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Improving Students' Digital Literacy through Technology: The Importance of Information Seeking Skills

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Abstract. *The development of digital technology has transformed how university students access and process information. Digital literacy has become an essential skill encompassing the ability to search for, evaluate, and effectively use information. This study aims to analyze the factors influencing university students' digital literacy, the role of technology in supporting these skills, and effective strategies that can be implemented to improve digital literacy in academic environments. The research method employed is a mixed-method approach with data collection techniques through digital questionnaires administered to 25 students from various majors, as well as a literature review from various sources. The results of the study show that 52% of students use the internet for more than six hours a day, 83.3% actively seek information daily, and 60% always verify information before sharing it. The main obstacles in improving digital literacy include limited access to digital learning resources (54.2%) and a lack of literacy training (54.2%). Proposed strategies to address these challenges include integrating digital literacy materials into the curriculum, organizing regular training and seminars, and optimizing the use of educational technology platforms. The conclusion of this study emphasizes that digital literacy is not just about technical skills but also involves critical thinking and filtering accurate information. Therefore, systematic efforts are needed from various parties, including universities, lecturers, and students, to create an academic environment that supports the optimal development of digital literacy.*

Keywords: *Digital literacy, information verification, learning strategies, students, technology.*

1. INTRODUCTION

Based on UNDP data in 2010, UNESCO survey data and the urgency of the role of literacy in the progress of the nation, this research focuses on measuring literacy. According to the Great Indonesian Dictionary (KBBI) online, literacy has three meanings, the first is the ability to read and write, the second is knowledge or skills in a particular field or activity, and the third is literacy also means the ability of individuals to process information and knowledge for life skills.

According to the 2015 World Economic Forum, there are six basic 21st century life skills that the younger generation, including students, need to master. These include literacy, numeracy, scientific literacy, digital literacy, financial literacy, and cultural and civic literacy.

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Reading and Writing Literacy

Literacy is the knowledge and skills of reading, writing, searching, browsing, processing and understanding information. It is the ability to analyse, respond to and use written texts to achieve goals, develop self-understanding and potential, and participate in the social environment. In this skill, students are measured on their ability to read, write and search for information using both physical and digital means.

Numeracy Literacy

Numeracy literacy is knowledge and skills in:

a. Acquire, interpret, use and communicate different numbers and mathematical symbols to solve practical problems in everyday life.
b. Analyse information presented in different forms (graphs, tables, charts, etc.) to make informed decisions.

Pupils are measured on the implementation of numeracy skills, both through physical and digital facilities.

Science Literacy

Science literacy includes scientific knowledge and skills for:

a. Identify issues and gain new knowledge.
b. Explain scientific phenomena and draw conclusions from facts
c. Understand the characteristics of science and how science and technology shape the natural, intellectual and cultural environment.
d. Raising awareness and interest in science-related issues

Students are measured on the implementation of science literacy through both physical and digital facilities.

Digital Literacy

Digital literacy is the knowledge and skills to use digital media, communication tools or networks to find, evaluate, use and create information. This literacy emphasises the healthy, wise, intelligent, careful, appropriate and legal use of technology to support communication and interaction in everyday life. Pupils are measured on the basis of their implementation of digital literacy through physical and digital facilities.

Financial Literacy

Financial education includes knowledge and skills in;

a. Understand financial concepts and risks.
b. Develop financial management skills
c. Have the motivation and understanding to make effective financial decisions to improve personal and social wellbeing.

Students are measured on the implementation of financial education through physical and digital facilities.

Cultural Literacy and Citizenship

Cultural and civic literacy encompasses knowledge and skills for understanding and responding to Indonesian culture. This literacy aims to increase awareness of cultural diversity and the role of a responsible citizen. Students will be measured on the implementation of cultural and civic literacy through both physical and digital facilities.

