Digital Literacy Development Among University Students: Preparing for The Challenges of Disruptive 5.0 Innovation in Education

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Abstract. The development of disruptive technology 5.0 has created an urgent need to improve digital literacy among students to prepare them for future educational challenges. Digital literacy is essential in supporting the learning process and facilitating student readiness to face rapid technological changes. This research focuses on assessing students' digital literacy level, its influence on academic achievement, and their readiness to face the disruptive era. The study aims to identify the factors that influence digital literacy and how educational institutions and industry can play a role in supporting the development of these skills. Using quantitative and qualitative methods, data was collected through questionnaires and in-depth interviews with students at several universities. The results of the study show that digital literacy contributes significantly to student academic achievement, while readiness to face disruptive technology is still diverse. In conclusion, increasing digital literacy needs to be a priority, with collaboration between educational institutions and industry to provide broader access to digital technology and training. This study provides a comprehensive view of the importance of digital literacy in facing the challenges of modern education.

Keywords: Digital Literacy-1; Disruptive Technology 5.0-2, Academic Achievement-3, Student Readiness-4, Institution-Industry Collaboration-5

1 Introduction

In the era of digital transformation and disruptive technology innovation 5.0, digital literacy skills are essential for students as a generation entering the modern world of work. Rapid developments in technologies such as artificial intelligence, the Internet of Things (IoT), and Big Data have impacted almost all aspects of life, including higher education. However, students' readiness to adapt to technology is still challenging. Many students have a theoretical understanding of digital technology but must be able to apply it practically in professional and everyday contexts [1]. This issue prompts an urgent need for educational institutions to develop

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effective strategies to improve digital literacy among students [2], in order to prepare them for rapid change in this disruptive era [3].

The literature related to digital literacy highlights that these skills involve more than just the ability to use technology; digital literacy includes a deep understanding of how to manage, interpret, and apply digital information. Research conducted by [4] introduces the concept of digital literacy as a critical skill in the information age, while a further study by [5] defines it as the ability to use digital devices, understand digital information, and communicate and collaborate effectively. On the other hand, research on students' readiness to face disruptive technology, as discussed by [6] shows that digital literacy contributes to their readiness to adapt to technological changes. This study supports research that aims to understand the role of digital literacy in preparing students for disruptive technology 5.0 [7], [8].

This study fills several gaps in the study of student digital literacy in the Disruptive 5.0 era, namely the lack of understanding of digital literacy oriented to human and AI collaboration, the lack of research on digital literacy as an essential skill for critical thinking and digital ethics, and the difference in digital readiness in various universities. In addition, previous research tended to only measure the level of digital literacy without offering concrete strategies to improve it and not much discussed the influence of digital literacy on students' career readiness in the digital workforce. This study contributes by exploring effective learning strategies, paying attention to the gap in technology access, and highlighting the relationship between digital literacy and student employability.

This research aims to explore the level of digital literacy among students, understand the influence of digital literacy on their academic achievement, and evaluate their readiness to face the challenges of disruptive technology 5.0. In addition, this study also wants to explore the role of educational institutions and the impact of industry involvement in supporting the development of student digital literacy. Through this approach, a clear picture of students' needs in terms of digital literacy can be obtained, and how educational institutions can improve these skills in their curriculum [9].

The study found that students' digital literacy varied, with most still at a basic level that needed further development. There is a positive correlation between digital literacy and academic achievement, which suggests that students with higher digital literacy tend to achieve better academic outcomes. However, students' readiness to face disruptive technology 5.0 still needs to improve. This shows that the role of institutions and industry is crucial in facilitating the development of these skills. Educational institutions are advised to integrate digital literacy programs into the curriculum and strengthen cooperation with the industry to provide relevant and practical learning experiences.

2 Method

This study uses quantitative-descriptive methods supported by qualitative data to provide a comprehensive understanding. The quantitative approach is used to analyze the level of digital literacy and its correlation with academic achievement. In contrast, the qualitative approach helps deepen students' understanding of readiness to face disruptive technology and the role of institutions and industries.

The sample used a purposive sampling technique involving students from several universities. The sample consisted of 100 students from various majors to obtain diverse data

related to digital literacy. Data was collected through questionnaires designed to measure students' level of digital literacy, understanding of disruptive technologies, and their perception of the role of institutions and industries. In-depth interviews were conducted with a sample of 20 students and 10 lecturers to understand more about technology readiness and the role of institutions. Conduct on-campus observations to see digital literacy support facilities and document relevant activities.

