ac.id/index.php/anuva/article/view/8073

[4]   M. Yamin, Paradigma Baru Pembelajaran. Jakarta: Gaung Persada Press, 2011, p. 107.

[5]   H.R. Kurniawan, H. Elmunsyah, Perbandingan Penerapan Model Pembelajaran project Based Learning dan Think Pair Share Berbantuan Modul Ajar terhadap Kemandirian dan Hasil Belajar Siswa Kelas XI di SMKN 3 Malang. Jurnal Pendidikan, 3(2), 2018, pp. 80-85. https://scholar.google.co.id/citations?user=_ZUakeAAAAAJ&hl=en

[6]   A.E.S. Bunandar, A.E. Setiadi, A.D. Kurniawan, Analisis Kemandirian Belajar Siswa pada Mata Pelajaran Biologi di Kelas X MAS Al-Mustaqim Kubu Raya. Skripsi. Pontianak: Universitas Muhammadiyah Pontianak, 2016. https://repository.unmuhpnk.ac.id/540/

[7]   N. Khoiri, Metodologi Penelitian Pendidikan (Ragam, Model, & Pendekatan), Semarang: Southeast Asian Publishing, 2018, p. 6.

[8]   Sugiyono, Metode Penelitian Kuantitatif, Kualitatif, dan R&D, Bandung: Alfabeta, 2013, p. 11.

[9]   C. Narbuko, A. Achmad, Metodologi Penelitian. Jakarta: PT. Bumi Akasara, 2015, p. 119.

[10] A. Hamid, N.K.E. Yulianti, Minat Siswa Kelas XII SMAN 1 Bolano Lambunu Parigi Moutong untuk Melanjutkan Studi ke Jenjang Perguruan Tinggi, Jurnal Pendidikan Ilmu Sosial, 16(1), 2019, pp. 47-57.https://jurnal.fkip.untad.ac.id/index.php/jurpis/article/view/511

[11] D.S. R.A., R. Hardianto, H. Filtri, Analisis Tingkat Kepuasan Mahasiswa terhadap Perkuliahan Daring pada Era Pandemi Covid-19. Jurnal Sistem Informasi, 3(2), 2021, pp. 130-142. http://journal.unilak.ac.id/index.php/zn/article/view/8353

[12] P. Setyosari, Metode Penelitian Pendidikan dan Pengembangan. Jakarta: Prenada Media, 2016, p.234.

[13] I.M. Yuliara, Regresi Linier Sederhana. Modul. Bali: Universitas Udayana, 2016, pp. 2-5.

[14] S. Marfu'ah, Analisis Kemandirian Belajar Siswa dalam Pembelajaran Matematika Secara Online di SMP Negeri 1 Cilongok. Skripsi. Purwokerto: IAIN Purwokerto, 2020. https://eprints.uinsaizu.ac.id/8900/1/SKRIPSI%20SOLIKHATUN%20MARFU AH%201617407044.pdf

[15] W. Teguh, Peningkatan Kemandirian Belajar PKN melalui Model Problem Solving menggunakan Metode Diskusi pada Siswa Kelas V SD Negeri Rejowinangun III Kotagede Yogyakarta. Tesis. Yogyakarta: Universitas Negeri Yogyakarta, 2010.

[16] B. Elpira, Pengaruh Penerapan Literasi Digital terhadap Peningkatan Pembelajaran Siswa Di SMP Negeri 6 Banda Aceh, Skripsi thesis, UIN Ar-Raniry Banda Aceh. https://repository.ar-raniry.ac.id/id/eprint/4331/

[17] D.A. Sekarini, Hubungan Antara Literasi Teknologi dan Kemandirian Belajar Siswa Kelas IX di SMP Negeri 5 Cilacap Tahun Ajaran 2018/2019. Skripsi. Semarang: Universitas Negeri Semarang, 2019.

[18] D.K. Sudyana, N.M. Surawati, Analisis Penerapan Literasi Digital dalam Menciptakan Kemandirian Belajar Siswa Hindu di Masa Pandemi Covid 19. WIDYANATYA, 3(1), 2021, pp. 1–5. https://ejournal.unhi.ac.id/index.php/widyanatya/article/view/1674