In today's digital and globalised age, literacy is an essential skill for students. Literacy is not limited to the ability to read and write, but also includes digital literacy, numeracy, scientific literacy, financial literacy and media literacy. Students with good literacy skills are better able to access, understand, evaluate and manage information critically and effectively, which in turn supports their academic performance and employability.

In the midst of the industrial revolution 4.0 and the acceleration of post-pandemic digital transformation, the concept of literacy has experienced a significant expansion in meaning. UNESCO (2023) defines literacy in the digital age as "complex competencies" that include adaptive skills to responsibly access, evaluate, create and reflect on content in digital spaces.

The phenomenon of the information explosion (2.5 trillion bytes of data created per day according to IBM) and the rise of disinformation (72% of students in Southeast Asia are exposed to educational hoaxes according to SEAMEO, 2022) emphasise that literacy is not just a supportive tool, but an existential foundation in the academic and social ecosystem of students.

However, there are still many students who face barriers to developing their literacy skills. shows that many students still struggle to understand complex reading, analyse data and interpret information in depth. In addition, a low reading culture and lack of access to quality information sources are also factors that affect students' literacy levels.

Technological developments such as generative artificial intelligence (ChatGPT, Gemini), metaverse and big data analytics have changed the learning landscape. Students need to master not only technical skills (digital literacy), but also critical-transformative literacy, which includes;

a. Data literacy: The ability to interpret statistical visualisations and recommendation algorithms.
b. Digital ethical literacy: Awareness of privacy, copyright and the environmental impact of digital footprints.
c. Collaborative literacy: Participating in global communities through knowledge crowdsourcing platforms such as ResearchGate or Kaggle.

However, the skills gap remains a multi-dimensional challenge. Results from PISA (2022) show that only 35% of Indonesian students are able to distinguish between fact and opinion in digital media. The inhibiting factors are systemic:

a. Cognitive: habitual skimming of information without in-depth analysis (research by Wolf, 2018: digital reading habits reduce understanding of complex concepts).
b. Socio-technical: The dominance of entertainment platforms (TikTok, Instagram) that encourage a culture of instant content consumption.
c. Institutional: Educational curriculum that is not integrated with UNESCO's digital literacy framework (89% of Southeast Asian universities do not have mandatory digital literacy courses according to QS Report, 2023).

The importance of students' literacy skills not only affects their academic success, but also their ability to think critically, communicate effectively and adapt to technological and information developments. Digital literacy, for example, enables students to make the most of technology in learning, while numeracy helps them to analyse data and make informed decisions.

Adequate language skills enable students to express their thoughts/ideas and feelings through language. Language skills include 1) listening skills, 2) speaking skills. 3) reading skills, and 4) writing skills. These are the learning outcomes that students must have when taking Indonesian language courses.

Therefore, effective strategies are needed to improve students' literacy skills. This study aims to analyse the strategies that can be used to improve the literacy skills of university students and to emphasise the importance of literacy skills in their academic and professional lives.

2. RESEARCH METHODOLOGY

Both quantitative and qualitative approaches were used in this research. The quantitative method was carried out by distributing digital questionnaires to 25 students from different universities and study programmes. The sampling technique was through convenience sampling to ensure a representative variation of the data. In addition, the qualitative method was applied through the analysis of literature studies, which included academic journals, books and research reports relevant to the topic of digital literacy.

The data obtained from the questionnaire was analysed using quantitative descriptive techniques by presenting the percentage of the respondents' responses regarding their digital habits, barriers to accessing information, as well as strategies they considered effective to improve digital literacy. Meanwhile, the literature review was used to corroborate the results of the quantitative analysis by comparing the research findings with existing academic references.

3. RESULT AND DISCUSSION

Profile of Respondents

64% of the respondents in this study were female, while 36% were male. In terms of age, the majority of respondents (76%) were between the ages of 18 and 20. This shows that the research participants are dominated by young students who are in the early stages of their studies, so their digital habits and skills may reflect Generation Z in terms of digital literacy.