2. 1. Data Analysis

Quantitative Analysis: Data from the questionnaire was analyzed using descriptive and inferential statistics. Descriptive statistics were used to describe students' digital literacy profiles, while Pearson's correlation test was used to assess the relationship between digital literacy and academic achievement. Qualitative Analysis: Data from interviews are analyzed using thematic analysis techniques, where key themes on technology readiness, institutional roles, and industry involvement are identified and categorized.Data Triangulation: Triangulation integrates quantitative and qualitative data to understand students' digital literacy and its supporting factors comprehensively.

With structured stages, methods, and analysis, this research is expected to provide an in-depth picture of students' digital literacy and readiness to face the challenges of the disruptive era 5.0, as well as the role played by educational institutions and industry in supporting the development of digital skills.

3 Results and Discussion

3. 1. Results

After conducting the research and in-depth analysis of this study, there are five points as a discussion: 1) the level of student digital literacy, 2) the influence of digital literacy on academic achievement, 3) readiness to face disruptive technology 5.0, 4) the role of institutions in developing digital literacy, and 5) the impact of industry involvement in increasing digital literacy.

3.1.1 Student Digital Literacy Level

This study shows that most students have basic digital literacy. However, there still needs to be a gap in the ability to use technology effectively for advanced academic activities, especially in innovative technologies such as data analysis and digital collaboration tools.

Table 1. Student Digital Literacy Level

No	Digital Literacy Aspects	Percentage (%)	Result
1	Basic (Information search, email usage, browsing)	85%	The majority of students can search and communicate through essential platforms.
2	Intermediate (Data processing, use of productivity applications)	60%	Many students master essential productivity apps like Microsoft Office or Google Workspace.

3	Advanced (Use of analytical tools, basic programming)	35%	Only one-third of students can use technology for data analysis or programming.
4	Inovatif (Penggunaan teknologi disruptif seperti AI dan IoT)	15%	The level of mastery of innovative technologies still needs to improve among students, especially in educational applications.

Table one explains the level of digital literacy of students. The results of the study showed significant variations in the level of students' digital literacy. Most college students (85%) master basic skills, such as searching for information on the internet, using email, and browsing. At the intermediate literacy level, which includes skills in using productivity applications such as Microsoft Office and Google Workspace, about 60% of students are proficient, demonstrating sufficient readiness for basic academic tasks. However, only about 35% of students have advanced digital literacy skills, such as data processing using analytical tools and basic programming. Finally, only 15% of students can use disruptive technologies such as Artificial Intelligence (AI) and the Internet of Things (IoT), which are important aspects in the industry 5.0 era. The low mastery of disruptive technology shows that universities need to strengthen the curriculum or training program to increase students' readiness to face innovative technologies that are rapidly developing in the future.

3.1.2 The Effect of Digital Literacy on Academic Achievement

Table 2. Digital Literacy on Academic Achievement

No	Digital Literacy Level	Percentage of Students with GPA ≥ 3.5 (%)	Average Grade of Group and Project Assignments	Increase in Academic Achievement Compared to Students with Low Literacy (%)
1	Basic Digital Literacy	30%	70	-
2	Intermediate Digital Literacy	45%	78	10%
3	Advanced Digital Literacy	60%	85	25%
4	Innovative Digital Literacy	75%	90	30%

Table 2 shows the results of the positive correlation study between students' digital literacy and the improvement of academic achievement. Students with higher digital literacy skills can more effectively access, analyze, and apply digital information in their assignments and projects. This study shows a positive relationship between the level of digital literacy and student academic achievement. Students with basic digital literacy only achieved a GPA of ≥ 3.5 in the range of 30%, with an average score of 70 for group and project assignments. Meanwhile, students with intermediate digital literacy showed a better increase in academic achievement, with a GPA percentage of ≥ 3.5 of 45% and an average score of group assignments of 78, or an increase in achievement of 10% compared to students with low literacy.

Students with advanced digital literacy skills experienced a more significant increase in achievement. As many as 60% of this group had a GPA ≥ 3.5, and the average score of their group assignment reached 85, reflecting an increase in academic achievement of up to 25%. Most notably, students with innovative digital literacy showed the highest results, with 75% having a GPA ≥ 3.5 and an average assignment score of 90, or a 30% increase over the low-literacy group.

This data makes it clear that the higher students' digital literacy, the better their academic achievement. This emphasizes that digital literacy facilitates access to information and supports analytical and collaboration skills, which directly contribute to improved academic achievement. The study also noted that students with qualified digital skills are able to access and utilize more digital-based learning resources, which improves the quality of their understanding of academic materials by up to 30% better than those without access or similar skills. This data emphasizes that digital literacy is not just an additional skill, but a determining factor for academic success in the digital era. These findings underscore the importance of digital literacy development programs in higher education to improve the quality of education and student readiness to face academic challenges and the increasingly digital world of work.