Duration of Internet Usage

An interesting finding was the length of time spent online each day. More than half of respondents (52%) spend more than 6 hours a day online. Meanwhile, 24% use the internet for 2-4 hours a day. This long duration of use reflects students' dependence on digital technology for both academic needs and social activities. However, long duration does not necessarily correlate positively with digital literacy, as internet use is often dominated by entertainment or social media platforms that do not always require analytical skills.

Ability to utilize technology

52% of respondents rated their digital skills as 'very good' and 40% as 'good'. While the majority are confident in their skills, this subjective assessment needs to be looked at more critically. Previous research has shown that high levels of self-confidence do not always correlate with the objective ability to verify information or use digital tools productively. Therefore, it is important to further test whether these perceptions match actual competence.

Verifying the accuracy of information

As many as 60% of respondents said that they always check the truth of information before passing it on, 24% often and 16% only sometimes. This finding suggests that some students already have a critical awareness when responding to information. However, the 16% who still ignore verifying information must be a serious concern, especially in an era of rampant disinformation and hoaxes. If not addressed, this could contribute to the widespread spread of false content.

Obstacles in Improving Digital Literacy

Limited access to digital learning resources (54.2%) and lack of digital literacy training or workshops (54.2%) are the two main barriers faced by students. Access issues include not only the availability of scientific journals or digital books, but also the lack of appropriate technological equipment. On the other hand, the lack of formal training leads students to rely on informal sources such as social media or personal blogs, the credibility of which is difficult to establish.

Effective Strategies to Improve Digital Literacy

Increasing access to digital learning resources (28%) - One of the strategic steps to improve digital literacy is to increase access to quality digital learning resources. This can be achieved by providing free subscriptions to educational platforms for students or teachers, either through collaborations with online educational service providers or through initiatives by educational institutions. Institutions can also develop digital libraries of diverse academic references, scholarly journals and interactive learning materials that can be accessed by the entire academic community. These efforts aim to ensure that everyone has an equal opportunity to obtain information and to deepen their understanding of digital literacy.

Encouraging proactive information seeking (32%) - A culture of self-directed learning is key to improving digital literacy. Individuals are encouraged to actively seek information from a variety of credible sources, such as online courses, webinars, discussion forums and academic articles available on the internet. By becoming accustomed to researching information independently, individuals will have better critical thinking skills and be able to distinguish valid information from fake news or hoaxes. In addition, this culture of digital literacy can be strengthened through educational campaigns that raise awareness of the importance of proactively accessing information relevant to academic and professional needs.

Regular seminars and workshops (24%) - To improve understanding of digital literacy, a structured training programme in the form of regular seminars and workshops is needed. Seminars can bring in experts in digital literacy, information technology and cybersecurity to provide the latest insights into the development of the digital world. Meanwhile, workshops focus more on applicable technical skills, such as how to use data analysis tools, methods for identifying credible sources of information, and fact-checking techniques that can help individuals avoid spreading misinformation. Through this activity, participants can gain practical knowledge that can be applied in their daily lives, both in academic, professional and social environments.

Integrating digital literacy materials into the curriculum (16%) - To ensure that digital literacy becomes a skill that all learners possess, it needs to be integrated into the formal education curriculum. Educational institutions can develop compulsory courses that specifically address aspects of digital literacy, such as ethics in the digital world, cybersecurity, information management, and the impact of technology on social and cultural life. In addition, digital literacy can be integrated into other relevant subjects so that students are accustomed to applying the principles of digitalisation in different academic and professional contexts. Through this integration, it is expected that individuals will not only be able to use technology effectively, but also have an awareness of the impact and responsibility of its use.

Analysis and recommendations

In order to improve students' digital literacy, there are strategies that can be recommended, namely the strategy of using e-modules in an effort to improve students' digital literacy. The three main strategies that can be applied are the use of interactive e-modules, project-based learning and the strengthening of information evaluation skills.