3.1.3 Readiness to Face Disruptive Technology 5.0

This study identifies that the level of student readiness to face disruptive technologies such as Artificial Intelligence, the Internet of Things, and Big Data still needs to be higher. Students are less exposed to these technologies in the context of education, which can hinder their readiness to enter the world of work in the industrial era 5.0.

Table 3. Aspects of Readiness in Distractive Technology 5.0

No	Indicator	Student Readiness (%)	Scala Readiness
1	Students feel ready to face disruptive technological changes.	25%	Very Ready
2	Students feel they need more skills.	50%	Less Ready
3	Students need to prepare for this change.	25%	Not Ready
4	Students have a basic understanding of disruptive technologies.	70%	Understanding Disruptive Technologies
5	Students can apply knowledge in practical contexts.	20%	Able to Apply Knowledge
6	Students who have attended related training or courses.	15%	Participating in Connected Training
7	Students are interested in exploring new technologies.	80%	Interest in Further Learning

Table 3 explains that research results on student readiness in higher education to face disruptive technology 5.0 still need to be higher. As many as 25% of students admitted that they felt very ready to adapt to the changes brought about by new technologies such as Artificial Intelligence (AI) and the Internet of Things (IoT). In comparison, another 50% felt unprepared, and 25% felt not ready at all. This indicates that educational institutions face significant challenges in equipping students with the skills needed to compete in the disruptive era.

Although 70% of students understand disruptive technologies, only 20% can apply that knowledge in practical contexts. This low percentage can be attributed to the fact that only 15% of students have attended disruptive technology-related training or courses, indicating a lack of opportunities for hands-on learning. Interestingly, despite concerns regarding readiness, around 80% of students are highly interested in learning more about new technologies, suggesting the potential for better skill development if provided with adequate support.

The results of this study underscore the importance of educational institutions responding to this need by designing more relevant curricula and providing training and resources that support students in improving their readiness to face the challenges presented by disruptive technology 5.0. With these steps, it is hoped that students can be better prepared to enter the world of work increasingly dependent on modern technology.

3.1.4 The Role of Institutions in Developing Digital Literacy

The role of educational institutions is crucial in developing digital literacy among students, especially when facing disruptive technology 5.0. In this study, the low student readiness level to adapt to new technologies is mainly due to the institution's lack of support and resources. Institutions must serve as key drivers in improving digital literacy through several comprehensive strategies. First, institutions need to design a curriculum that is more responsive to the development of digital technology. It includes the integration of courses that focus on digital literacy, such as an introduction to AI, IoT, and Big Data, as well as practical skills in using digital tools and applications. In this way, students gain theoretical knowledge and practical skills that can be directly applied in academic and professional contexts.

Second, institutions must provide facilities and resources that support the development of digital literacy. This can be a computer lab equipped with the latest software, fast and stable internet access, and diverse digital learning resources. In addition, institutions also need to hold training, workshops, and seminars that discuss the latest developments in digital technology so that students can continue to update their knowledge and skills. Third, institutions must encourage collaboration between students, lecturers, and industry practitioners. Internship programs or collaborative projects involving the industry can provide students with hands-on experience in applying the digital skills they learn [10], [11]. This kind of collaboration improves students' understanding of the practical applications of digital literacy and strengthens their professional network [12], [13]. By adopting these approaches, educational institutions can play a central role in developing digital literacy among students [1], [14]. This is crucial to prepare them for the challenges and opportunities in the disruptive era 5.0 while improving their competitiveness in a job market increasingly dependent on technology [13], [15]. Through consistent and targeted efforts, institutions can create a learning environment that encourages students to become adaptive and innovative individuals in an ever-changing world.

3.1.5 The Impact of Industry Involvement in Improving Digital Literacy

The impact of industry involvement in increasing digital literacy among students is significant, especially in facing the challenges of disruptive technology 5.0. This research shows that collaboration between educational institutions and the industry sector provides access to better resources and creates a more relevant and contextual learning experience for students. By engaging in industry, students can gain first-hand insight into the needs and demands of the job market. Hence, they are better prepared to enter the professional world after completing their studies. One effective form of industry engagement is through internship programs, where students can apply the digital literacy skills they learn in a natural work environment. This internship program provides opportunities for students to learn from experienced professionals

to understand best practices in using digital technology and how to adapt to rapid change. The involvement of industry in curriculum development also allows for the integration of materials relevant to current industry needs so that students not only learn theory but also skills that employers are looking for [16]–[18].

In addition, cooperation with industry often includes providing training and workshops facilitated by experts from the relevant sectors. This activity improves students' technical knowledge and builds their confidence in using digital technology. Through direct interaction with practitioners, students can explore practical applications of digital skills and understand the latest trends in the industry. Another positive impact is the strengthening of professional networks for students. Industry involvement opens up opportunities for students to build valuable connections, which can contribute to their future career development. By having a solid network, students have access to job opportunities and can collaborate on innovative projects that enrich their learning experience. Overall, industry involvement in improving digital literacy provides a double benefit [19]. On the one hand, it helps students prepare for the increasingly digital world of work [20], [21]; on the other hand, it ensures that graduates have the skills and knowledge relevant to the market's needs [9], [22]. This makes collaboration between educational institutions and the industrial sector a key element in creating an adaptive generation ready to face technological challenges in the disruptive era of 5.0.

3. 2.Discussion

The study results show that the level of digital literacy among students varies, with 70% having a basic understanding of digital technology. However, only 20% can apply this knowledge in actual practice. This indicates a gap between theoretical knowledge and practical applications, hindering students' ability to adapt to new technologies. This study found a positive relationship between the level of digital literacy and student academic achievement. Students with higher digital literacy performed better, with 75% having a GPA $\geq$ 3.5. This increase in academic achievement shows that strong digital skills contribute to students' ability to learn and complete academic tasks.

Student readiness to face disruptive technology 5.0 still needs to improve, with only 25% feeling very prepared. Although 80% of students show interest in learning more about new technologies, more training and support from educational institutions are needed. This indicates the need to develop more relevant curricula and training programs that support improving digital literacy. Educational institutions have an important role in improving digital literacy by designing a curriculum that is responsive to technological developments. This study shows that the integration of courses on digital literacy and practical training can help students prepare themselves to face challenges in the world of work. In addition, the provision of adequate resources and facilities is also essential to support the development of digital skills [23]–[25]. Industry involvement in education has positively impacted students [26]. Through internship programs and collaborations in curriculum development, students gain real experiences that increase their readiness to face the world of work [27] In addition, industry involvement also opens up opportunities for students to build professional networks that are beneficial for their future career development.

The implications of this study show that the development of digital literacy among students depends not only on the curriculum taught in institutions but also on solid cooperation between educational institutions and industry. Synergy must provide relevant training, resources, and practical experience to prepare students for the disruptive era 5.0 [28]. This research also emphasizes the importance of curriculum updates that focus on the latest technology and digital skills needed in the world of work. The interpretation of the results of this study shows that

although students have a high interest in digital literacy, there needs to be more practical application and readiness to face disruptive technology [29]. This reflects a broader challenge in higher education, where many institutions still need to fully adapt their courses to the changing needs of the industry [30], [31]. Therefore, institutions need to adapt quickly to provide relevant education and support the development of students' digital skills.

In comparing the results of this study with other relevant studies, such as those conducted by [32] regarding the effect of digital literacy on academic achievement among students, it was found that high digital literacy contributes positively to academic outcomes. However, this study adds a new dimension by exploring students' readiness to face disruptive technology [33]as well as the role of institutions and industry in the development of digital literacy [34] This suggests that there is an urgent need for further research that incorporates these factors in the context of higher education [35] The recommendation for the following research is to conduct a longitudinal study to monitor the development of students' digital literacy in line with technological changes and industry dynamics. It is also essential to explore more deeply how innovative teaching methods and learning experiences can improve digital literacy. Research is also suggested to involve the perspectives of students and industry more deeply in curriculum development to create educational programs that are more adaptive and relevant to current needs.

4 Conclusion

This study reveals that the level of digital literacy among students still has room for improvement, especially in the practical application of digital skills to prepare themselves to face the challenges of disruptive technology 5.0. Although 70% of students understand digital literacy, only 20% can apply it in broader contexts, such as work and daily life. In addition, the link between digital literacy and academic achievement shows that students with higher digital literacy tend to have better academic achievements. However, only 25% of students feel ready to face disruptive technological developments, indicating an urgent need for educational institutions to improve student readiness through curriculum development, collaboration with industry, and supporting facilities.

This research significantly contributes to the academic world by highlighting the role of educational institutions and industry in improving students' digital literacy. The results of this study confirm the importance of digital literacy not only as an additional skill but as an integral part of higher education in the era of disruptive technology. These findings make a valuable contribution to academics and policymakers' paying more attention to the integration of digital literacy into the curriculum. In addition, this research also serves as a reference for further research in evaluating the impact of digital literacy on student readiness in the world of work and adaptation to disruptive technology.

This study has several limitations, including the limited sample scope of students from several universities, so the results may not need to represent the general student population. In addition, this study focuses more on descriptive analysis without using longitudinal methods that can show the development of students' digital literacy over time. External factors affecting students' digital literacy, such as economic background and access to technology, have yet to be fully explored. Therefore, follow-up research with a broader sample and a more in-depth approach is needed to understand digital literacy in a more complex context

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