First, interactive e-modules with multimedia such as videos and animations help students to better understand digital concepts. Second, project-based learning trains them to search, analyse and present information digitally, thus improving their research and source validation skills. Third, strengthening information evaluation skills is important to distinguish between valid news and hoaxes, for example through discussions or case studies on digital misinformation. By using these three strategies, students' digital literacy can be optimally developed.

Another strategy to improve students' digital literacy is to provide training on how to use the Canva application. The three main strategies used in this training are;

a. Another strategy to improve students' digital literacy is to provide training on how to use the Canva application. The three main strategies used in this training are
b. Hands-on - Students are guided through the use of Canva, including account creation, template selection and use of the design tools available. They also receive feedback on their work.

c. Discussion and reflection - After the exercise, students discuss the benefits of Canva in supporting academic work and the importance of digital literacy in education and work.

Other strategies that can be recommended to improve students' digital literacy include;

a. Integrating technology into learning - using digital platforms such as learning management systems (LMS), e-books and online journals to support teaching and learning and improve access to digital resources.

b. Digital literacy development Ethics and responsibility

1) Digital ethics workshop: Discussions on plagiarism, copyright, social media communication ethics and the impact of sharing negative content.
2) Positive content campaign: A project to create educational content (e.g. TikTok videos, infographics) that promotes digital literacy or social issues.
3) Technology impact analysis: Case studies on misinformation, cyberbullying or technology addiction to raise critical awareness.

c. Data Literacy and Digital Analytics

1) Training in data analysis tools: Introduction to tools such as Google Analytics, Excel or Python to process and visualise data.
2) Simple data project: The task of analysing digital trends (e.g. social media usage patterns) and presenting them in the form of a dashboard.
3) Critical of Big Data: A discussion on privacy implications, algorithmic bias and the use of personal data by tech companies.

The above strategies can be adapted to the needs of the institution, the literacy level of the participants and the availability of the technological infrastructure. The combination of *theory, practice and critical reflection* approaches will strengthen students' holistic understanding of the digital world.

4. CONCLUSIONS AND SUGGESTIONS

. On the basis of the results of the research discussed, it can be concluded that the majority of the students surveyed have a high habit of using digital technology, with a relatively long period of daily access to the Internet. However, a high level of internet use is not always proportional to a good level of digital literacy. Although most respondents rated their digital literacy skills as 'good' or 'very good', there is still a gap between perceived and actual competence in checking information and using technology productively.

In addition, there are several barriers that students face in improving their digital literacy, such as limited access to digital learning resources and lack of structured training. To overcome this, several strategies have been proposed, such as increasing access to digital learning resources, encouraging students to be more proactive in seeking information, organising seminars and workshops, and integrating digital literacy into the educational curriculum. Additional strategies such as the use of interactive e-modules, digital design training using Canva, and data literacy and digital analysis can also support the improvement of students' skills to face the challenges of the digital world.

Suggestions that can be given to:

a. Educational Institutions
    1) Develop policies that support the integration of digital literacy into the formal education curriculum.
    2) Providing wider access to digital learning resources such as academic journals, e-books and online learning platforms.
    3) Organise regular training in the form of workshops or seminars to improve students' practical understanding of digital literacy.
b. Student
    1) Raise awareness and be proactive in seeking information from credible sources.
    2) Use various online learning platforms to enhance digital skills relevant to academic and professional needs.

3) Actively participate in digital literacy activities such as seminars, training and discussion communities to enhance understanding and application of digital technology.

c. Government and Related Parties

1) Support the digital literacy programme by providing training and technology resources for students.
2) Develop policies to ensure equitable access to digital technology, especially for students in areas with limited infrastructure.
3) Promote educational campaigns on the importance of digital literacy in meeting the information challenges of the digital age.

By implementing the proposed strategies, students are expected to become more digitally literate, not only in using technology, but also in thinking critically, evaluating information and optimising digital potential for academic and professional purposes.

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